REFERENCES

Agarwala, S.N. (1977) : *India's Population Problems*, Tata McGraw Hill, New Delhi.

Bhutani, Smita (1995) : *Demographic Dynamism in India*, Discovery Publishing House, New Delhi.

Bose, A. (1988) : *From Population to People, Vol. I*, B.R. Publishing Corporation, New Delhi.

Bose, Ashish (2010) : *India's Quest for Population Stabilisation*, National Book Trust, New Delhi.

Census of India (2011) : Provisional Population Totals, Paper 1 of 2011 India Series 1, Registrar General and Census Commissioner India, New Delhi.

Chandna, R.C. (2011) : *A Geography of Population*, Kalyani Publishers, Ludhiana.

Chatterjee, S.P. (1962) : "Regional Pattern of Density and Distribution in India." *Geographical Review of India*, 24, 1-28.

Clarke, John I (1972) : *Population Geography*, Pergamon Press, Oxford.

Davis, Kingsley (1951) : *The Population of India and Pakistan*, Princeton University Press, Princeton.

Economic Survey, 2011-12, Oxford University Press, New Delhi.

Economic Survey, 2012-13, Oxford University Press, New Delhi.

Ghosh, S. (1970) : "Physical and Economic Factors in Population Distribution of Bihar", *The National Geographical Journal of India*, 16, 61-70.

Gosal, G.S. (1982) : "Recent Population Growth in India", *Population Geography*, Vol. 4, pp. 33-53.

India, 2014 : Publication Division, Ministry of Information and Broadcasting, Government of India, New Delhi.

Krishan, Gopal (1968) : "Distribution and Density of Population in Orissa", *National Geographical Journal of India*, 14, 250-257.

Krishan, Gopal (1984) : Spurts in India's Population Growth during the Twentieth Century–A spatial view, *Population Geography*, Vol. 6, Nos. 1 & 2, June-Dec.

Mehta, B.C. (1973) : "Spatial Distribution of Population in Rajasthan" *National Geographical Journal of India*, 19, 149-157.

Ministry of Health and Family Welfare, Department of Family Welfare, New Delhi; National Population Policy, 1976.

Ministry of Health and Family Welfare, Department of Family Welfare (2000), New Delhi; National Population Policy, 2000.

Mitra, Ashok (1978) : *India's Population : Aspects of Quality and Control*, Abhinav Publications, New Delhi.

Morris, A. (1998) : *Geography and Development*, University College of London Press, London.

Prakash, O. (1970) : "Pattern of Population in Uttar Pradesh" *National Geographical Journal of India*, 16, 150-160.

Premi, Mahendra K (2006) : Population of India, In the New Millennium : Census 2001, National Book Trust, New Delhi.

Premi, Mahendra, K (2009) : *India's Changing Population Profile*, National Book Trust, New Delhi.

Premi, Mahendra and Das Dipendra Nath (2012) : *Population of India 2011*, B.R. Publishing Corporation, Delhi.

Sinha, R.K. (2007) : *India 2005*, Shipra Publications, New Delhi.

Swami, S. (1974) : *Population Growth and Economic Development in Ashis Bose et. al (eds.), Population in India's Development 1947-2000*, Vikas Publishing House, New Delhi.

UNFPA : *The State of World Population*, United Nations Population Division.

United Nations Development Programme (UNDP) : *Human Development Report, 2011*, Oxford University Press.

Verma, S.D. (1956) : "Density and Pattern of Population in Punjab" *National Geographical Journal of India.*

Zlinsky, W. (1966) : *A Prologue to Population Geography*, Prentice Hall, Inc. N.J.

Population Composition

Population composition is a vast field which refers to the physical, socio-cultural and economic attributes of population, such as ethnicity, tribes, language, religion, literacy and education, age, sex, economically active population and many more traits. The study of composition of population helps us in understanding the social, economic and demographic structure of population.

ETHNIC COMPOSITION

Our present day population is a conglomeration of people belonging to different racial groups with different ethnic backgrounds. These people entered India from different parts of the world at different points of time adopting different land and water routes. In fact India has been a meeting pot of various races and tribes from times immemorial. Almost all the major races of the world are visible in India as a result of which the country is said to have a varied and diverse ethnic composition. The present day population of the country has been derived mainly from the following racial groups :

1. The Negritos

According to Hutton, the earliest occupants of India were the people of Negrito race. S.K. Chatterjee and S.M. Katre have expressed the view that Negroid people migrated to India from Africa and established their language on the soil of India. **A.C. Haddon** opines that Negrito features are met with particularly amongst the Andaman islanders and most probably the Uralis of Nilgiri hills, Kadors of Kochi, Pullayans of Palni hills, etc. Besides some tribes like the Angami Nagas in the north-east and the Badgis in the Rajmahal hills in Jharkhand, etc. possessing some physical traits reminiscent of the Negrito are seen. The Negrito race is characterised by short stature, dark chocolate brown skin, woolly hair, bulbous forehead, broad flat nose and slightly protruding jaws.

2. The Proto-Australoids

Hutton is of the opinion that the Proto-Australoids came to India from the East Mediterranean area (Palestine). They came soon after the Negritos. Today they constitute the bulk of population in many isolated and semi-isolated parts of central and southern India. The Veddahs, Malavedahs, Irulas and Sholagas are the true representatives of Proto-Australoids. The Bhils, Kols, Badagas, Korwas, Kharwars, Mundas, Bhumjis and Malpaharis of the highlands of Central India and the

Chenchus, Kurumbas, Malayans and Yeruvas of South India may all be treated as Proto-Australoids. Some anthropologists believe that the Proto-Australoids supported the Mediterraneans in building the Indus Valley Civilization. On their arrival in India, the Proto-Australoids pushed, pressed, displaced and supplanted the Negritos and forced them to shift to more inaccessible, remote and less hospitable areas, where they are found even today. In the process, there was some admixture of the two races, perhaps more so in the south than in the north. In physical appearance the Proto-Australoids more or less resemble the Negritos with the main exception that they do not have wooly hair like the Negritos. Their other physical characteristics are bulbous forehead, broad flat nose and slightly protruding jaws.

3. The Mongoloid

According to **Risley**, "On its northern and eastern frontier, India marches with the great Mongoloid region of the earth". Most of the anthropologists believe China to be the homeland of the Mongoloid race from where they were pushed southward into the Malaya peninsula and Indonesia. They entered India through the passes in the northern or eastern mountains. Hutton is of the opinion that the bulk of Burma (Myanmar) in any case is primarily Mongoloid, and any non-Mongoloid streams of migration that may have reached India through Myanmar have absorbed a vast quantity of Mongolian blood. There is also some evidence of a Mongoloid Melanesian intrusion from Oceania to Tamil Nadu and Kerala and probably that accounts for the occasional Mongoloid element noticed among the people of these states. Presently, they occupy large areas in Ladakh, Sikkim, Arunachal Pradesh and some other parts of east India. Some of the basic physical characteristics of the Mongoloid race include a round and broad head, face with very high cheek bones and a long flat nose, with little or no hair on the face and the body. The tribes of Garo, Khasi, Jaintia, Lipchas, Chakmas, Murmis, Naga and Daffla belong to the Mongoloid race.

The Mongoloid racial stock of India can be divided into two sub-groups as follows :

(*i*) Palaeo-Mongoloids

(*ii*) Tibeto-Mongoloids.

(*i*) ***Palaeo-Mongoloids*** are further divided into ***broad headed*** and ***long headed*** sub-types. They settled mainly along the fringes of the Himalayas in Assam and the Myanmar border.

(*ii*) ***Tibeto-Mongoloids*** have come from Tibet as their name suggests. They are mostly living in Bhutan and Sikkim, as well as in the north-western Himalayas and Trans Himalayan regions.

4. The Mediterraneans

The Mediterranean racial stock came to India from eastern Mediterranean region or South West Asia. They are believed to have migrated during the third and the second millennium B.C. This race has contributed much to the physical composition of peoples of India and also to its culture. They brought earlier forms of Austro-Asiatic languages and are believed to be the bearers of the earliest form of Hinduism in India. *Palaeo-Mediterrraneans* are considered to be the first and the most ancient of all the Mediterranean races to enter India. Their physical characteristics include medium stature, dark skin and long head. In all probability, they first settled in north-west India and started practising agriculture there. However, they were pushed into central and southern India by subsequent immigrants. Today the Palaeo-Mediterranean stock forms the bulk of population of south India and a considerable proportion of population in northern India. The Mediterraneans were the chief architects of the Indus Valley Civilization as is evident from the excavations of Mohanjo Daro and Harappa.

The Dravidians. To quote **Risley**, "The Dravidian race, the most primitive of the Indian types, occupies the oldest geological formation in India, the medley of forestclad ranges, terraced plateaus, and undulating plains which stretches, roughly speaking, from the Vindhyas to Cape Comorin (Kanniyakumari). On the east and west of the peninsular area the domain of the Dravidian is coterminous with the Ghats; while further north it reaches on one side to the Aravalis and on the other to the Rajmahal hills. Where the original characteristics have been unchanged by contact with Indo-Aryan or Mongoloid people, the type is remarkably uniform and distinctive."

5. Brachycephals

Brachycephal groups of races of India are characterised by broad heads. Coorgis and Parsis are representatives of the Brachycephals in India. These races are sub-divided into three major groups. They followed three different routes to enter India.

(*i*) Alpinoids,

(*ii*) Dinarics and

(*iii*) Armenoids.

(*i*) ***Alpinoids.*** Alpinoids came to India along the route passing through Baluchistan, Sind, Kathiawar, Gujarat, Maharashtra, Karnataka and Tamil Nadu.

(*ii*) ***Dinarics.*** Dinarics followed the Ganga valley and its delta as their route to enter India.

(*iii*) ***Armenoids.*** Chitral, Gilgit, Kashmir and Nepal formed the third route for the Armenoids of the Brachycephal group of races to enter India.

6. The Nordics

The Nordics constitute the last wave of migration into India. They spoke Aryan language and migrated to India sometime during the second millennium B.C. The main concentration of these people is in the north-western part of the country. They are a predominant type in Punjab, Haryana and Rajasthan. They are mostly represented among the upper castes of North India particularly in Punjab. The main characteristics of this race are long head, fair complexion, well developed nose and a well built, strong body.

CASTE GROUPS

India's present caste system owes its origin to the ***chatur varna*** which divided the population into four classes, viz. Brahmins, Kshatriyas, Vaishyas, and Shudras. This division was based on the occupation of the people and the complexion of the skin. In due course of time, the caste system in India became extremely hierarchical and rigid encouraging high caste people to exploit the low cast people. Unfortunately, even today, the Indian cast system is intensely hierarchical resulting in several social and economic problems. Today India has more than 3,000 castes.

For the sake of convenience, the castes of the country are divided into three groups. **Table 11.1** indicates that various castes are concentrated in various regions. In other words, their distribution is mainly regional. The regional dimensions of the caste system has led to regional differentiation in social geography of India.

Four major castes according to *varna* (literally colour) are briefly described as under :

1. Brahmans. Brahmans are at the top in *varna* hierarchy. Main castes of this *varna* are those of priests, teachers, custodians of social ritual practices and arbiter of correct social and moral behaviour. Geographically, they are the most ubiquitous because they officiate in a variety of rituals. Although ritually barred from cultivation, they have gathered large stretches of land through grants by local rulers and patrons by virtue of their traditional prestige. Thus they constitute a prominent land owning and money lending class. The services of Brahmans is constantly in demand by other castes for major ritual functions such as births, marriages, deaths, etc. Although Brahman households are a few in a typical village, yet they command a wide variety of services from other castes because they own a large part of agricultural

TABLE 11.1. Caste Groups

Caste		
High (Brahmans, Kshatriyas and Vaishyas)	Middle (Cultivating Castes)	Low (Harijans or Scheduled Castes)
1. Saryupanies of Awadh	1. Jats of Haryana and Punjab	1. Chamars of U. P.
2. Namboodris of Kerala	2. Bhumihars of Bihar	2. Balais of W. Bengal
3. Chitpowans of Maharashtra	3. Reddys of Andhra Pradesh	3. Megh of Gujarat
4. Chattopadhyayas of West Bengal	4. Vellalas of Karnataka	4. Mahars of Maharashtra
5. Iyengars of Tamil Nadu		5. Malls of Andhra Pradesh
		6. Adi-Dravidas of Tamil Nadu

land in the village. By and large Brahmans are better educated than other caste groups.

2. Kshatriyas. Next to Brahmans are the Kshatriyas in *varna* ranking. They comprise very powerful castes as they are traditionally warriors and play a major role in defence. However, the role of defence is now largely submerged under the rule of land ownership. When castes form large majorities in a village, the village is generally known by the *jati* name of the Kshatriyas. There are several examples of *Rajput* villages (Rajasthan), *Jat* villages (Haryana, Uttar Pradesh), *Thakur* villages (Himalayan region) and *Nair villages* (Kerala).

3. Vaishyas. Vaishyas rank below Kshatriyas, but fall within the ambit of ritually high *varna*. Vaishyas are primarily engaged in farming and retail trade. Several prominent vaishya groups have established successful monolithic business all over the country.

4. Shudras. These belong to the lowermost class in *varna* ranking. They are mostly engaged in cultivation, and in a wide variety of artisan services such as carpentry, metal work, and basket weaving. However, they are debarred from several ritual privileges. Currently they form the bulk of the country's population.

SCHEDULED CASTES

At the bottom of the social ladder are the *niravasita* meaning "excluded" or the "exterior" castes, so called "*casteless*", officially "scheduled castes". Since the Government of India Act of 1935, they have been listed in special official schedules for administrative and representational purposes. Article 341 of the Constitution provides that the President may, with respect to any State or Union territory, specify the castes, races or tribes or parts of groups within castes, races or tribes which shall for the purposes of the Constitution be deemed to be Scheduled Castes in relation to that State/Union territory. In pursuance of these provisions, the lists of Scheduled Castes are notified for each State and Union territory and are valid only within the jurisdiction of that State or Union territory and not outside.

It is important to mention here that under the Constitution (Scheduled Castes) Order, 1950, no person who professed a religion different from Hinduism was deemed to be a member of a Schedule Caste in addition to every member of the Ramdasi, Kabirpanthi, Majhabi or Siraligar caste resident in Punjab or Patiala and East Punjab States Union (PEPSU) were in relation to that State whether they professed the Hindu or Sikh religion. Subsequently in September, 1956, by an amendment, the Presidential Order of 1950 and all subsequent Presidential Orders relating Scheduled Castes, the population professing the Hindu and the Sikh religions were placed on the same footing with regard to their inclusion as Scheduled Castes. Later on as per amendment made in the Constitution (Schedule Castes) Order 1990, the Hindu, the Sikh and the Buddhist professing population were placed on the same footing with regard to recognition of the Scheduled Castes. Their occupations are unclean (with respect to upper castes) which include disposal of the dead, flaying of dead animals, menial work, cleaning, etc. Many of them are agricultural labourers, cultivators of small land holdings, petty labourers and industrial workers. To the upper castes, they are "untouchables". The practice of untouchability started with their original "unclean" occupations, and physical contact with upper castes was prohibited. They are forced to live in segregation particularly in rural India.

It is clear from the above description that Scheduled castes have been a deprived, neglected and exploited lot in Indian society since the introduction of caste system in the country. It is, therefore, necessary to make a thorough study of these castes. Scheduled Caste is a heterogeneous group consisting of 542 castes. As regards their social and economic status *vis-à-vis* the rest of the population, they are homogeneous to some extent. Majority of them are poor, live in rural areas and are engaged in agriculture. They provide substantial support to agriculture which is the backbone of Indian economy.

Scheduled castes constitute an important segment of Indian population. The Scheduled Caste population has been increasing steadily since 1951, not only in absolute numbers but also in proportion to the total population. Scheduled Castes population was 64 million in 1961 which rose to 80 million in 1971, 105 million in 1981, 138.2 in 1991 (excluding Jammu and Kashmir where 1991 census could not be held), 166.6 million in 2001 and 201.4 million in 2011. The share of Scheduled Castes population has been growing almost consistently since 1951 at the rate of 1.1 per cent to reach 16.63 per cent of the total population in India in 2011.

Distributional Pattern of Schedules Castes

A reference to **Table 11.2** shows that Scheduled Castes are not confined to specific areas; rather they are distributed all over the country. Uttar Pradesh had the largest number of 41.35 million Scheduled Caste people in 2011. This was followed by West Bengal where 21.46 million Scheduled Caste population. These two states account for nearly one-third (31.3 per cent) of the Schedules Caste population of the country. Other states with large size of the Scheduled Caste population are Bihar (16.5 million), Tamil Nadu (14.4 million), Andhra Pradesh and Telangana (13.8 million), Maharashtra (13.2 million), Rajasthan (12.2 million), Madhya Pradesh (11.3 million), Karnataka (10.4 million), Punjab (8.8 million) and Odisha (7.2 million). States with low concentration of scheduled castes population are Sikkim, Manipur, Meghalaya and Goa. Union territories of Daman and Diu and Dadra and Nagar Haveli also have low concentration of Scheduled Castes. No Scheduled Castes have been reported in the states of Arunachal Pradesh, Nagaland and Union Territories of Lakshadweep and Andaman and Nicobar Islands.

It is clear from the above description that the highest concentration of Scheduled Caste is found in the alluvial plains of north India because they find ready employment as agricultural labourers. They are also found in large numbers in the delta plains of South India. In contrast, most of the north-eastern states and largest parts of Jammu and Kashmir have very low concentration of Scheduled Castes.

In terms of the percentage of Scheduled Caste population to the total population, Punjab with 31.94 per cent tops the list. Other states with more than one-fifth of population being Scheduled Caste are Himachal Pradesh (25.19%), West Bengal (23.51%) and Uttar Pradesh (20.69%). As many as 10 states and union territories have 15 to 20 per cent of their population termed as Scheduled Castes. These are in descending order, Uttarakhand, Chandigarh, Rajasthan, Tripura, Karnataka, Odisha, NCT of Delhi, Andhra Pradesh (including Telangana), Tamil Nadu and Madhya Pradesh. In Jharkhand, Chhattisgarh and Maharashtra, the proportion of Scheduled Caste population to total population varies from 10 to 15 per cent. Kerala, Jammu and Kashmir, Gujarat, Assam and Sikkim have 5 to 10 per cent of the population as Scheduled Castes. Daman and Diu, Manipur, Dadra and Nagar Haveli, Goa, Arunachal Pradesh, and Meghalaya have less than five per cent Scheduled Caste population. Scheduled Castes are negligibly small in Mizoram, no castes have been scheduled for Arunachal Pradesh, Nagaland, Lakshadweep and Andaman and Nicobar Islands (**Fig. 11.1**).

Keeping in view the above description regarding the distribution of Scheduled Caste population, following two zones of high concentration are recognised :

(*a*) **The Indo-Gangetic Plains.** The Indo-Gangetic Plains are composed of rich alluvial soils. Water supply, suitable climate and weather provide opportunities for agricultural labourers to settle in the alluvial plains. Consequently, the Indo-Gangetic Plains are the zones of high concentration of scheduled castes who are primarily agricultural labourers.

(*b*) **The East Coastal Plains.** The East Coastal plains provide identical opportunities for the settlement of agricultural communities as they are available in the Indo-Gangetic Plains of the north. Hence, the scheduled castes are found concentrated on eastern coasts particularly in coastal areas of Tamil Nadu, Andhra Pradesh, and Odisha.

The Changing Caste System. The origin of caste system in India may be traced in the Aryan settlement and expansion sometime in the second millennium. Ever since its introduction, caste system has persisted and expanded, with assimilation of new elements, to form new castes. This system has worked very well in the rural, self-contained, conservative society of India in which each social stratum performs its assigned functional role. But this system is based on social inequalities and is surely undemocratic in its fundamental nature. Moreover, it presupposes a fiscal environment of unchanging social norms and needs.

Keeping above facts in mind, there is an urgent need to demolish this unethical, unreasonable, and undemocratic caste system. Fortunately, there are great forces like literacy and constitutional democracy

TABLE 11.2. Total Population and Percentage of Scheduled Caste and Scheduled Tribe : 2011 Census

Sl. No.	India / State/ Union Territory	Total	Scheduled Caste		Scheduled Tribe	
		Population ('000)	Total Population ('000)	Percentage of total population	Total Population ('000)	Percentage of total population
	INDIA	**1,21,05,69,573**	**20,13,78,086**	**16.63**	**10,42,81,034**	**8.61**
1.	Jammu and Kashmir	1,25,41,302	9,24,991	7.37	14,93,299	11.91
2.	Himachal Pradesh	68,64,602	17,29,252	25.19	3,92,126	5.71
3.	Punjab	2,77,43,338	88,60,179	31.94	0	0.00
4.	Chandigarh*	10,55,450	1,99,086	18.86	0	0.00
5.	Uttarakhand	1,00,86,292	18,92,516	18.76	2,91,903	2.89
6.	Haryana	2,53,51,462	51,13,615	20.17	0	0.00
7.	NCT of Delhi*	1,67,87,941	28,12,309	16.75	0	0.00
8.	Rajasthan	6,85,48,437	1,22,21,593	17.83	92,38,534	13.48
9.	Uttar Pradesh	19,98,12,341	4,13,57,608	20.69	11,34,273	0.57
10.	Bihar	10,40,99,452	1,65,67,325	15.91	13,36,573	1.28
11.	Sikkim	6,10,577	28,275	4.63	2,06,360	33.79
12.	Arunachal Pradesh	13,83,727	0	0.00	9,51,821	68.79
13.	Nagaland	19,78,502	0	0.00	17,10,973	86.48
14.	Manipur	25,70,390	97,042	3.78	9,02,740	35.12
15.	Mizoram	10,97,206	1,218	0.11	10,36,115	94.43
16.	Tripura	36,73,917	6,54,918	17.83	11,66,813	31.76
17.	Meghalaya	29,66,889	17,355	0.58	25,55,861	86.15
18.	Assam	3,12,05,576	22,31,321	7.15	38,84,371	12.45
19.	West Bengal	9,12,76,115	2,14,63,270	23.51	52,96,953	5.80
20.	Jharkhand	3,29,88,134	39,85,644	12.08	86,45,042	26.21
21.	Odisha	4,19,74,218	71,88,463	17.13	95,90,756	23.85
22.	Chhattisgarh	2,55,45,198	32,74,269	12.18	78,22,902	30.62
23.	Madhya Pradesh	7,26,26,809	1,13,42,320	15.62	1,53,16,784	21.09
24.	Gujarat	6,04,39,692	40,74,447	6.74	89,17,174	14.75
25.	Daman and Diu*	2,43,247	6,124	2.52	15,365	6.32
26.	Dadra and Nagar Haveli*	34,33,309	6,186	1.79	1,78,564	51.95
27.	Maharashtra	11,23,74,333	1,32,75,898	11.81	1,05,10,213	9.35
28.	Andhra Pradesh and Telangana	8,45,80,777	1,38,78,078	16.41	59,18,073	6.99
29.	Karnataka	6,10,95,297	1,04,74,992	17.15	42,48,987	6.95
30.	Goa	14,58,545	25,449	1.74	1,49,274	10.23
31.	Lakshadweep*	64,473	0	0.00	61,120	94.79
32.	Kerala	3,34,06,061	30,39,573	9.09	4,84,839	1.45
33.	Tamil Nadu	7,21,47,030	1,44,38,445	20.01	7,94,697	1.10
34.	Puducherry*	12,47,953	1,96,325	15.73	0	0.00
35.	Andaman and Nicobar Islands*	3,80,581	0	0.00	28,530	7.49

*Union territory

Source : Computed from Census of India 2011 Report on revised data issue on C.D. in 2014.

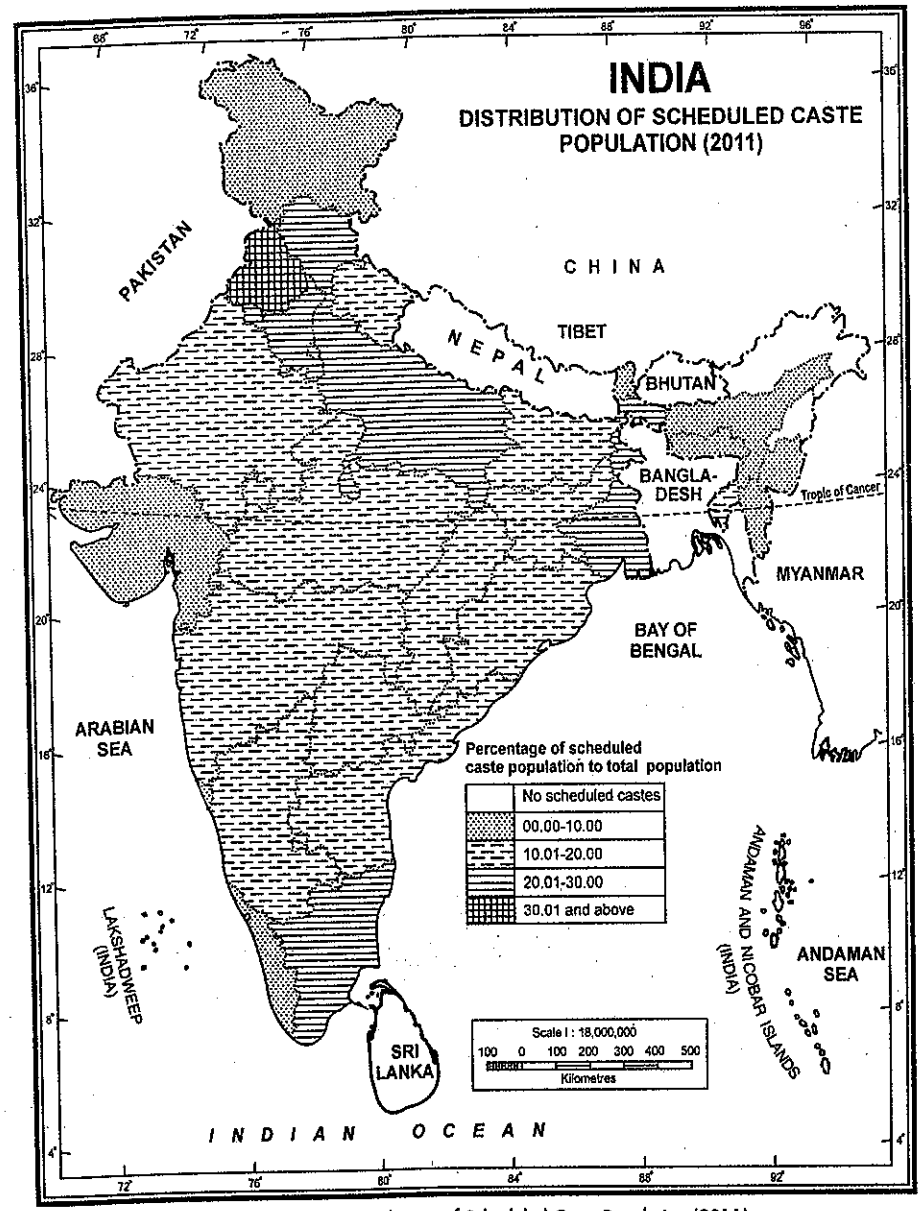


FIG. 11.1. India : Distribution of Scheduled Caste Population (2011)

working with increasing strength against it as the society becomes more urbanised and modernised. Traditional restrictions are slowly being sloughed off in the cities and caste inequalities are being eroded perceptibly. City life inhibits the observance of caste rituals in the matter of interlining and polluting physical contact in public places like cinema houses, shopping areas, city transport, restaurants, etc. Spatial

diffusion of these social amenities to rural areas is still limited, but it is on the increase. Transport facilities have penetrated in the rural landscape of India making significant changes in the economic and social life of the rural masses. The traditional self-sufficiency of the villages has been reduced drastically as the money economy becomes more popular. The handicrafts and the caste-related *jajmani* are also disappearing slowly but gradually.

TRIBAL POPULATION

The tribes are the autochthonous or native people of the land who are believed to be the earliest settlers in the Indian Peninsula. They are generally called *adivasis*, implying original inhabitants. The ancient and medieval literature mention a large number of tribes living in India. Before the introduction of the caste system during the Brahminic Age, people were divided into various tribes. A tribe was a homogeneous and self contained unit without any hierarchical discrimination.

The study of tribal population suffers from serious anomalies as there is no clear cut and scientific criteria for this purpose. For example, the Gonds are a Scheduled Tribe in Madhya Pradesh, but a Scheduled Caste in Uttar Pradesh. This problem of anomalies is further aggravated in the case of transhumant groups like the Gujjars of north-western India. A Gujjar Bakarwal Kafila when pasturing in Himachal Pradesh during summer belongs to the scheduled category and the same group loses this status in its winter pastures on the Jammu plains. However, under Article 342 of the Constitution of India, certain tribes have been specified as Scheduled Tribes. Article 342 provides for specification of tribes or tribal communities which are deemed to be for the purposes of the Constitution the Scheduled Tribes and relation to that State or Union territory. In pursuance of these provisions the lists of Scheduled Tribes are notified for each State or Union territory and are valid only within the jurisdiction of the State or Union territory and not outside.

Growth of Tribal Population

The demographic study of tribal population has suffered seriously due to the adoption of arbitrary criteria for 'scheduling' the tribes. After the partition of the country in 1947, the tribal population, as determined by the Constitutional (Determination of Population) Order 1950 was reduced from 24.7 million in 1941 to about 17.9 million. The 1951 census, which was the first census after Independence, recorded a total tribal population of 1,91,19,054. This number of tribal population was according to the terms of the *Scheduled Tribes Order* of 1950. This led to strong resentment among certain tribes resulting in stresses and strains in the Indian polity. In pursuance of the 'Modification Order' of 1956, another 34,00,000 persons, belonging to tribal groups and left out earlier, were added and the number rose to 2,25,19,054. This accounted for 6.23 per cent of the total population of the country at that time. According to 1961 census, there were 3,01,73,998 persons belonging to Scheduled Tribes accounting for 6.87 per cent of the total population of the country. The situation further changed during the 1961-71 inter censal period. Several communities of Uttar Pradesh, *viz.* Jaunsari, Tharus, Buxas, Bhutias and Rajis were included in the 'Schedule' in terms of Presidential Order of June 1967. Thus at the time of 1971 census, the number of Scheduled Tribes had risen to 3,80,15,162 accounting for 6.94 per cent of India's total population. In 1981, the total tribal population (excluding Assam where 1981 census was not held) was 5.38 crore which worked out to 7.58 per cent of the total population. The decennial growth rate during 1971-81 was abnormally high at 41.56 per cent. This was caused by the amendment in the lists of Scheduled Tribes in 1976 removing area restrictions. During this decade, the list of Scheduled Tribes was promulgated by the President in respect of Sikkim (22-6-1978). As per 1991 census, Scheduled Tribes population was 6,77,58,380 (excluding Jammu and Kashmir) and its share in the total population worked out to be 8.08 per cent. The decennial growth during 1981-91 was 25.91 per cent. The rate of growth of the tribal population during 1991-2001 had been recorded at 24.34 per cent, which was higher than the general population growth rate of 21.54 per cent. The tribal population of India increased from 8.43 crore in 2001 to 10.43 crore in 2011 registering a growth rate of 23.72 per cent during the decade. Table 11.3 shows the growth of tribal population as well as its share in the total population.

It is obvious from the above discussion that the growth of Scheduled Tribes population was due to following two reasons :

(*i*) There has been a rapid natural growth of tribal population and

(*ii*) Additions have been made to the list of Scheduled Tribes time and again.

TABLE 11.3. Growth of Scheduled Tribes in India

Census Year	Total Population of Scheduled Tribes in lakhs	Percentage of Scheduled Tribes to Total Population
1951	225	6.23
1961	302	6.87
1971	380	6.94
1981*	538	7.58
1991**	678	8.08
2001	843	8.20
2011	1,043	8.61

*Excluding Assam

**Excluding Jammu and Kashmir

Source : (*i*) Census of India 2001

(*ii*) Census of India 2011 Report released on C.D. in 2014.

There are divergent opinions regarding the actual number of tribal communities living in different parts of India. The 1961 census recorded 354 communities based on the scheduled castes and scheduled tribes lists (Modification Order, 1956), **N.K. Bose** (1971) and B.K. Roy Burman (1972) had put the number of Scheduled Tribes at 427 and 450 respectively. The Census of India had given the number of scheduled tribes as 573 in its paper-2 of 1992 of series 1. But a caution has been given that it should not be taken as the total number of tribes, as a tribe might have been notified in different states and union territories and counted as tribe more than once. For example, Bhil has been notified as a scheduled tribe in Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Tripura. Thus in the total of 573, Bhil has been added seven times, once in each of the seven states. Hence, this total does not reflect the actual number of tribes in the country. A fairly accurate estimate puts the number of tribes in India at 365.

Distribution of Scheduled Tribes

An appraisal of the distribution pattern of the tribal communities shows that their spatial distribution is characterised by a striking tendency of clustering and concentrating in pockets, which have suffered from isolation and are situated in areas where environmental setting is, by and large, not suitable for settled agriculture. Thus, most of the tribal communities live in hilly and forested tracts and other remote areas of the country. Constrained by the rigors of environment, which fostered physical and social isolation for ages, the tribal communities have developed their own traditional mode of living. However, the interaction between tribal and non-tribal people after Independence has changed the scenario to some extent.

The distribution of Scheduled Tribes is markedly different from that of Scheduled Castes. For example, Scheduled Tribes have a tendency to concentrate in remote and less hospitable areas, whereas Scheduled Castes show a very high concentration in the fertile Indo-Gangetic Plain and the Coastal Plains where they work as agricultural labourers. Further, it is interesting to note that while no caste has been scheduled in Arunachal Pradesh, Nagaland, Andaman and Nicobar Islands and Lakshadweep, no tribe has been scheduled in the states of Haryana and Punjab and the Union Territories of Chandigarh, Delhi and Puducherry.

State Level Patterns

There are wide variations in the state level distribution of tribal population. While, on one hand, no tribes have been scheduled in Punjab and Haryana, and the union territories of Delhi, Chandigarh and Puducherry, as much as 94.43 per cent of the total population in Mizoram and 94.79 per cent in Lakshadweep belongs to Scheduled Tribes. The other States/Union Territories with predominantly Scheduled Tribes population are : Nagaland (86.48), Meghalaya, (86.15), Arunachal Pradesh (68.79). Manipur, Chhattisgarh and Tripura also have substantial proportion of population as Scheduled Tribes. Among the 15 major states, Chhattisgarh has the largest proportion of Scheduled Tribe population of 30.62 per cent followed by Jharkhand 26.21 per cent. Gujarat, Assam, Rajasthan and Jammu and Kashmir and Goa are the other four major States in

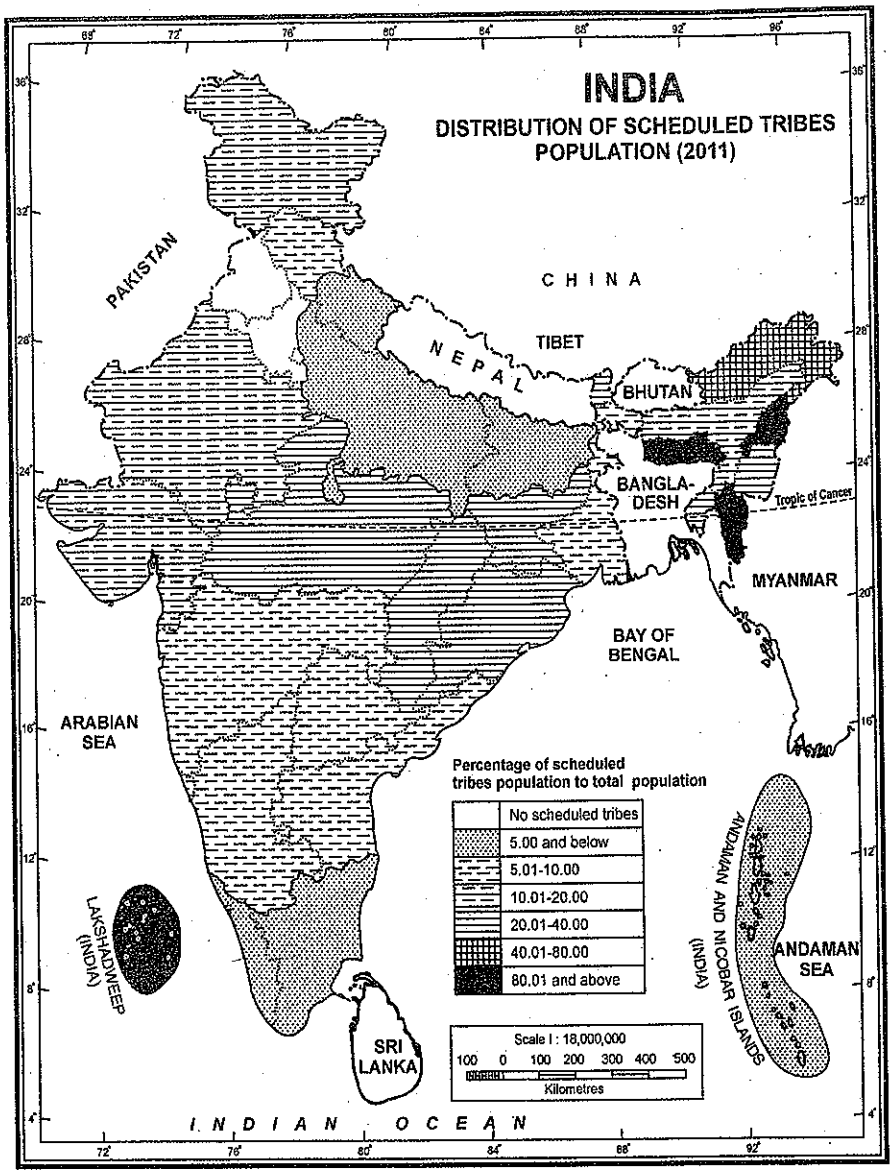


FIG. 11.2. India : Distribution of Schedule Tribes

which more than 10 per cent of the population belong to Scheduled Tribes.

Of the total Scheduled Tribes population of about 10.43 crores counted in different States/UTs in India, 14.68 per cent are in Madhya Pradesh, 10.08 per cent in Maharashtra and 9.12 per cent in Odisha. Thus, roughly one-third of the Scheduled Tribes population of India lives in these three states only. Going a little further, 71 per cent of the Scheduled Tribes population of India lives in six states, viz. Madhya Pradesh, Maharashtra, Odisha, Gujarat, Rajasthan and Jharkhand. In terms of absolute numbers, the Scheduled Tribes population was 153.17 lakhs in Madhya Pradesh, 105.1 lakhs in Maharashtra, 95.9 lakhs in Odisha, 92.38 lakhs in Rajasthan, 89.17 lakhs in Gujarat, 86.46 lakhs in Jharkhand 54.18 lakhs in Andhra Pradesh (including Telangana), 52.96 lakhs in West Bengal, 42.49 lakhs in Karnataka, 38.84 lakhs in Assam, 25.56 lakhs in Meghalaya and 17.11 lakhs in Nagaland. All other states and Union territories together have about 45 lakhs Scheduled Tribe population; there being absolutely no scheduled tribe population recognised in Haryana, Punjab, Chandigarh, Delhi and Puducherry.

Tribal Economy

Tribal economy forms an important criterion for classifying Scheduled Tribes in India. The dominant economies of the tribes are : (1) Hunting, fishing and food gathering, (2) Shifting cultivation and lumbering, and (3) Sedentary cultivation and animal husbandry. A brief account of tribes practising these economies is given as under :

(1) Hunting, Fishing and Gathering. A large number of tribes live in isolation in forests and depend upon hunting, fishing and food gathering. Some of the tribes depend exclusively on these occupations. The main tribes which practise these professions are the Raji in Uttar Pradesh; Kharia, Birhor, Korwa, Pariha and Birgias in Jharkhand; Kuki in West Bengal; Hill-Maria in Chhattisgarh, Juang in Odisha, Chenchu and Yanadi in Andhra Pradesh and Telangana; Koya, Reddi, Kadar and Paliyan in Tamil Nadu, Bhil, Garasia in Maharashtra and Gujarat; Bhil, Garasia and Sahariya in Rajasthan and Kuki, Konyak and Naga in Assam, Meghalaya, Nagaland and Arunachal Pradesh.

(2) Shifting Cultivation and Lumbering. Shifting cultivation is said to be as old as history of agriculture itself. In this type of cultivation, a piece of forest land is cleared by slash-and-burn technique and crops are grown. After 2-3 years, the fertility of the soil is reduced and the farmer shifts to another piece of land. This is the reason that it is called shifting agriculture. It is known by different names in different parts of the country. It is called *Jhum* or *jum* in north-east India, *kumari* in Western Ghats, *watra* in south-east Rajasthan and *penda, bewar* or *dahia* and *deppa* in different parts of Chhattisgarh and Madhya Pradesh. **Lumbering** involves obtaining wood from the forests. The main tribes practising shifting cultivation and lumbering are Koria, Saharia, Bhutias and Kharwar in Uttar Pradesh, Korwa and Asur in Jharkhand; Garo, Mal-Paharia in West Bengal; Maria, Gonda, Baiga and Dhora in Chhattisgarh and Madhya Pradesh; Saora, Khond, Kurumba and Bagola in Andhra Pradesh; Saora, Keria and Khond in Odisha; Khond, Gond, Kurumba and Muduwan in Tamil Nadu; Bhil and Garasia in Maharashtra and Gujarat; Kathodia in Rajasthan, Naga, Lakher, Chakmas, Garo, Riang, Notia, etc., in the north eastern states.

(3) Sedentary Cultivation and Animal Husbandry. Sedentary cultivation is a type of agriculture in which the farmer grows crops to meet his own requirements and not much is left for sale in the market. This is not an advanced type of cultivation and is generally practised by the tribal people along with animal husbandry. The main tribes adopting these professions are the Tharu, Maghi Khasa, Bhoksa, Kol and Bhotias in Uttar Pradesh; Munda, Ho, Oraon, Tamaria, Korwa and Santhal in Jharkhand; Santhal, Polia, and Bhumji in West Bengal; Parja, Bhatra, Baija and Gond in Chhattisgarh and Madhya Pradesh, Badaga, Irula, Parga and Malydi in Tamil Nadu, Badaga, Koya, Irula and Kota in Andhra Pradesh and Telangana; Bhil, Dubla, Raiwari, Barali, Koli, Dhamalia, etc. in Maharashtra and Gujarat, and Bhil, Garasiya and Meena in Rajasthan.

LANGUAGE AND DIALECT GROUPS

India is a land of vastness and continuity. It is now certain that the inhabitants of the country are not her original people. They entered India in different spans of time and got settled here. Most of them belong to the Asian parts—Central, Eastern and Western. It is natural that differences and variations exist in their languages and dialects owing to their coming into India from different parts of Asia. After coming into India, cultural mixing has taken place among various races and it led to the mixing of their languages and dialects to a great extent. Despite all this, people of different races and classes live in different parts of the

country and they speak different languages and dialects.

Classification of Indian Languages

People of India speak a large number of languages which are broadly divided into the following four families :

1. Indo-European Family (Arya),
2. Dravidian Family (Dravida),
3. Austric Family (Nishada), and
4. Sino Tibetan Family (Kirata).

The above classification is based upon the number of people speaking each family of languages. The first is the Aryan family which is numerically and also culturally, the most important in India. About 73% of the Indian population speaks different languages of the Aryan family. Next comes the Dravidian family which is spoken by about 20 per cent of the Indian population. The Austric and the Sino-Tibetan languages are spoken by small percentage of people.

1. The Aryan Languages

This is the most important of all the families of languages and spoken by a little less than three fourths of the Indian population. The Aryan languages are divided into following two main branches :

(*i*) The Dardic Aryan Languages and

(*ii*) The Indo Aryan Languages

(*i*) The Dardic Aryan Languages. This group comprises a number of languages which are current among very small mountain communities in Kashmir. Out of India, it is spoken by small communities living on the frontier between Pakistan and Afghanistan. The Dardic languages fall into three branches : (*a*) Shina including Kashmiri, Shina proper and Kohistani; (*b*) Khowar or Chatrari or Chitrali and (*c*) Kafiristan (or Nuristani) dialects.

In Kashmir, there is Shina and Kashmiri, and some dialects allied to Kashmiri. Kashmiri appears to be in its bases a Dardic Aryan dialect. But it has been profoundly influenced by Sanskrit and the Prakrits from the very early times. Many scholars are of the opinion that Kashmiri is Indo-Aryan rather than Dardic. Most scholars consider Dardic to be just a branch of Indo-Aryan. These Dardic dialects are largely on the way to extinct. Kashmiri, however, is one of the recognised national languages of the Indian Union. Except Kashmiri, which is spoken by more than 20 lakh people, no other language of the Dardic Aryan languages is spoken by more than 7 thousand people.

(*ii*) The Indo-Aryan Languages. This is the second sub-group of the Aryan languages in which Hindi, Bengali, Punjabi, Rajasthani, Gujarati, Sindhi, Kachchi, Marathi, Oriya, Sanskrit, Assamese and Urdu are included. Based upon the regional distribution of the people speaking these languages, they are further grouped as under :

(*a*) ***Northern Aryan Languages.*** Languages of this group belong to the dialects spoken by the hilly people in North India. They include Nepali, Central Pahari and Western Pahari Aryan languages.

(*b*) ***North-Western Aryan Languages.*** Khanda, Kachchi and Sindhi are the well-known Aryan languages which are spoken by the people living in the north-western part of the country.

(*c*) ***Southern Aryan Languages.*** Marathi and Konkani are the languages included in the Southern group of Aryan languages.

(*d*) ***Eastern Aryan Languages.*** The region of these languages lies in the eastern parts of the country. Bihari, Oriya, Bengali and Assamese languages constitute this group of Aryan languages.

(*e*) ***East Central Aryan Languages.*** Avadh, Bundelkhand and Chhattisgarh regions include these languages as the languages of the people living there. Avadhi, Bugheli and Chhattisgarhi are their languages.

(*f*) ***Central Aryan Languages.*** The central region of India is the region of Central Aryan languages. The major languages of this region are Hindi, Punjabi, Rajasthani and Alawari.

Among the Aryan languages, Hindi is the most important language, spoken by a large percentage people of the country. In every Indian state, Hindi-speaking people are commonly found. Even the illiterate people can speak and understand Hindi. It would, therefore, be in the interest of one and all to give Hindi the status of a national language.

2. Dravidian Languages

Dravidian languages are older than the Aryan languages. According to an estimate, Dravidians entered India much before the Aryans. Other estimates indicate that they are the original inhabitants of the country, who were driven away towards south by the Aryans at a later stage. Today, the Dravidian languages form a well knit family by themselves and unlike the Aryan, the Austric and the Sino-Tibetan speeches, they have no relations outside the Indian subcontinent. The Dravidian languages fall into several groups. Two major groups are as under :

(*i*) The North Dravidian Languages. Telugu and a number of other languages such as various Gondi dialects, Kuruth or Oraon, Maler or Malpahariya, Kui or Kandh, Parji, Kolami and a few others are included in this group. Telugu is numerically the most important of all the Dravidian languages and has a very rich literature. This language has spread outside India also—in Myanmar, Indo-China and South Africa. It is usually called the *Italian of the East* by its admirers. Its vocabulary is much influenced by Sanskrit.

(*ii*) South Dravidian Languages. This group of languages includes Tamil, Kannada and Malayalam. A number of speeches like Tulu, Kota, Kurgi (or Kedagu) and Toda are also included in this group. Tamil is spoken in large parts of Tamil Nadu. Outside India, it is spoken by a large number of people in Sri Lanka. This language has preserved the old Dravidian spirit in its original form to a great extent. Tamil literature goes back to many centuries before Christ. Tamil presents certain new literary types which are not found in Sanskrit and other Aryan languages. While it includes extensive Sanskrit element, this language has retained the purity of its Dravidian vocabulary to a much greater extent than any other cultivated Dravidian language.

Malyalam is currently the language of Kerala and Lakshadweep. It had its origin in the old Tamil about 1,500 years ago. The Old Tamil speech, started showing simplifications as early as 10th century A.D. Then it followed its own path away from its sister dialects. The speech of Kerala developed independently and became transformed into Malyalam. The first Malayalam writings are said to go back into the period from 13th century to 15th century, when it was established as an independent language. Malayalam has been influenced by Sanskrit more than any other language of India.

Kannada is the main language of the present Karnataka state. The literary cultivation of this language began from the middle of the first millennium A.D. Kannada has passed through three stages : (*a*) Old Kannada upto 13th century (*b*) Medieval Kannada upto 16th century and (*c*) Hosa Kannada which is the language of the present day.

3. Austric Languages

The Austric languages of India belong to the Austro-Asiatic sub-family. This category is further sub-divided into Munda and Mon-Khmer.

(*i*) Munda or Kol Languages. Munda languages are the largest of the Austric group of languages. They consist of fourteen tribal languages. The Kherwari is the major group, which is current in Eastern India (Chota Nagpur, Odisha, Chhattisgarh and West Bengal) and includes Santhali, Mundari, Ho, Birhor, Bhumiej, Korwa and Korku (or Kurku). Santhali, Mundari, and Ho languages have a noteworthy literature preserved orally, consisting of songs and mythological romantic stories.

(*ii*) Mon-Khmer Languages. Mon-Khmer group of Austric languages has two sub-groups—Khasi and Nicobari. Khasi languages are spoken by Khasi tribal people of Meghalaya, while Nicobari languages are the languages of the tribal people of the Nicobar islands. Khasi used to be written in Bengali-Assamese script about a century ago. Through the influence of Welsh Methodist missionaries, the Roman alphabet has been adopted for Khasi and some literature has been produced.

4. Sino-Tibetan Languages

The Sino-Tibetan languages are spoken by a variety of people. Depending upon the region of settlement, these languages are put into several groups and sub-groups. Sino-Tibetan languages have three major sub-divisions :

(*i*) The Tibeto-Himalayan.
(*ii*) The North-Assamese
(*iii*) The Assam-Myanmari (Burmese)

(*i*) The Tibeto-Himalayan Languages. This sub-division of the Sino-Tibetan group of languages

is further sub-divided as the Himalayan group and the Bhutia group.

(*a*) ***The Himalayan Group.*** The Himalayan group consists of 4 languages. They are Chamba, Lahauli, Kannauri and Lepcha. Kannauri is the most widely spoken language of the Himalayan group.

(*b*) ***The Bhutia Group.*** Tibetan, Balti, Ladakhi, Lahauli, Sherpa and Sikkim Bhutia are included in the Bhutia group of Sino-Tibetan languages. Ladakhi has largest number of Bhutia speakers. It is followed by Sikkim Bhutia and the Tibetan languages in that order.

(*ii*) **North Assam Languages.** The North Assam branch of languages of the Sino-Tibetan group is also called the *Arunachal* branch. It consists of six languages, such as Aka, Daflta, Abor, Miri, Mishnil and Mishing. Largest number of people speak Miri language.

(*iii*) **The Assam Myanmari Languages.** This group of languages include Boro or Bodo, Naga, Cochin, Kukichin and Myanmar groups. Naga is the largest speaking language of this group.

Besides these, the Sino-Tibetan group of languages has some other important languages. They are Manipuri, Garo, Tripuri, Mikir and Lusai. Lusai is also termed as Mizo.

Linguistic Regions. It is said that India is a (veritable) forest of languages. In the Linguistic Survey conducted during the British period it was concluded that there were 179 languages and 544 dialects in this region (Linguistic Survey of India, 1903-1928). The principal credit for this significant piece of work is given to its editor-in-chief Sir George A. Grierson. In this survey of modern Indian languages, he classified them into language families along historical (comparative) lines. Out of a total of 179 languages mentioned in the Linguistic Survey, 116 are small tribal speeches. They are spoken only on the northern and north-eastern fringes of India and are current among less than one per cent of the total population of the country. Nearly two dozen more are, likewise, insignificant speeches of other language groups; or they are languages not truly belonging to India.

The most comprehensive data on languages was collected at the time of 1961 Census. According to these census figures, there were 187 languages spoken in India. Out of these, as many as 94 languages are spoken by less than 10,000 persons each and 23 languages together account for 77 per cent of the total population of the country. Of these 23 languages, 15 languages in addition to English have been specified in the Eighth Schedule of the Constitution of India. Three more languages have been added to Eighth Schedule by a Parliamentary Act on 20th August, 1992. These languages are Nepali, Konkani and Manipuri. Later on, Maithili, Santali, Dogri and Bodo were also included in the Schedule, making a total of 22 languages. The number of people and their percentage to the total population speaking these languages is given in **table 11.4.**

TABLE 11.4. Schedule Languages in Descending Order of Speakers' Strength-2001

Language	Persons who returned the language as their mother tongue 2001	Percentage to total population 2001
INDIA	1,02,86,10,328	96.56
1. Hindi	42,20,48,642	41.03
2. Bengali	8,33,69,769	8.11
3. Telugu	7,40,02,856	7.19
4. Marathi	7,19,36,894	6.99
5. Tamil	6,07,93,814	5.91
6. Urdu	5,15,36,111	5.01
7. Gujarati	4,60,91,617	4.48
8. Kannada	3,79,24,011	3.69
9. Malayalam	3,30,66,392	3.21
10. Oriya	3,30,17,466	3.21
11. Punjabi	2,91,02,477	2.83
12. Assamese	1,31,68,484	1.28
13. Maithili	1,21,79,122	1.18
14. Santali	64,69,600	0.63
15. Kashmiri	55,27,698	0.54
16. Nepali	28,71,749	028
17. Sindhi	25,35,485	0.25
18. Konkani	24,89,015	0.24
19. Dogri	22,82,589	0.22
20. Manipuri	14,66,705	0.14
21. Bodo	13,50,478	0.13
22. Sanskrit	14,135	N

Speakers of certain other languages left out of the Eighth schedule are demanding the inclusion of their languages in the list of the languages. Some of the important languages of this category are Sindhi, Rajasthani, Khasi and Gondi.

Language became a very important basis for the formation of states in India after Independence, thereby adding a new political meaning to the geographical distribution of languages. Today, most of the states of the Indian Union have been delimited on the basis of linguistic pattern of languages. However, the languages and dialects of the tribal people living in the north-eastern, eastern and central parts of the country do not fit in any linguistic pattern, as they are varying in number and their speakers live in unspecified areas or regions. In all, there are 12 languages in India, which are widely spoken.

Based on these languages, there are twelve linguistic states, of which states delimited from the political point of view are depicted in **Table 11.5** and **Fig. 11.3**.

The relative importance of different languages had undergone drastic change in the historical time. Until the ninth century, Sanskrit was the language for administration and of the cultural elite. Today, Sanskrit is no longer a spoken language, although it is mother of any Indian language. Persian and later Urdu became the court and the administrative language of the Mughal and other Muslim rulers. In the eighteenth century when the Britishers established their supremacy and became the rulers of India, English replaced Persian as the language of courts, administration and higher learning. In the post-independence period, Hindi has emerged as the most popular language and is spoken by majority of people living particularly in north India. This is the official language of several Hindi speaking states like Uttar Pradesh, Uttarakhand, Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Haryana, Rajasthan, and Himachal Pradesh. Including its variants like the Bihari, Rajasthani, Marwari, Magadhi, Chhattisgarhi, Maithili, Pahari, Bhojpuri, etc. Hindi ranks numerically third most widely spoken language of the world after Mandarin Chinese and English. As per 2001 Census figures, Hindi along with its recognised regional variants is spoken by 422 million Indians which is about 41% of the total population. The other major languages are Bengali (8.1%), Telugu (7.2%), Marathi (6.9%), Tamil (5.9%) and Urdu (5.0%). Gujarati, Kannada, Malayalam, Oriya, Punjabi and Assamese are spoken by less than 5 per cent but more than one per cent of total population. Kashmiri, Nepali, Sindhi, Konkani, Dogri, Manipuri, Bodo and Sanskrit are spoken by less than one per cent population each.

TABLE 11.5. Linguistic Regions and Languages

Linguistic Region	State/U.T.
1. Kashmiri	Valley of Kashmir
2. Punjabi	Punjab and adjoining parts of Haryana
3. Hindi	U.P., Haryana, H.P., M.P., Chhattisgarh, Jharkhand, Uttarakhand, Delhi, Bihar and Rajasthan
4. Bengali	W. Bengal and Parts of Tripura
5. Assamese	Assam and other northeastern states
6. Oriya	Odisha
7. Gujarati	Gujarat
8. Marathi	Maharashtra, Goa
9. Kannada	Karnataka
10. Telugu	Andhra Pradesh and Telangana
11. Tamil	Tamil Nadu, Puducherry
12. Malayalam	Kerala, Lakshadweep

It is worth mentioning here that although, the present political map of India represents more or less the language map of the country, the state boundaries do not always correspond to linguistic boundaries. The example of Hindi belt may be cited here. This belt covers major states of Uttar Pradesh, Bihar, Jharkhand, Rajasthan, Madhya Pradesh, Chhattisgarh, Haryana, Himachal Pradesh and Uttarakhand including the union territories of Delhi and Chandigarh. In these areas, various languages and dialects have all been brought under the aegis of Hindi and without considering the spoken languages in Garhwal or Kumaon, Magadha or South Bihar, Rajasthan and Bastar district of Chhattisgarh the entire region has been labelled as the Hindi area. As a matter of fact, the linguistic boundary itself is not well defined. Instead of being a sharp line, it is a transitional zone over which one language gradually loses its dominance and gives way to the other.

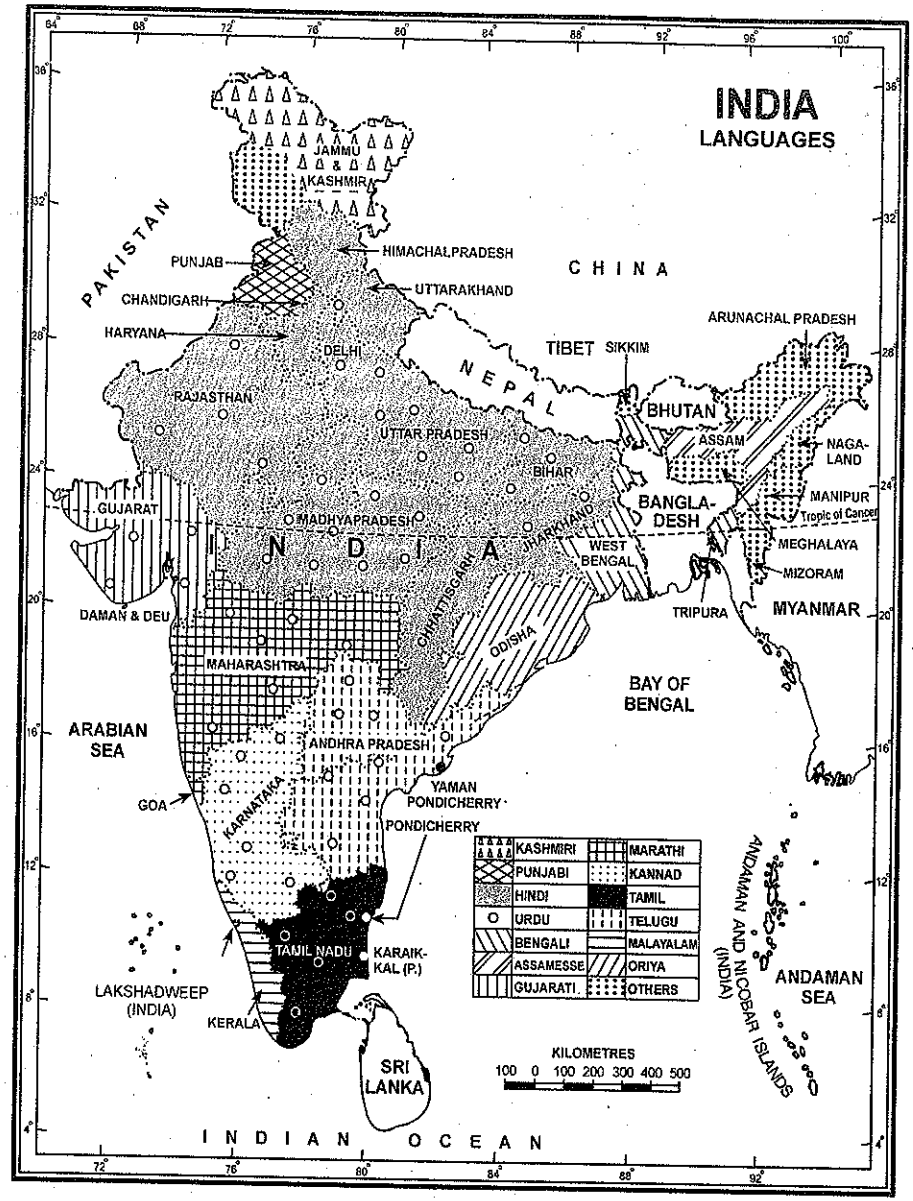


Fig. 11.3. Linguistic Regions

The complexity and diversity of India's linguistic landscape is further compounded by the prevalence of considerable bilingualism or multilingualism along the inter-state boundaries where two or three languages merge into each other. It is estimated that about 10 per cent of India's population is bilingual or trilingual. In several states, the major language of one adjacent state is the second largest language of the

state. For example Tamil is the second most important language in Kerala; in Tamil Nadu it is Telugu; in Telangana it is Urdu. As a matter of fact, Urdu is the "second language" of over 43 million speakers in several states (**Fig. 11.3**). Hindi is claimed to be the "second language" by about 30 million speakers living out of the "Hindi belt". States of Uttar Pradesh, Uttarakhand, Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh, Haryana, Himachal Pradesh and Rajasthan are included in the "Hindi belt". Further, nearly 10 per cent of the Telugu-speakers live outside the Telugu-speaking states of Andhra Pradesh and Telangana. Cosmopolitan cities like Delhi, Mumbai, Kolkata and Chennai contain significant number of speakers of several languages.

National Language and National Unity

Talking of a national language for people living in a polyglot country like India is a complicated matter and poses a serious problem. Hindi is spoken by the largest number of people living in large states. As such Hindi has been championed as the national language since India got independence. The Indian Constitution bestows upon 22 of the country's major languages status of official languages (**Table 11.4**) with pride place for Hindi (in Devanagari script) which is recognised as the "official language" for all India communication at the central level. The Constitution of India also provided that English would continue to be used for all purposes at the central level for a period of 15 years from 1950 to 1965. This language was assigned a special role in central government's transactions, in parliamentary debate, in courts and as a medium of instruction for specialised subjects for higher and technical education, and also a **'link'** language between various states. At the state level, regional languages are the official languages.

Making Hindi the central language by 1965 met with great resistance from the non-Hindi speaking states, particularly the Dravidian language states in south India. It was argued that literary tradition in Hindi was less developed as compared to that of several regional languages such as Bengali, Tamil, Telugu, Marathi, etc. To make things more complicated Hindi was infused with Sanskrit based vocabulary. As such Hindi went beyond the comprehension of non-Hindi speaking people and hence unacceptable to them. The problem became further complicated when Hindi was accorded the status of optional administrative language at the level of central government and the Public Service Commission examinations. This was treated as a discriminatory imposition of Hindi imperialism by several non-Hindi speaking states. To allay the fears of non-Hindi speaking states, the parliament passed the language bill 1963 according to which English was to continue to be used even after 1965, in addition to Hindi. Thus, English was allowed to be used "as an associate official language" until all non-Hindi speaking states had consented to the use of Hindi, thereby retaining English almost indefinitely. Thus, English remains an official language of the central government along with Hindi, and is *serving as a link between the different states*.

Since independence, English has been loosing its importance as medium of instruction and as official language. Several non-Hindi speaking states have been advancing their regional languages as the primary media of instruction at school, college and university level as well as for public service examinations. This has dealt a severe blow to English in these states. Circulation of regional language newspapers and films have tended further to weaken the usage of English as a *lingua franca*. However, English still continues to enjoy the status of an associate official language and an important link between different linguistic regions. The language problem still does not show any sign of abatement and is putting India's overall structure of national unity to a severe test.

RELIGIOUS COMPOSITION

Religion is a very important characteristic of the Indian population and Indian masses are *religious par excellence*. Religion is a way of life in India and it affects the social, economic and political structure of society. Different religions followed by different people living in different parts of the country, have created diversity of culture and brought about changes in life style of the masses.

India is the birth place of four major religions—*Hinduism*, *Buddhism*, *Jainism* and *Sikhism*. The most dominant religion, however, is Hinduism. *Hindustan*, the land of the Hindus, is one of the names by which

TABLE 11.6. Population by Religious Communities and Sex, India, 1961-2001

Religious Communities	1961	1971	1981	1991	2001
			Person		
All religious communities	**439,234,771**	**547,949,809**	**665,287,849**	**838,583,988**	**1,028,610,328**
Hindus	366,526,866	453,292,086	549,779,481	687,646,721	827,578,868
Muslims	46,940,799	61,417,934	75,512,439	101,596,057	138,188,240
Christians	10,728,086	14,223,382	16,165,447	19,640,284	24,080,016
Sikhs	7,845,915	10,378,797	13,078,146	16,259,744	19,215,730
Buddhists	3,256,036	3,812,325	4,719,796	6,387,500	7,955,207
Jains	2,027,281	2,604,646	3,206,038	3,352,706	4,225,053
Others	1,498,895	2,184,556	2,766,285	3,269,355	6,639,626
Religion not stated	113,040	36,083	60,217	415,569	727,588
			Males		
All religious communities	**226,293,201**	**283,936,614**	**343,930,423**	**435,216,358**	**532,156,772**
Hindus	188,750,134	234,837,669	284,392,942	357,252,833	428,678,554
Muslims	24,262,926	31,961,789	38,989,763	52,631,365	71,374,134
Christians	5,394,783	7,161,792	8,113,569	9,848,930	11,984,663
Sikhs	4,242,565	5,583,846	6,957,891	8,610,508	10,152,298
Buddhists	1,643,476	1,942,757	2,416,780	3,272,200	4,074,155
Jains	1,053,565	1,342,870	1,651,361	1,722,715	2,177,398
Others	741,436	1,086,525	1,376,106	1,649,354	3,332,551
Religion not stated	57,216	19,366	32,011	220,253	383,019
			Females		
All religious communities	**212,941,570**	**264,013,195**	**321,357,426**	**403,367,630**	**496,453,556**
Hindus	177,776,732	218,454,417	265,386,539	330,393,888	398,900,314
Muslims	22,677,873	29,456,145	36,522,676	48,964,692	66,814,106
Christians	5,333,303	7,061,590	8,051,878	9,791,354	12,095,353
Sikhs	3,603,350	4,794,951	6,120,255	7,649,236	9,063,432
Buddhists	1,612,560	1,869,568	2,303,016	3,115,300	3,881,052
Jains	973,716	1,261,776	1,554,677	1,629,991	2,047,655
Others	757,459	1,098,031	1,390,179	1,620,001	3,307,075
Religion not stated	55,824	16,717	28,206	195,316	344,569

Source : Census of India, 2001, The First Report on Religion Data Abstract (2004) p. xxvii.

India was known. Hinduism, a religion thousands of years old and whose origin is difficult to trace, evovled out of the varied Indian ways of life, so different and yet in some intangible way unified. The early pre-Vedic Hindu religion got modified in the Vedic period after the middle of the second millennium B.C.

In addition to being the birth place of four major religions of the world, India has embraced other world religions also. For example, Christianity and Islam came to India from other lands. The entry of these two religions in India goes back to almost the first days of their prophets. Syrian Christians appeared on the West Coast of India in the very first century of the Christian Era. The Arab traders brought Islam to the West Coast of India much before the Muslim conquest of this country. The prosecuted Jews and Zoroastrians (Parsis) found sanctuary on the Indian soil. Sikhism appeared on the religious scene of India only about five centuries ago.

There have been large scale changes in the religious composition of population due to conversions from one faith to another. Spatial pattern of distribution of different religious groups had undergone drastic changes due to large scale migrations as a result of partition of India in 1947. Before partition, Hindus accounted for 66.5 per cent of the population of the sub-continent and Muslims 23.7 per cent (census 1941). With partition, large number of Muslims migrated from India to Pakistan and Bangladesh and Hindus migrated to India from these countries. Consequently, the proportion of these two religious communities in the total population changed. The percentage of Hindus rose to 84.1 per cent and that of Muslims fell to 9.8 per cent (census 1951). Since then, the percentage of Hindu population has fallen marginally while that of Muslims has increased considerably. The percentage of Hindus had fallen from 83.4 per cent in 1961 to 80.5 per cent in 2001 while that of Muslims had increased from 10.7 per cent in 1961 to 13.4 in 2001. However, after making adjustment for Assam and Jammu and Kashmir, where census could not be conducted in 1981 and 1991 respectively, the percentage of the Hindus and Muslims work out at 81.4 and 12.4 respectively in 2001. (*see* **Table 11.7**).

One heartening fact about religious composition of India is that different religious groups have coexisted for the last several centuries even during the troubled times when there have been clashes based on

TABLE 11.7. Proportion of Population by Religious Communities, India, 1961-2001

Religious communities	Unadjusted					Adjusted*				
	1961	1971	1981	1991	2001	1961	1971	1981	1991	2001
All religious communities	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Hindus	83.4	82.7	82.6	82.0	80.5	84.4	83.5	83.1	82.4	81.4
Muslims	10.7	11.2	11.4	12.1	13.4	9.9	10.4	10.9	11.7	12.4
Christians	2.4	2.6	2.4	2.3	2.3	2.4	2.6	2.5	2.3	2.3
Sikhs	1.8	1.9	2.0	1.9	1.9	1.8	1.9	2.0	2.0	1.9
Buddhists	0.7	0.7	0.7	0.8	0.8	0.7	0.7	0.7	0.8	0.8
Jains	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.4	0.4
Others	0.3	0.4	0.4	0.4	0.6	0.3	0.4	0.4	0.4	0.7
Religion not stated	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.

*Excludes Jammu & Kashmir and Assam for all decades from 1961 to 2001.

Note : 1. The Census 2001 population figures for India and Manipur exclude those of Mao Maram, Paomata and Purul sub-divisions of Senapati district of Manipur.

2. No Census conducted in Assam in 1981 and in Jammu & Kashmir in 1991.

3. Neg.—Negligible.

Source : Census of India, 2001, The First Report on Religion Data Abstract, (2004), p. xxviii.

religion. India is the only country in the world where people belonging to different relgious faiths are co-existing in peace and harmony.

The Hindus

As mentioned earlier, the Hindus are the preponderant majority in most of the states and union territories of India. According to 2001 census figures here were 827.6 million Hindus which accounted for 80.5 per cent of the total population of the country . The Hindus of India account for about 12 per cent of the world population ranking below those professing Christianity and about equal with the followers of Islam, but much above other religions. However, the percentage of Hindus to total population of India is decreasing gradually. It came down from 83.4 per cent in 1961 to 80.5 per cent in 2001. This is largely because of comparatively lower growth rate of the Hindus and partly due to conversion of Hindus into other religious faiths. For example, the unadjusted growth rate of Hindu population was registered at 20.3 per cent as against 22.7 per cent for all religions in 1991-2001. But as per adjusted figures the growth rate of the Hindus was 20.0 per cent against 21.5 per cent recorded for all religions during the decade 1991-2001.

The growth rate of the Hindus had been declining consistently since 1971. It was 24.2 per cent in 1971-81, 22.8 per cent in 1981-91 and fell down to 20 per cent in 1991-2001 (**Table 11.8**).

The Hindus constitute the majority community in most states and union territories of India. While the Hindus comprised 80.15 per cent of the total population of India in 2001 they were 95.4 per cent in Himachal Pradesh, 94.7 per cent in Chhattisgarh, 94.4 per cent in Odisha, 93.5 per cent in Dadra and Nagar Haveli and 91.1 per cent in Madhya Pradesh (**Table 11.9**). However, the Hindus are in minority in certain states and union territory of Lakshadweep. They are outnumbered by the Muslims in Jammu and Kashmir and Lakshadweep, by Sikhs in Punjab, by Christians in Meghalaya, Mizoram, Nagaland and almost equalled by unspecified religions and persuasions in Arunachal Pradesh (**Fig. 11.4**). States and Union territories having Hindus less than 10 per cent of their total population are Nagaland (7.7%), Mizoram (3.6%) and Lakshadweep (3.7%).

In terms of absolute figures, Uttar Pradesh, most populous state, has the largest number of 133.98 million Hindus. This is followed by Maharashtra (77.86 million), Bihar (69.08 million), Andhra Pradesh (67.84 million), West Bengal (58.10 million), Madhya Pradesh (55.0 million), Tamil Nadu (54.98 million), Rajasthan (50.15 million), and Karnataka (44.32 million). These nine states together account for about three-fourths of the total Hindu population of India.

TABLE 11.8. Growth Rate of Population by Religious Communities, India, 1961-2001

	Unadjusted				Adjusted*			
	1961-71	1971-81	1981-91	1991-01	1961-71	1971-81	1981-91	1991-01
All religious communities	**24.8**	**21.4**	**26.0**	**22.7**	**24.8**	**24.8**	**23.8**	**21.5**
Hindus	23.7	21.3	25.1	20.3	23.4	24.2	22.8	20.0
Muslims	30.8	22.9	34.5	36.0	31.2	30.8	32.9	29.3
Christians	32.6	13.7	21.5	22.6	36.0	19.2	17.0	22.1
Sikhs	32.3	26.0	24.3	18.2	32.0	26.2	25.5	16.9
Buddhists	17.1	23.8	35.3	24.5	17.0	25.4	35.0	23.2
Jains	28.5	23.1	4.6	26.0	28.5	23.7	4.0	26.0
Others	45.7	26.6	18.2	103.1	97.7	26.6	13.2	111.3
Religion not stated	–68.1	66.9	590.1	75.1	–65.7	67.1	573.5	76.3

* Excludes Assam and Jammu and Kashmir for all decades from 1961 to 2001 as no Census was conducted in these states in 1981 and 1991 respectively.

Source : Census of India 2001, The First Report on Religion Data Abstract (2004), p. xxviii.

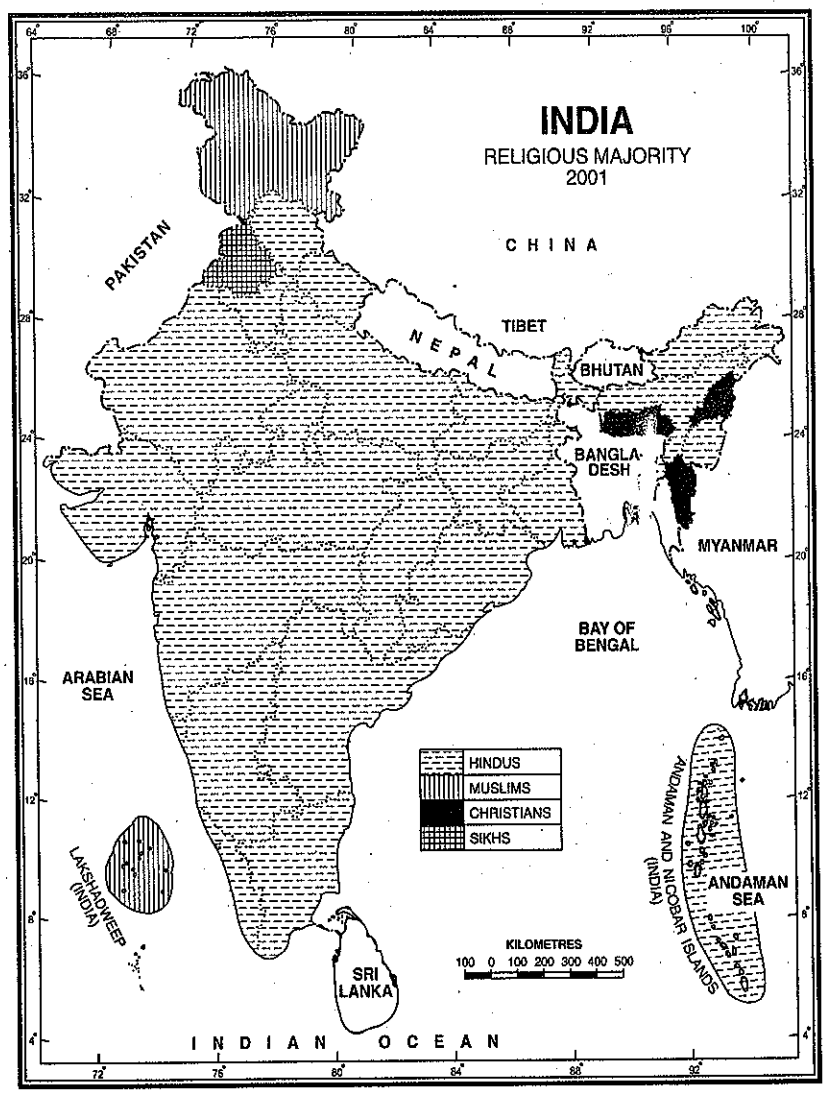


FIG. 11.4. India : Religious Majority

The Muslims

The Muslims constitute the second largest religious community and the largest minority community of India. According to 2001 census figures, the Muslim population numbered 138.19 million which worked out to be 13.4 per cent of the total population of India. The special feature of the Muslim population is that it has shown an overall growth rate of 36 per cent (unadjusted) during 1991-2001. This percentage of growth rate was arrived at by including the Muslim dominated population of Jammu and Kashmir where census could not be conducted in 1991. If adjusted data is considered, the Muslim growth rate will decline from 32.9 per cent during 1981-91 to 29.3 per

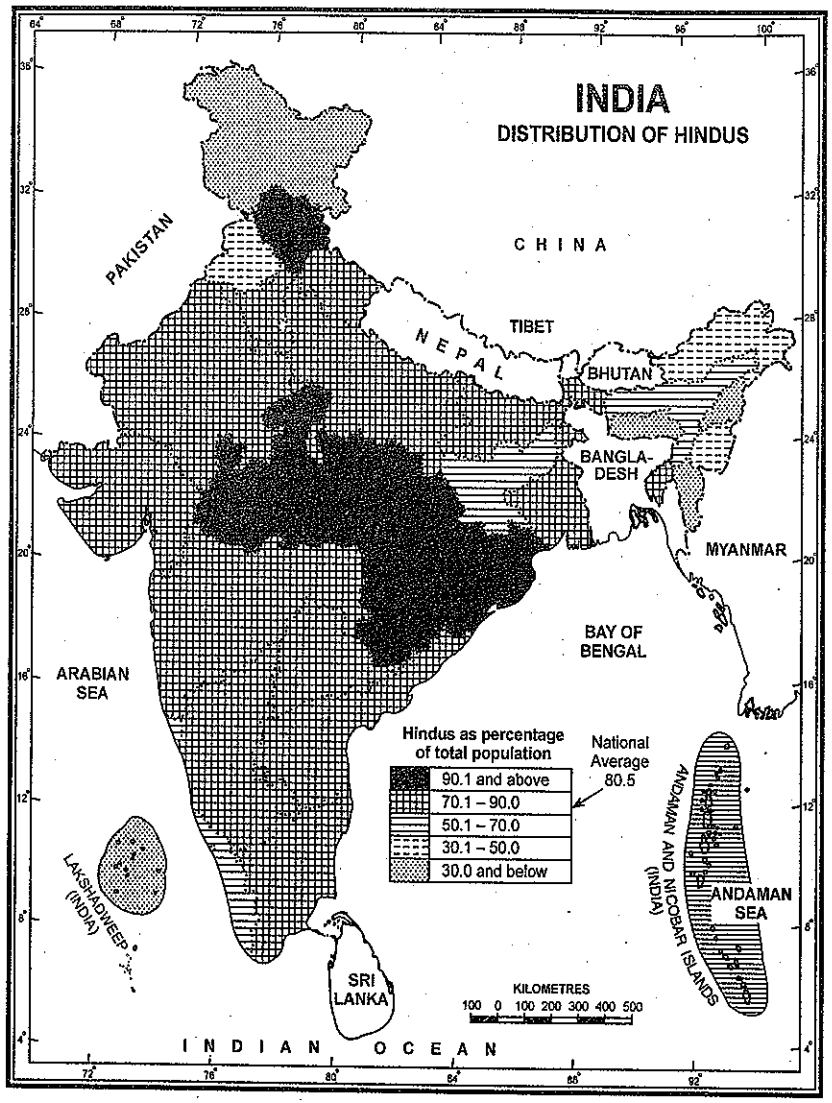


FIG. 11.5. Distribution of Hindus

cent during 1991-2001. Even this growth rate is much higher when compared to growth rate of Hindus which declined from 22.8 per cent in 1981-1991 to 20.0 per cent in 1991-2001. Muslims have rejected family planning vociferously on religious ground and higher growth rate of the Muslims is the natural sequel.

There was no census in Assam in 1981 and in Jammu and Kashmir in 1991, but heads were counted in the whole country in 1961, 1971 and 2001. The comparison of the growth rates of Hindus and Muslims during this period makes an interesting study. The Hindu population that was at 453.3 million in 1971 which grew to 827.6 million in 2001

TABLE 11.9. Proportion of Religious Communities to total Population, 2001 (India, States and Union territories, 2001)

India/ States/ Union territories	All religious communities	Hindus	Muslims	Christians	Sikhs	Buddhists	Jains	Others
India	**100.0**	**80.5**	**13.4**	**2.3**	**1.9**	**0.8**	**0.4**	**0.6**
Jammu & Kashmir	100.0	29.6	67.0	0.2	2.0	1.1	0.0	0.0
Himachal Pradesh	100.0	95.4	2.0	0.1	1.2	1.2	0.0	0.0
Punjab	100.0	36.9	1.6	1.2	59.9	0.2	0.2	0.0
Chandigarh	100.0	78.6	3.9	0.8	16.1	0.1	0.3	0.0
Uttarakhand	100.0	85.0	11.9	0.3	2.5	0.1	0.1	0.0
Haryana	100.0	88.2	5.8	0.1	5.5	0.0	0.3	0.0
Delhi	100.0	82.0	11.7	0.3	2.5	0.1	1.1	0.0
Rajasthan	100.0	88.8	8.5	0.1	1.4	0.0	1.2	0.0
Uttar Pradesh	100.0	80.6	18.5	0.1	0.4	0.2	0.1	0.0
Bihar	100.0	83.2	16.5	0.1	0.0	0.0	0.0	0.1
Sikkim	100.0	60.9	1.4	6.7	0.2	28.1	0.0	2.4
Arunachal Pradesh	100.0	34.6	1.9	18.7	0.2	13.0	0.0	30.7
Nagaland	100.0	7.7	1.8	90.0	0.1	0.1	0.1	0.3
Manipur	100.0	46.0	8.8	34.0	0.1	0.1	0.1	10.9
Mizoram	100.0	3.6	1.1	87.0	0.0	7.9	0.0	0.3
Tripura	100.0	85.6	8.0	3.2	0.0	3.1	0.0	0.0
Meghalaya	100.0	13.3	4.3	70.3	0.1	0.2	0.0	11.5
Assam	100.0	64.9	30.9	3.7	0.1	0.2	0.1	0.1
West Bengal	100.0	72.5	25.2	0.6	0.1	0.3	0.1	1.1
Jharkhand	100.0	68.6	13.8	4.1	0.3	0.0	0.1	13.0
Odisha	100.0	94.4	2.1	2.4	0.0	0.0	0.0	1.0
Chhattisgarh	100.0	94.7	2.0	1.9	0.3	0.3	0.3	0.5
Madhya Pradesh	100.0	91.1	6.4	0.3	0.2	0.3	0.9	0.7
Gujarat	100.0	89.1	9.1	0.6	0.1	0.0	1.0	0.1
Daman & Diu	100.0	89.7	7.8	2.1	0.1	0.1	0.2	0.1
Dadra & Nagar Haveli	100.0	93.5	3.0	2.7	0.1	0.2	0.4	0.0
Maharashtra	100.0	80.4	10.6	1.1	0.2	6.0	1.3	0.2
Andhra Pradesh	100.0	89.0	9.2	1.6	0.0	0.0	0.1	0.0
Karnataka	100.0	83.9	12.2	1.9	0.0	0.7	0.8	0.2
Goa	100.0	65.8	6.8	26.7	0.1	0.0	0.1	0.0
Lakshadweep	100.0	3.7	95.5	0.8	0.0	0.0	—	—
Kerala	100.0	56.2	24.7	19.0	0.0	0.0	0.0	0.0
Tamil Nadu	100.0	88.1	5.6	6.1	0.0	0.0	0.1	0.0
Puducherry	100.0	86.8	6.1	6.9	0.0	0.0	0.1	0.0
Andaman & Nicobar Island	100.0	69.2	8.2	21.7	0.4	0.1	0.0	0.1

Note : 1. Population figures for India and Manipur exclude those of Mao Maram, Paomata and Purul sub-divisions of Senapati district of Manipur State.
2. All religious communities include 'Religion not stated'.

Source : Census of India 2001, The First Report on Religion Data Abstract (2004), p. xxix.

TABLE 11.10. Religion-wise Population in India, 2001

India / States/Union territories	Hindus	Muslims	Christians	Sikhs	Buddhists	Jains	Others
India	827,578,868	138,188,240	24,080,016	19,215,730	7,955,207	4,225,053	6,639,626
Jammu & Kashmir	3,005,349	6,793,240	20,229	207,154	113,787	2,518	97
Himachal Pradesh	5,800,222	119,512	7,687	72,355	75,859	1,408	425
Punjab	8,997,942	382,045	292,800	14,592,387	41,487	39,276	8,594
Chandigarh	707,978	35,548	7,627	145,175	1,332	2,592	257
Uttarakhand	7,212,260	1,012,141	27,116	212,025	12,434	9,249	770
Haryana	18,655,925	1,222,916	27,185	1,170,662	7,140	57,167	1,255
Delhi	11,358,049	1,623,520	130,319	555,602	23,705	155,122	2,174
Rajasthan	50,151,452	4,788,227	72,660	818,420	10,335	650,493	5,253
Uttar Pradesh	133,979,263	30,740,158	212,578	678,059	302,031	207,111	9,281
Bihar	69,076,919	13,722,048	53,137	20,780	18,818	16,085	52,905
Sikkim	329,548	7,693	36,115	1,176	152,042	183	12,926
Arunachal Pradesh	379,935	20,675	205,548	1,865	143,028	216	337,399
Nagaland	153,162	35,005	1,790,349	1,152	1,356	2,093	6,108
Manipur	996,894	190,939	737,578	1,653	1,926	1,461	235,280
Mizoram	31,562	10,099	772,809	326	70,494	179	2,443
Tripura	2,739,310	254,442	102,489	1,182	98,922	477	1,277
Meghalaya	307,822	99,169	1,628,986	3,110	4,703	772	267,245
Assam	17,296,455	8,240,611	986,589	22,519	51,029	23,957	22,999
West Bengal	58,104,835	20,240,543	515,150	66,391	243,364	55,223	895,796
Jharkhand	18,475,681	3,731,308	1,093,382	83,358	5,940	16,301	3,514,472
Odisha	34,726,129	761,985	897,861	17,492	9,863	9,154	361,981
Chattisgarh	19,729,670	409,615	401,035	69,621	65,267	56,103	95,187
Madhya Pradesh	55,004,675	3,841,449	170,381	150,772	209,322	545,446	409,285
Gujarat	45,143,074	4,592,854	284,092	45,587	17,829	525,305	28,698
Daman & Diu	141,901	12,281	3,362	145	126	268	103
Dadra & Nagar Haveli	206,203	6,524	6,058	123	457	864	90
Maharashtra	77,859,385	10,270,485	1,058,313	215,337	5,838,710	1,301,843	236,841
Andhra Pradesh	67,836,651	6,986,856	1,181,917	30,998	32,037	41,846	4,768
Karnataka	44,321,279	6,463,127	1,009,164	15,326	393,300	412,659	115,460
Goa	886,551	92,210	359,568	970	649	820	353
Lakshadweep	2,221	57,903	509	6	1	—	—
Kerala	17,883,449	7,863,842	6,057,427	2,762	2,027	4,528	2,256
Tamil Nadu	54,985,079	3,470,647	3,785,060	9,545	5,393	83,359	7,252
Puducherry	845,449	59,358	67,688	108	73	952	158
Andaman & Nicobar Islands	246,589	29,265	77,178	1,587	421	23	238

Source : Census of India 2001, The First Report on Religion Data Abstract (2004), pp. xxxi – xxxvii.

registering a growth rate of 82 per cent. The Muslim population grew from 61.4 million in 1971 to 138.2 million in 2001, thus registering an increase of 125 per cent. Even after making adjustment for population of Jammu and Kashmir, the growth of the Muslims is the highest as per 2001 census figures. This is a dangerous trend and is likely to disturb the demographic set up of the country. The north-eastern states have registered an exceptionally high growth rate of the Muslim population primarily due to exodus of Bangladesh Muslims into these states.

In terms of absolute figures, Uttar Pradesh (30.74 million), West Bengal (20.24 million), Bihar (13.72 million), Maharashtra (10.27 million), Assam (8.20 million), Kerala (7.86 million), Andhra Pradesh (6.99 million), Jammu and Kashmir (6.79 million), Karnataka (6.46 million) are the major states where Muslim population is mainly concentrated. These nine states account for over four-fifth of the Muslim population of India. Muslims are in small numbers in other states. Curiously, Uttar Pradesh has the largest number of both Hindus and Muslims. This is justified by the fact that this is the most populous state in India with a total population of over 166 million in 2001.

Entirely different picture emerges when we consider the percentage of the Muslim population to the total population of the respective states/union territories. Lakshadweep had the highest percentage of 95.5 per cent Muslims although, this group of Islands had only 57,903 Muslims in 2001. Among the states, Jammu and Kashmir had the highest percentage of 67 per cent Muslims. The highest concentration of Muslims is found in the Kashmir Valley, where in certain areas the Muslims constitute well over 95 per cent of the total population. Assam has about 31 per cent of its population consisting of Muslims. In West Bengal, the Muslims account for 25.2 per cent of the total population. Murshidabad is the main area of concentration, where Muslims comprise over 55 per cent of the total population. Kerala has 24.7 per cent of its population comprised by the Muslims, where Malappuram is the main area of concentration. In Uttar Pradesh 18.5 per cent of the total population is Muslim. Most of the Muslims of Uttar Pradesh are concentrated in Rohilkhand and Upper Ganga plain, where the districts of Rampur, Bijnor, Moradabad, Bareilly, Pilibhit, Saharanpur, Muzaffarnagar, Meerut and Ghaziabad have fairly high proportion of Muslims. Muslims constitute less than five per cent of the total population in Punjab, Chandigarh, Himachal Pradesh, Sikkim, Arunachal Pradesh, Nagaland, Mizoram, Meghalaya, Odisha, Chhattisgarh, and Dadra and Nagar Haveli.

The Christians

The Christians form the third largest religious community in India. According to 2001 census figures there are about 24.1 million Christians living in India. Christians formed just 1.6 per cent of Indian population in 1941 but it rose to 2.3 per cent in 1951, perhaps due to partition of the sub-continent. In 1971, there were 2.6 per cent Christians in India which fell slightly to 2.5 per cent in 1981 and to 2.3 per cent in 1991 and 2001. The north-eastern states are predominantly inhabited by Christians. For example, Christians constitute 90.0 per cent of the total population in Nagaland, 87.0 per cent in Mizoram, 70.3 per cent in Meghalaya and 34.0 per cent in Manipur. Christians are in large proportion in Goa and Kerala also, where they form 26.7 and 19.0 per cent of the total population respectively. But speaking in absolute figures, Kerala has the largest number of Christians, amounting to about one-fourth of the total Christian population of India. The total number of Christians living in Kerala is over six million (2001). In Kottayam and Ernakulam districts of Kerala, Christians account for over 40 per cent of the total population. There are several other districts in this state where the Christian population ranges between 15 to 25 per cent. After Kerala the important states with Christian population are Tamil Nadu (3.78 million), Arunachal Pradesh (1.79 million), Meghalaya (1.63 million), Andhra Pradesh (1.18 million), Jharkhand (1.09 million) and Maharashtra (1.05 million).

Varying trends are observed with regard to growth rate of the Christians. It was 36.0 per cent in 1961-71 which declined to 19.2 per cent in 1971-81 and to 17.0 per cent in 1981-91. But it increased to 22.1 per cent in 1991-2001.

The Sikhs

There were 19.21 million Sikhs in 2001. Sikhs constituted just 1.7 per cent of the total population of India in 1941. Their percentage increased to 1.9 in

1951 as a result of large scale migration of the Sikhs from Pakistan to India following partition of the country in 1947. Thereafter, the percentage of the Sikhs to total population of India has been increasing steadily. They constituted 1.9 per cent of the total population in 2001. Needless to say that the Sikhs are an enterprising race and are scattered in almost all parts of the country. However, their largest concentration is in Punjab. According to 2001 census figures, 14.59 million Sikhs live in Punjab which is about sixty per cent of the total population of the state. It is estimated that 75.9 per cent of the total Sikhs of the country live in Punjab alone. This is quite obvious because Sikhism took its roots in the soil of Punjab, where Guru Nanak, the founder of the Sikhism preached his teachings. The Sikhs have an absolute majority in the districts of Amritsar, Kapurthala, Ferozepur, Gurdaspur, Bhatinda, Patiala, Ludhiana, Faridkot, Fatehgarh Sahib and Mansa. In the neighbouring state of Haryana 1.1 million Sikhs are living according to 2001 census data. This amounts to 5.5 per cent of the total population of the state. Ambala, Kurukshetra, Karnal, Fatehabad and Sirsa are the main districts of Sikh population. Minor pockets of the Sikh concentration are found in the Tarai region of Uttarakhand and Uttar Pradesh as well as in Ganganagar, Alwar and Bharatpur districts of Rajasthan. In the union territory of Delhi 5.55 lakh Sikhs are living, and they account for 4 per cent of its total population.

The most important factor about the Sikhs is that their rate of growth has declined considerably. It was 32.0 per cent in 1961-71 which came down to 26.2 per cent in 1971-81 and 25.5 per cent in 1981-91. A steep decline was observed between 1981-91 and 1991-2001. In 1991-2001 their growth rate was 16.9 per cent which was the lowest among all the religious communities.

Buddhists

India's 7.95 million Buddhists constitute only 0.8 per cent of the total population of the country. Their growth rate had been changing in each censual decade. In 1961-71 it was only 17.0 per cent and shot up rather out of proportion to 36.0 per cent in 1981-1991. This was perhaps due to large scale conversion of people from other religions to Buddhism. However, it fell to 23.2 per cent in 1991-2001.

The Buddhists are largely found in Maharashtra, Karnataka, Uttar Pradesh, West Bengal, Madhya Pradesh, Arunachal Pradesh and the Ladakh District of Jammu and Kashmir. They are also found to a lesser extent in Mizoram, Tripura and Himachal Pradesh. The concentration of Buddhists in the northern part of India is mainly because it is near here that the Buddhism originated and spread over the Himalayas. In 2001, Maharashtra had the largest number of 5.84 million Buddhists which accounted for 73.5 per cent of the total Buddhist population of India, though it was only 6% of the total population of the state. The large population of Buddhists in Maharashtra is mostly due to the wholesale conversion of a community of Harijans, following the advice of their leader, Dr. B.R. Ambedkar. Sikkim's 152,042 Buddhists, however, give this state the largest proportion of Buddhists in the country, 28.1% of its total population. Other states with reasonably good percentage of Buddhist population are Arunachal Pradesh (13.0 per cent) and Mizoram (7.9 per cent).

The Jains

4.22 million Jains of India are widely spread in the western parts of the country. Maharashtra (13 lakh), Rajasthan (6.5 lakh), Madhya Pradesh (5.4 lakh), Gujarat (5.2 lakh) and Uttar Pradesh (2 lakh) are important states. Nowhere they account for more than 1.3 per cent of the total population. The Jains have maintained their growth rate above the national growth rate. However, abnormally low growth rate of only 4.0 per cent in 1981-91 appears to an aberration when compared with the other decades.

The Parsis

As per 2001 census, the Parsis population in the country is 69,601 (33,949 males and 35,652 females) as against their population of 76,382 (37,736 males and 38,646 females) in 1991 census. This is clearly a visible but extremely unfortunate decline of a rich civilization of Zoroastrians and its people. It is apparent from 2001 census results that urgent and drastic interventions are required by all concerned including the government and definitely the Parsi community leaders to ensure survival of Parsi population in India. Fertility improvement innovative initiatives rather than fertility control measures

adopted by the community so far are-possibly the need of the hour before it reaches a point of no return. It is expected that this loud and clear message from 2001 census results awakens the country and the Parsi community from the deep slumber it is possibly in and have a beneficial effect for them. About 90 per cent of this community is concentrated in the city of Mumbai and the southern coastal Gujarat, around Surat.

SEX COMPOSITION

Sex composition of the human population is one of the basic demographic characteristics, which is extremely vital for any meaningful demographic analysis. Changes in sex composition largely reflect the underlying socio-economic and cultural pattern of a society in different ways. It is an important social indicator to measure the extent of prevailing equity between males and females at a given point of time. "The separate data for males and females are important for various types of planning and for the analysis of other demographic characteristics such as natality, mortality, migration, marital status, economic characteristics, etc. The balance of sexes affects the social and economic relationship within a community". (Chanana : 2012)

Sex composition is expressed with the help of a ratio known as sex ratio. Sex ratio in India is defined as "*number of females per 1,000 males in the population.*" It is expressed in the following form.

$$\text{Sex Ratio} = \frac{\text{Number of females}}{\text{Number of males}} \times 1000$$

Thus, a sex ratio of 1,000 implies complete parity between the two sexes. Ratios above 1,000 indicate excess of females over males; those below 1,000 indicate a deficit of females.

Sex ratio of population of a country is mainly the outcome of the interplay of sex differentials in mortality, sex selective migration, sex ratio at birth and at times the sex differential in population enumeration. According to figures of 2011 census, out of total population of 1210.1 millions, 623.7 millions are males and 586.4 millions are females. Thus, the overall sex ratio for Indian population is 940. This suggests that the number of females is quite less as compared to males. In other words the sex ratio in the country had always remained unfavourable to females. Moreover, barring some hiccups, it has shown a long term declining trend. The sex ratio at the beginning of the twentieth century was 972 and thereafter showed continuous decline until 1941. In 1951 there was a marginal increase of one point, but the country saw the sharpest decline of 11 points in sex ratio from 941 in 1961 to 930 in 1971. A slight improvement of 4 points in 1981 could not be maintained and there was a fall of 7 points from 934 in 1981 to 927 in 1991. Increase of six points from 927 in 1991 to 933 in 2001 and seven points in 2011 is a welcome improvement and it is hoped that the same trend will continue in the coming decades. However, it may be mentioned that the net deficit of females which was 3.2 million in 1901 has now widened to over 37.3 million at the time of 2011 census. **Table 11.11** and **Fig. 11.6** show the trends in sex ratio in India from 1901 to 2011.

TABLE 11.11. Sex Ratio-India : 1901–2011

Census Year	Sex Ratio	Census Year	Sex Ratio
1901	972	1961	941
1911	964	1971	930
1921	955	1981	934
1931	950	1991	927
1941	845	2001	933
1951	946	2011	940

Sex ratio in India is substantially low as compared to Russian Federation (1,167), Japan (1,055), Brazil (1,042), the USA (1,025), Nigeria (1,016) and Indonesia (988). The world sex ratio declined from 986 in 2001 to 984 in 2011.

Following are some important factors responsible for low and declining sex ratio.

1. More males are born than females. This is almost a worldwide phenomena and India is no exception. In a study of about two million births that took place in hospitals and health centres throughout India during 1949-58, the sex ratio at birth was found to be 942 for the country as a whole. The data collected by the Registrar General, India regarding six million live births that took place during 1981-91 in hospitals, health centres and institutions located

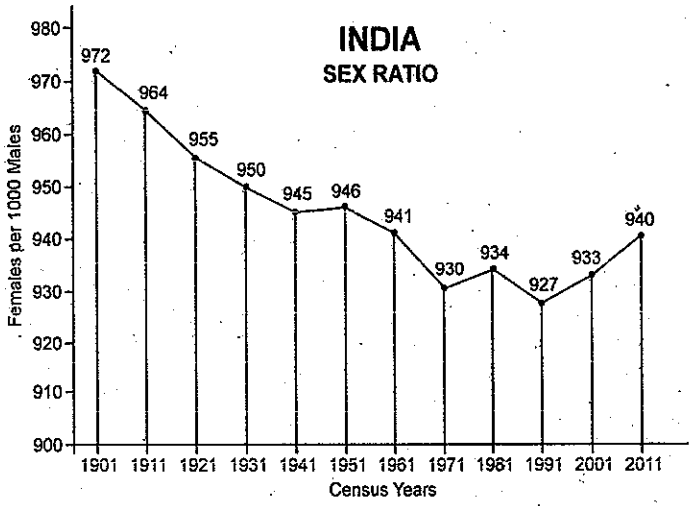


FIG. 11.6. Sex ratio in India from 1901 to 2011.

mostly in urban areas in various parts of the country, gave the sex ratio at birth at 891. Thus there has been a drastic decline in the sex ratio at birth from the 1950s to 1980s.

According to the findings of the census of India, the imbalance in the number of males and females starts in the beginning. It is now a well established law of nature that the males exceed females at the time of birth. It is believed that 943-952 female births take place for every 1,000 male births, which in effect would mean that there is a deficiency of about 50 females per 1,000 males in every birth cohort. Many demographers believe that left to its own, this is an unalterable constant.

The data on sex ratio at birth for the past many years as obtained from Sample Registration System (SRS) is indicative of a larger than usual shortfall in female births as compared to male births. During the decade 1981-90 the SRS sex ratio at birth was above 900 whereas in the succeeding decade it has shown definite sign of a decline below 900. Thus for recent period there is some primary evidence that sex ratio at birth in the country as a whole is possibly lower than generally accepted range of 943-952 but it needs to be corroborated by some more data.

2. Males get preferential treatment while females are neglected. This results in higher female mortality. More females die in India at infancy, as well as during the reproductive period. In old age too the females suffer greater neglect than their male counterparts.

3. The practice of female infanticide in the past and the cognizant foeticide at present have also resulted in low sex ratio. Although it is difficult to assess the impact of these two practices in the absence of the relevant data, the craze for the male child is reflected in increasing number of sex determination tests and the resultant termination of pregnancy in case foetus happens to be a female. Thus the number of girl children continues to fall, rather drastically, as compared to boys. Such a skewed ratio of male-female at the time of birth islargely due to female foeticide.

Despite the Pre-Conception and Pre-Natal Diagnostic Technique (Prohibition of Sex Selection) Act being in force since 1996, these tests are being conducted particularly in Punjab, Haryana and Delhi, in clear violation of the act and the girl child is killed in the womb itself before she takes her birth. Obviously the law has failed to yield the desired result because of its inherent loopholes and faulty implementation.

4. With small family norms, many young couples do not go for a second child if the first child happens to be a male.

5. There has been a steady rise in dowry deaths in the recent past, although its exact impact on sex ratio cannot be specified in the absence of relevant data.

State Level Patterns of Sex Ratio

There are large spatial and temporal variations in sex ratio at state level. **Table 11.12** gives the trends in sex ratio for hundred years in between 1901 and 2001 in respect of all the States and Union territories, except Arunachal Pradesh, for which data are not available from 1901 to 1951. In 1901, there were as many as eleven States and Union territories that had sex ratio of more than unity. Among these, except Kerala all other States and Union territories have shown a downward slide. The major States that are largely responsible for the decline in the overall sex ratio in India are Uttar Pradesh, Bihar, Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh, Gujarat, Maharashtra and Tamil Nadu, although some of these states have shown some improvement with regard to sex ratio. Although the sex ratio in Punjab has been consistently low, it has shown a long term upward trend and has not contributed to the overall deterioration in sex ratio of the country. In Rajasthan, the sex ratio kept fluctuating in a narrow band and always remained at a low level. Haryana, Andhra Pradesh, Telangana and Karnataka are the States where the sex ratio has remained more or less stagnant. In West Bengal the sex ratio declined sharply from 1901 to 1941 and then made a gradual turnaround on an upward path to reach 947 in 2011. Goa, Manipur, Mizoram, Odisha and Lakshadweep (except in 1911 and 1931) have invariably shown sex ratio of over one thousand upto 1961, although for different reasons. In spite of the fact that data for 1901, 1931 and 1941 in respect of Puducherry are not available, this Union Territory is supposed to have sex ratio in favour of females upto 1961. This union territory experienced a steep fall in sex ratio from 1,013 in 1961 to 979 in 1991. But in decades 1991-2001 and 2001-11 Puducherry made a remarkable recovery to reach a sex ratio of 1,038 in 2011 from 1001 in 2001. Thus in 2011, Kerala and Puducherry are the only two areas to record a sex ratio favourable to women. Sex ratio favourable to females has been shown by Bihar and Meghalaya upto 1921 and by Tamil Nadu upto 1951. Kerala is the only state which has shown more females than males throughout the census history of India. In 2011, Kerala with a sex ratio of 1,084 was at the top among all the states. This is a demographic trait which is more characteristic of the developed countries.

The other states and union territories with sex ratio higher than the national average in 2001 are Himachal Pradesh, Uttarakhand, Manipur, Mizoram, Tripura, Meghalaya, Assam, West Bengal, Odisha, Chhattisgarh, Andhra Pradesh (including Telangana), Karnataka, Goa, Lakshadweep, Kerala, Tamil Nadu and Puducherry. Thus 18 states and union territories have sex ratio above the national average. The remaining 17 states and union territories have sex ratio below the national average. Sex ratio of 950 is considered tolerable in the Indian context. Jammu and Kashmir, Punjab, Chandigarh, Haryana, Delhi, Sikkim, Daman and Diu, Dadra and Nagar Haveli, and Andaman and Nicobar Islands have a very low sex ratio of 900 or below. Five union territories of Andaman and Nicobar Islands, Delhi, Dadra and Nagar Haveli, Chandigarh and Daman and Diu have critically low sex ratio. None of them has sex ratio exceeding 878. In the states of Punjab and Haryana and the Union territories of Delhi and Chandigarh, extremely low sex ratio prevails due to large scale sex determination and female foeticide. Chandigarh and Delhi are highly urbanized union territories where people (mostly males) migrate in large numbers in search of livelihood, leaving their families (mostly females) in their native towns and villages.

One conspicuous improvement has been with respect to Andaman and Nicobar Islands, where the sex ratio was desperately low at 318 in 1901 and remained below 600 till 1941. This was perhaps due to the repressive policy of the British regime, when freedom fighters from the main land of India were sent as prisoners there most of whom were males. The situation, however, improved after Independence and this Union Territory showed a record sex ratio of 878 in 2011 throughout its census history.

TABLE 11.12. Sex Ratio (females per 1,000 males), 1901-2011

State /UT Code	India / State / Union territory	Census year											
		1901	1911	1921	1931	1941	1951	1961	1971	1981	1991	2001	2011
	INDIA	972	964	955	950	945	946	941	930	934	927	933	940
1	Jammu & Kashmir	882	876	870	865	869	873	878	878	892	896	892	883
2	Himachal Pradesh	884	889	890	897	890	912	938	958	973	976	968	974
3	Punjab	832	780	799	815	836	844	854	865	879	882	876	893
4	Chandigarh*	771	720	743	751	763	781	652	749	769	790	777	818
5	Uttarakhand	918	907	916	913	907	940	947	940	936	936	962	963
6	Haryana	867	835	844	844	869	871	868	867	870	865	861	877
7	Delhi*	862	793	733	722	715	768	785	801	808	827	821	866
8	Rajasthan	905	908	896	907	906	921	908	911	919	910	921	926
9	Uttar Pradesh	938	916	908	903	907	908	907	876	882	876	898	908
10	Bihar	1,061	1,051	1,020	995	1,002	1,000	1,005	957	948	907	919	916
11	Sikkim	916	951	970	967	920	907	904	863	835	878	875	889
12	Arunachal Pradesh	NA	NA	NA	NA	NA	NA	894	861	862	859	893	920
13	Nagaland	973	993	992	997	1,021	999	933	871	863	886	900	931
14	Manipur	1,037	1,029	1,041	1,065	1,055	1,036	1,015	980	971	958	978	987
15	Mizoram	1,113	1,120	1,109	1,102	1,069	1,041	1,009	946	919	921	935	975
16	Tripura	874	885	885	885	886	904	932	943	946	945	948	961
17	Meghalaya	1,036	1,013	1,000	971	966	949	937	942	954	955	972	986
18	Assam	919	915	896	874	875	868	869	896	910	923	935	954
19	West Bengal	945	925	905	890	852	865	878	891	911	917	934	947
20	Jharkhand	1,032	1,021	1,002	989	978	961	960	945	940	922	941	947
21	Odisha	1,037	1,056	1,086	1,067	1,053	1,022	1,001	988	981	971	972	978
22	Chhattisgarh	1,046	1,039	1,041	1,043	1,032	1,024	1,008	998	996	985	989	991
23	Madhya Pradesh	972	967	949	947	946	945	932	920	921	912	919	930
24	Gujarat	954	946	944	945	941	952	940	934	942	934	920	918
25	Daman & Diu*	995	1,040	1,143	1,088	1,080	1,125	1,169	1,099	1,062	969	710	618
26	Dadra & Nagar Haveli*	960	967	940	911	925	946	963	1,007	974	952	812	775
27	Maharashtra	978	966	950	947	949	941	936	930	937	934	922	925
28	Andhra Pradesh (including Telangana)	985	992	993	987	980	986	981	977	975	972	978	992
29	Karnataka	983	981	969	965	960	966	959	957	963	960	965	968
30	Goa	1,091	1,108	1,120	1,088	1,084	1,128	1,066	981	975	967	961	968
31	Lakshadweep*	1,063	987	1,027	994	1,018	1,043	1,020	978	975	943	948	946
32	Kerala	1,004	1,008	1,011	1,022	1,027	1,028	1,022	1,016	1,032	1,036	1,058	1084
33	Tamil Nadu	1,044	1,042	1,029	1,027	1,012	1,007	992	978	977	974	987	995
34	Puducherry*	NA	1,058	1,053	NA	NA	1,030	1,013	989	985	979	1,001	1038
35	Andaman & Nicobar Islands*	318	352	303	495	574	625	617	644	760	818	846	878

* Union Territory

Source : Census of India 2011, Provisional Populatin Totals Paper 1 of 2011, Series 1, pp. 1974-75.

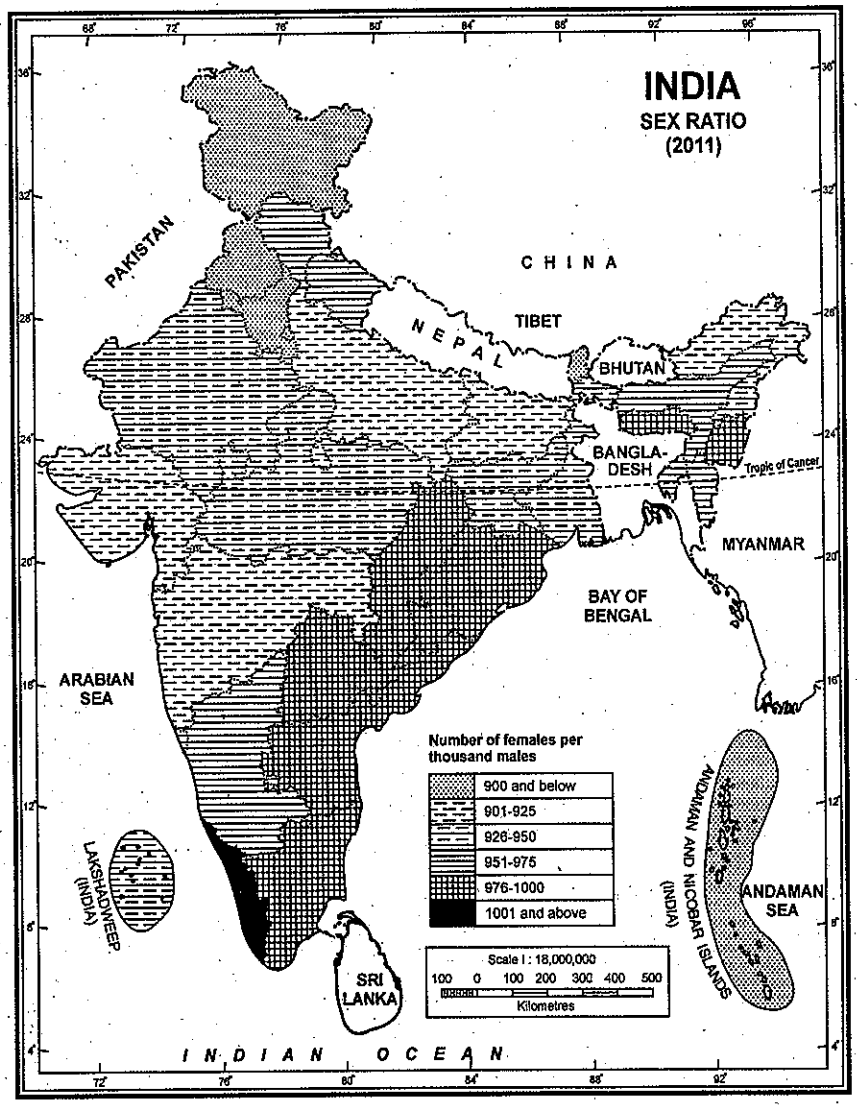


FIG. 11.7. India : Sex Ratio, 2011

Table 11.13 enables us to compare the condition of range of sex ratios in 2011 with that of 2001. Slight improvement seems to be with respect to extremely low range of sex ratio of below 880, wherein the number of states has decreased from 8 to 6 and the percentage of population has decreased from 5.98 to 3.65. On the other end, the number of states in the range above 986 has increased from 4 to 7 and the percentage of population has increased from 11.28 to 18.4.

The table also shows that the maximum number of states and percentage of population is in the sex ratio range of 916 to 950.

TABLE 11.13. Distribution of States/Union Territories by range of sex ratio of India : 2001 and 2011

Sex ratio	2001		2011	
	No. of states	Percentage of population to total population	No. of states	Percentage of population to total population
880 and below	8	5.98	6	3.65
881-915	4	17.44	4	19.87
916-950	11	47.18	10	45.08
951-985	8	18.12	8	13.01
986 and above	4	11.28	7	18.4

Source : Census of India 2011, Provisional Population Totals, Paper 1 of 2011 Series 1, p. 89.

Child Sex Ratio

Although overall sex ratio in India gives a gloomy picture, situation with respect to child sex ratio in the age group of 0-6 years is more depressing. Whereas overall sex ratios has slightly improved between 1991 and 2011, the child sex ratio has registered a steep fall from 976 in 1961 to a desperate 914 in 2011 (**Table 11.14** and **Fig. 11.8**). This is the lowest child sex ratio India has ever recorded since Independence. The current child sex ratio is very critical for any demographic set up because it is this sex ratio that will determine the overall sex ratio in the coming years. In 27 states and Union Territories, including Delhi, the child sex ratio had declined. "The rate of decline ranges from normal to alarming" the provisional census report for 2011 notes. This tragic picture has emerged largely due to craze of Indian parents for a male child and rampant sex determination in the womb, female infanticide, and foeticide in large parts of the country.

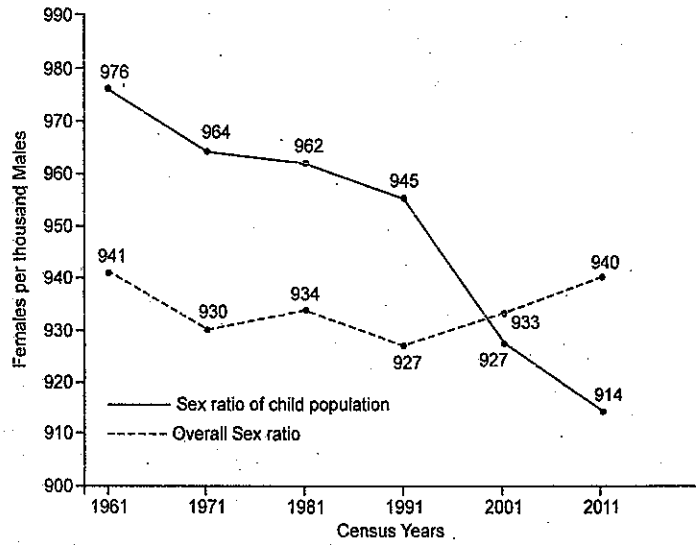


FIG. 11.8. Child sex ratio and overall sex ratio in India 1961-2011.

TABLE 11.14. Sex ratio of total population and child population in the age group 0-6 years : 1961-2011

Year	Sex ratio in the age group 0-6 years	Overall sex ratio
1961	976	941
1971	964	930
1981	962	934
1991	945	927
2001	927	933
2011	914	940

Source : Census of India 2011, Provisional Population Totals, Paper 1 of 2011 Series 1, p. 90.

The above mentioned grim reality prevails in spite of several steps taken by the Central and the State Governments to protect and empower the girl child. Some of the steps are briefly described as under :

1. Complete ban under law on sex determinaption during pregnancy and termination of pregnancy if the child happens to be a girl.
2. Declaring *24th January* as the National Girl Child Day in 2012.
3. *The Ladli Scheme* implemented by the Delhi and Haryana Governments aims at curbing female facticide and enhancing the social status of the girl child by promoting their education and protecting them from discrimination and deprivation.
4. *Sabla Scheme* launched on the International Women's Day in 2011 aims at enabling self development and empowerment of adolescent girls, improvement in their health and nutrition status, spread awareness about health, hygiene, nutrition, adolescent reproductive and several health, family and child care.
5. *Dhanlaxmi Scheme* launched as a pilot project in March, 2008 by the Ministry of Women and Child Development, Government of India, aims at providing a set of staggered financial incentives for families to encourage them to retain the girl child and educate her.
6. *Kishori Shakti Yojna* seeks to empower adolescent girls, so as to enable them to take charge of their lives.

A casual look at **table 11.15** brings us to the following conclusions :

1. The lowest child sex ratio has been observed in Haryana (830), Punjab (846) and Jammu and Kashmir (859) while among the Union Territories, Delhi (866), Chandigarh (867) and Lakshadweep (908) occupy the bottom position.
2. Child sex ratio has increased only in six states and two Union Territories. Some cause of cheer is the fact that the states where the child sex ratio had dropped alarmingly in census 2001 have shown slight improvement in 2011. This increase is substantial in Punjab (789 to 846—57 points), Haryana (819 to 830—11 points), Himachal Pradesh (896 to 906—10 points), Chandigarh (845 to 867—22 points), Gujarat (883 to 886—3 points) and Tamil Nadu (942 to 946—4 points). In addition, Mizoram (964 to 971—7 points) and Andaman and Nicobar Islands (957 to 966—9 points) have also shown some improvement.
3. The situation in other states and union territories has been discouraging. The child sex ratio has declined in 27 states and union territories. Sharp fall in the range of 22 to 82

Some of the findings of Census of India are glaring and will put any civilized society to shame.

- Child sex ratio has fallen drastically from 976 in 1961 to 914 in 2011.
- Haryana has the lowest child sex ratio of 830.
- Jhajjar in Haryana is the worst district with lowest child sex ratio of 774 in the country.
- The capital city of Delhi has a low child sex ratio of 866.
- India is a nation that so hates its female population, so many girls are killed before they are born, despite the fact that the absence of women for any society—certain death for they are after all, the reproducers.
- There are certain villages in Haryana where there are no women at all. So when it comes to seeking marriage partners, men have to import them from other states. The situation is almost the same in certain villages of Punjab also.

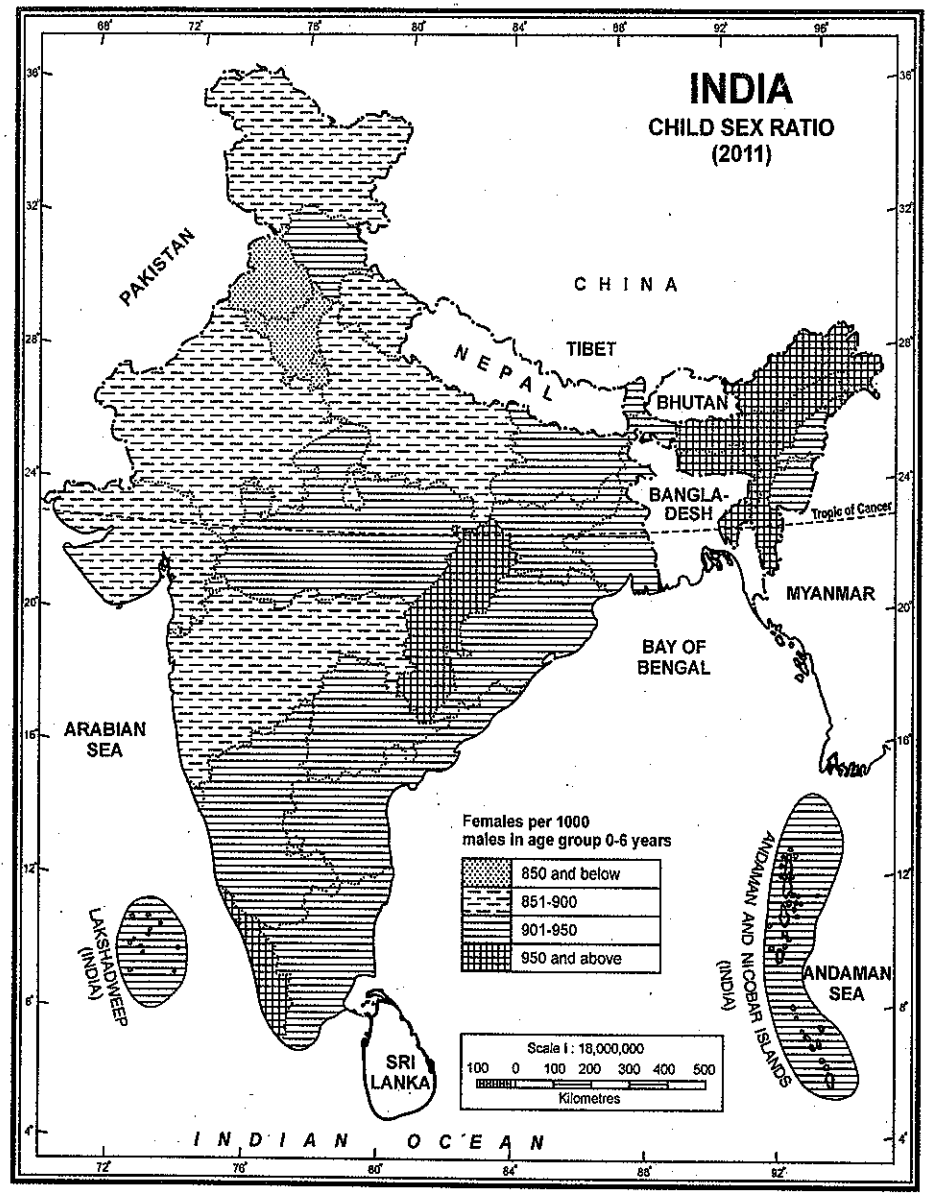


FIG. 11.9. India : Child Sex Ratio (2011).

oints has been reported in Jammu and Kashmir, adra and Nagar Haveli, Lakshadweep, Maharashtra, ajasthan, Manipur, Uttarakhand, Jharkhand, Madhya Pradesh and Tamil Nadu. Even the north eastern states like Sikkim and Arunachal Pradesh have shown declining trend.

TABLE 11.15. Sex Ratio of Child Population in the Age Group 0-6 : 2001-2011

State	India/States/Union Territory#	Sex ratio in the age group 0-6	
		2001	2011
	INDIA	927	914
01	Jammu & Kashmir	941	859
02	Himachal Pradesh	896	906
03	Punjab	798	846
04	Chandigarh#	845	867
05	Uttarakhand	908	886
06	Haryana	819	830
07	NCT of Delhi#	868	866
08	Rajashthan	909	883
09	Uttar Pradesh	916	899
10	Bihar	942	933
11	Sikkim	963	944
12	Arunachal Pradesh	964	960
13	Nagaland	964	944
14	Manipur	957	934
15	Mizoram	964	971
16	Tripura	966	953
17	Meghalaya	973	970
18	Assam	965	957
19	West Bengal	960	950
20	Jharkhand	965	943
21	Odisha	953	934
22	Chhattisgarh	975	964
23	Madhya Pradesh	932	912
24	Gujarat	883	886
25	Daman & Diu#	926	909
26	Dadra & Nagar Haveli#	979	924
27	Maharashtra	913	883
28	Andhra Pradesh (including Telangana)	961	943
29	Karnataka	946	943
30	Goa	938	920
31	Lakshadweep#	959	908
32	Kerala	960	959
33	Tamil Nadu	942	946
34	Puducherry#	967	965
35	Andaman & Nicobar Islands#	957	966

Source : Census of India, 2011, Provisional Population Totals, Paper 1 of Series I, p. 88.

LITERACY

It is necessary for a person to be literate before he becomes educated. Higher level of education provides dynamism to society and helps in social upliftment.

The Population Commission of United Nations considers the *ability, to both read and write a simple message with understanding in any language, a sufficient basis for classifying a person as literate.* The Census of India has adopted this definition with a little bit of modification. According to Census of India, "*person aged seven and above, who can both read and write with understanding in any language, is treated as literate.* A person, who can only read but cannot write, is not literate." In the Censuses prior to 1991, children below five years of age were necessarily treated as illiterates.

The age limit was raised to 7 years based on the advice of experts that the ability to read and write with understanding is not ordinarily achieved until that age. It was, therefore decided at the 1991 Census that all children in the age group 0-6, would be treated as illiterate by definition and the population aged seven years and above only would be classified as literate or illiterate. The same criterion has been retained in the Censuses of 2001 and 2011. It should be clearly understood that it is not necessary that to be treated as literate, a person should have received any formal education or acquired any minimum educational standard.

Literacy Rate—Definition

In earlier Censuses up to 1981, it was customary to work out the literacy rate taking into account the total population. Since literacy rate is more meaningful if the sub-population in the age group 0-6 is excluded from the total population. it was decided in 1991 to calculate literacy rate for the population seven years and above. The same concept has been retained in all Censuses since 1991.

The literacy rate taking into account the total population in the denominator has now been termed as 'crude literacy rate', while the literacy rate calculated taking into account the 7 and above population in the denominator is called the effective literacy rate. The formula for computing crude literacy rate and effective literacy rate are as follows :

Crude Literacy Rate =

$$\frac{\text{Number of Literate persons}}{\text{Total Population}} \times 100$$

Effective Literacy Rate =

$$\frac{\text{Number of Literate persons aged 7 and above}}{\text{Population aged 7 and above}} \times 100$$

Effective literacy rate and literacy rate have been used interchangeably in this chapter.

Literates and Illiterates by Gender

As per the provisional population totals of Census 2011, out of the provisional total population of 1,210,193,422, the number of persons aged seven years and above is 1,051,404,135. Out of this, 778,454,120 are literate and 272,950,015 are illiterates There has been an increase of 186,504,094 persons in the age group seven years and above during 2001-2011, while 217,700,941 additional persons have become literate during the decade.

A significant milestone reached in Census 2011, is that the total number of illiterates has come down from 304,146,862 in 2001 to 272,950,015 in 2011, showing a decline of 31,196,847 persons.

One of the interesting features of Census 2011 is that out of total of 217,700,941 literates added during the decade, females (110,069,001) out number males (107,631,940). A reverse trend was noticed during 1991-2001. The decadal increase in number of literates among males is of 31.98 percentage points while the corresponding increase in case of females is of 49.10 percentage points.

A notable feature is that out of the total decrease of 31,196,847 in the number of illiterates, the females (17,122,197) out number males (14,074,650). The above two changes are a clear indication of the fact that the gender gap in literacy is shrinking in the country. This trend of rising female literates will have far reaching consequences on the development of society.

Figure 11.10 gives a comparative picture of literacy and illiteracy in the country in 2001 and 2011 censuses.

Table 11.16 gives the number of literates and illiterates among the population aged seven years and above in absolute figures for India at the 2001 and 2011 censuses.

Literacy Rate–Trends

The effective literacy rate for India in Census 2011, works out to 74.04 per cent. The corresponding figures for males and females are 82.14 and 65.46 per cent respectively. Thus three-fourth of the population of aged 7 years and above is literate in the country. Four out of every five males and two out of every three females in the country are literate. The country has continued its march in improving literacy rate by recording a jump of 9.21 percentage points during 2001-11. The increase in literacy rates in males and females are in the order of 6.88 and 11.79 percentage points respectively.

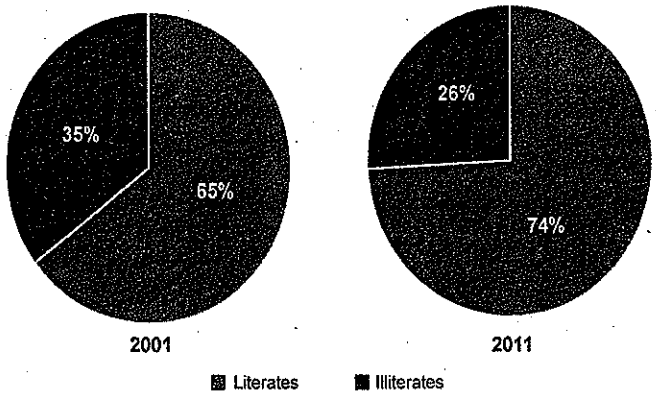


FIG. 11.10. Share of literates and illiterates in India according to Census 2001 and 2011.

TABLE 11.16. Number of literates and illiterates among population aged 7 years and above and their change–India : 2001 and 2011

Literates/illiterates		Persons	Males	Females
Population (aged 7 and above	2001	86,49,00,041	44,72,14,823	41,76,85,218
	2011	1,05,14,04,135	54,07,72,113	51,06,32,022
	Increase in 2011 over 2001	18,65,04,094	9,35,57,290	9,29,46,804
Literates	2001	56,07,53,179	33,65,71,822	22,41,81,357
	2011	77,84,54,120	44,42,03,762	33,42,50,358
	Increase in 2011 over 2001	21,77,00,941	10,76,31,940	11,00,69,001
Illiterates	2001	30,41,46,862	11,06,43,001	19,35,03,861
	2011	27,29,50,015	9,65,68,351	17,63,81,664
	Increase in 2011 over 2001	–3,11,96,847	–1,40,74,650	–1,71,22,197

Source : Census of India 2011, Provisional Population Totals, Paper 1 of Series 1, p. 100.

An extremely positive development in the decade 2001-11 is that the gap of 21.59 percentage points recorded between male and female literacy rates in 2001 census has reduced to 16.68 percentage points in 2011. Though the target set for the year 2011-2012 by the Planning Commission of reducing the gap to 10 percentage points has not been achieved, it is heartening that the reduction has been to the order of almost 5 percentage points.

Table 11.17 presents the effective literacy rate for the country by persons, males, females and the male-female gap since 1951.

TABLE 11.17. Literacy Rate in India 1951-2011

Census year	Persons	Males	Females	Male-Female gap in literacy rate
1951	18.33	27.16	8.86	18.30
1961	28.30	40.4	15.35	25.05
1971	34.45	45.96	21.97	23.98
1981	43.57	56.38	29.76	26.62
1991	52.21	64.13	39.29	24.84
2001	64.83	75.26	53.67	21.59
2011	74.04	82.14	65.46	16.68

Source : Census of India, Provisional Population Totals Paper 1 of Series 1 p. 102.

The above trends have been shown in **Fig. 11.11**. **Table 11.18** provides the crude literacy rate for India by sex during 1901-2011. The literacy rate designated as crude literacy rate in this statement has been computed with total population as base without removing the mandatory illiterate population aged 0-4 or 0-6 from the denominator. The crude literacy rate from 1901 onwards show a consistent increase both for males and females.

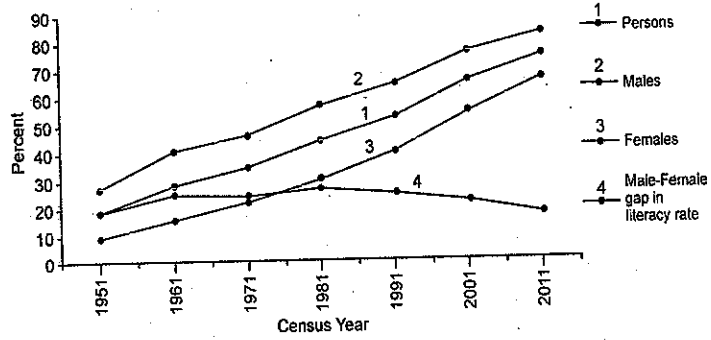


FIG. 11.11. Literacy rates in India.

The improvement in crude literacy rate has been phenomenal (48.22 percentage points) in post independent India. The corresponding increase in case of males has been of 46.32 percentage points and among females it is of 49.69 percentage points. The crude literacy rate has increased by almost 10 percentage points during the last decade. It surged forward by 12 percentage points in case of females while there was an increase of 8 percentage points in male crude literacy rate during the last decade. The gap in crude literacy rates of males and females has decreased from 18.09 percentage points in 2001 to 14.23 percentage points in 2011.

TABLE 11.18. Crude Literacy Rate in India by Sex : 1901 to 2011

Census Year	Crude literacy rate			Change in Percent points		
	Persons	Males	Females	Persons	Males	Females
1901	5.35	9.83	0.60	—	—	—
1911	5.92	10.56	1.05	0.57	0.73	0.45
1921	7.16	12.21	1.81	1.24	1.65	0.76
1931	9.50	15.59	2.93	2.34	3.38	1.12
1941	16.10	24.90	7.30	6.60	9.31	4.37
1951	16.67	24.95	7.93	0.57	0.05	0.63
1961	24.02	34.44	12.95	7.35	9.49	5.02
1971	29.45	39.45	18.69	5.43	5.01	5.74
1981	36.23	46.89	24.82	6.78	7.44	6.13
1991	42.84	52.74	32.17	6.61	5.85	7.35
2001	54.21	63.24	45.15	11.67	10.50	12.98
2011	64.32	71.22	56.99	9.81	7.98	11.84

Notes :

1. Figures upto 1941 are for undivided India.
2. Figures for 1981 excludes Assam as 1981 census could not be conducted in this state due to disturbed conditions.
3. Figures for 1991 census do not include Jammu and Kashmir, as no census was held in the state.

Source : Census of India 2011, Provisional Population Totals, Paper 1 of 2011, Series 1, p. 103.

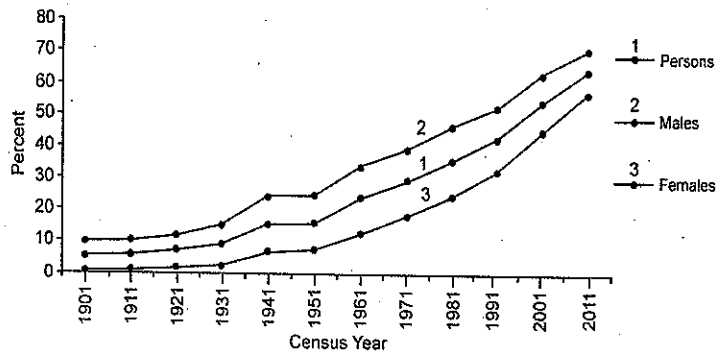


FIG. 11.12. India : Crude Literacy Rate by sex (1901-2011)

TABLE 11.19. Ranking of States and Territories by literacy rate : 2011

Rank	Persons		Rank	Males		Rank	Females	
	State/ Union Territory	Literacy rate		State/ Union Territory	Literacy rate		State/Union Territory	Literacy rate
1	Kerala	93.91	1	Lakshadweep#	96.11	1	Kerala	91.98
2	Lakshadweep#	92.28	2	Kerala	96.02	2	Mizoram	89.40
3	Mizoram	91.58	3	Mizoram	93.72	3	Lakshadweep#	88.25
4	Tripura	87.75	4	Goa	92.81	4	Tripura	83.15
5	Goa	87.40	5	Tripura	92.18	5	Goa	81.84
6	Daman & Diu#	87.07	6	Puducherry #	92.12	6	Andaman &	
7	Puducherry #	86.55	7	Daman & Diu#	91.48		Nicobar Islands#	81.84
8	Chandigarh #	86.43	8	NCT of Delhi#	91.03	7	Chandigarh#	81.38
9	NCT of Delhi #	86.34	9	Himachal Pradesh	90.83	8	Puducherry#	81.22
10	Andaman &		10	Chandigarh#	90.54	9	NCT of Delhi#	80.93
	Nicobar Islands #	86.27	11	Andaman &		10	Daman & Diu#	79.59
11	Himachal Pradesh	83.78		Nicobar Islands#	90.11	11	Nagaland	76.69
12	Maharashtra	82.91	12	Maharashtra	89.82	12	Himachal Pradesh	76.60
13	Sikkim	82.20	13	Uttarakhand	88.33	13	Sikkim	76.43
14	Tamil Nadu	80.33	14	Sikkim	87.29	14	Maharashtra	75.48
15	Nagaland	80.11	15	Gujarat	87.23	15	Tamil Nadu	73.86
16	Manipur	79.85	16	Tamil Nadu	86.81	16	Meghalaya	73.78
17	Uttarakhand	79.63	17	Manipur	86.49	17	Manipur	73.17
18	Gujarat	79.31	18	Dadra & Nagar Haveli #	86.46	18	Punjab	71.34
19	Dadra & Nagar Haveli #	77.65	19	Haryana	85.38	19	West Bengal	71.16
20	West Bengal	77.08	20	Nagaland	83.29	20	Gujarat	70.73
21	Punjab	76.68	21	Karnataka	82.85	21	Uttarakhand	70.70
22	Haryana	76.64	22	West Bengal	82.67	22	Karnataka	68.13
23	Karnataka	75.60	23	Odisha	82.40	23	Assam	67.27
24	Meghalaya	75.48	24	Punjab	81.48	24	Haryana	66.77
25	Odisha	73.45	25	Chhattisgarh	81.45	25	Dadra & Nagar Haveli#	65.93
26	Assam	73.18	26	Madhya Pradesh	80.53	26	Odisha	64.36
27	Chhattisgarh	71.04	27	Rajashthan	80.51	27	Chhattisgarh	60.59
28	Madhya Pradesh	70.63	28	Uttar Pradesh	79.24	28	Madhya Pradesh	60.02
29	Uttar Pradesh	69.72	29	Assam	78.81	29	Andhra Pradesh	59.74
30	Jammu & Kashmir	68.74	30	Jharkhand	78.45		(including Telangana)	
31	Andhra Pradesh	67.66	31	Jammu & Kashmir	78.26	30	Arunachal Pradesh	59.57
	(including Telangana)		32	Meghalaya	77.17	31	Uttar Pradesh	59.26
32	Jharkhand	67.63	33	Andhra Pradesh	75.56	32	Jammu & Kashmir	58.01
33	Rajasthan	67.06		(including Telangana)		33	Jharkhand	56.21
34	Arunachal Pradesh	66.95	34	Arunachal Pradesh	73.69	34	Bihar	52.33
35	Bihar	63.82	35	Bihar	73.39	35	Rajasthan	52.66

#Union Territory.

Source : Census of India 2011, Provisional Population Totals, Paper 1 of 2011, Series 1 pp. 110-11.

nal Variations on Literacy Rates

ıtes and Union Territories of India have been ːd in descending order will respect to overall ʳe literacy rates along with effective male and female literacy rates. Regional variations of overall, male and female literacy rates have been shown in **Fig. 11.13, 11.14** and **11.15** respectively. A brief description of overall male and female literacy rates is given below.

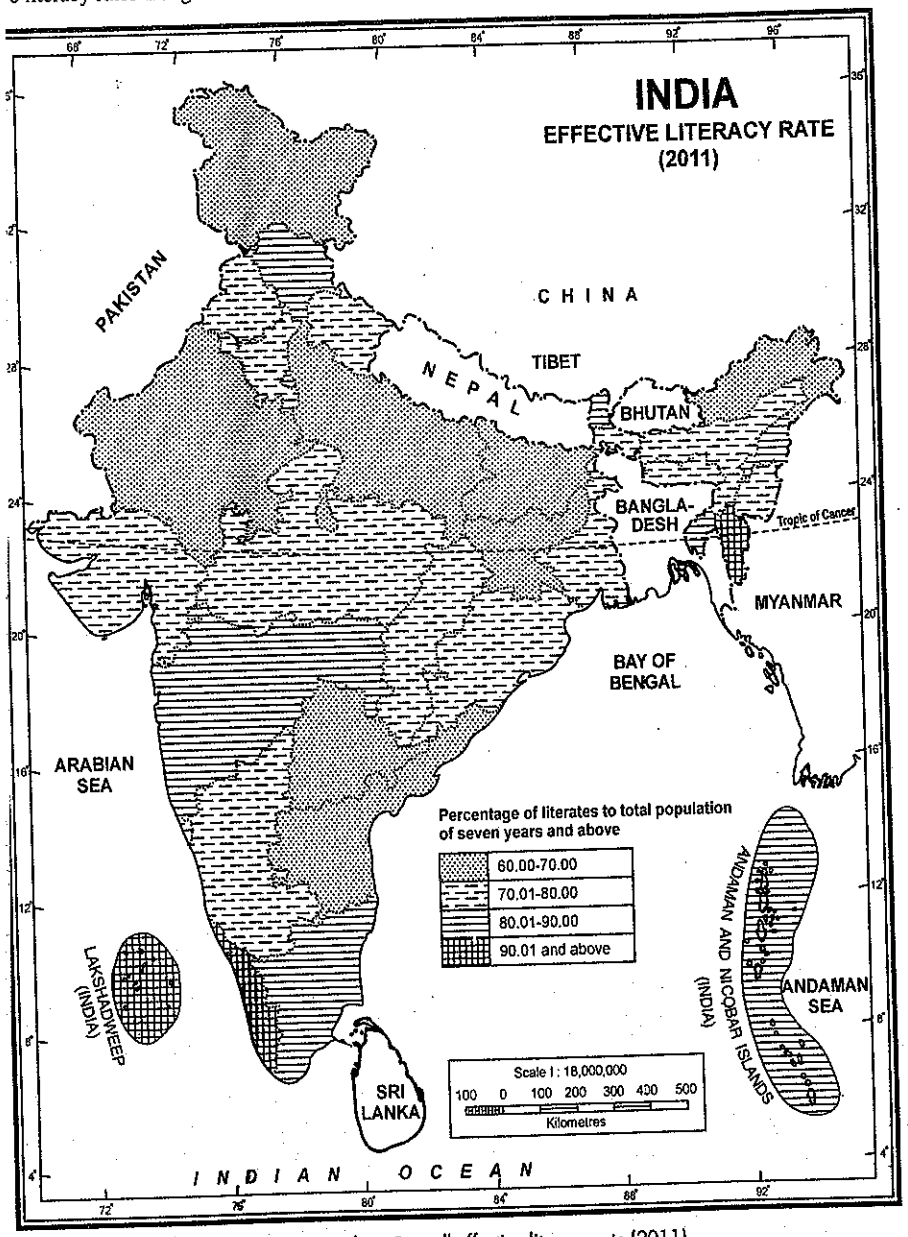


FIG. 11.13. India : Overall effective literacy rate (2011).

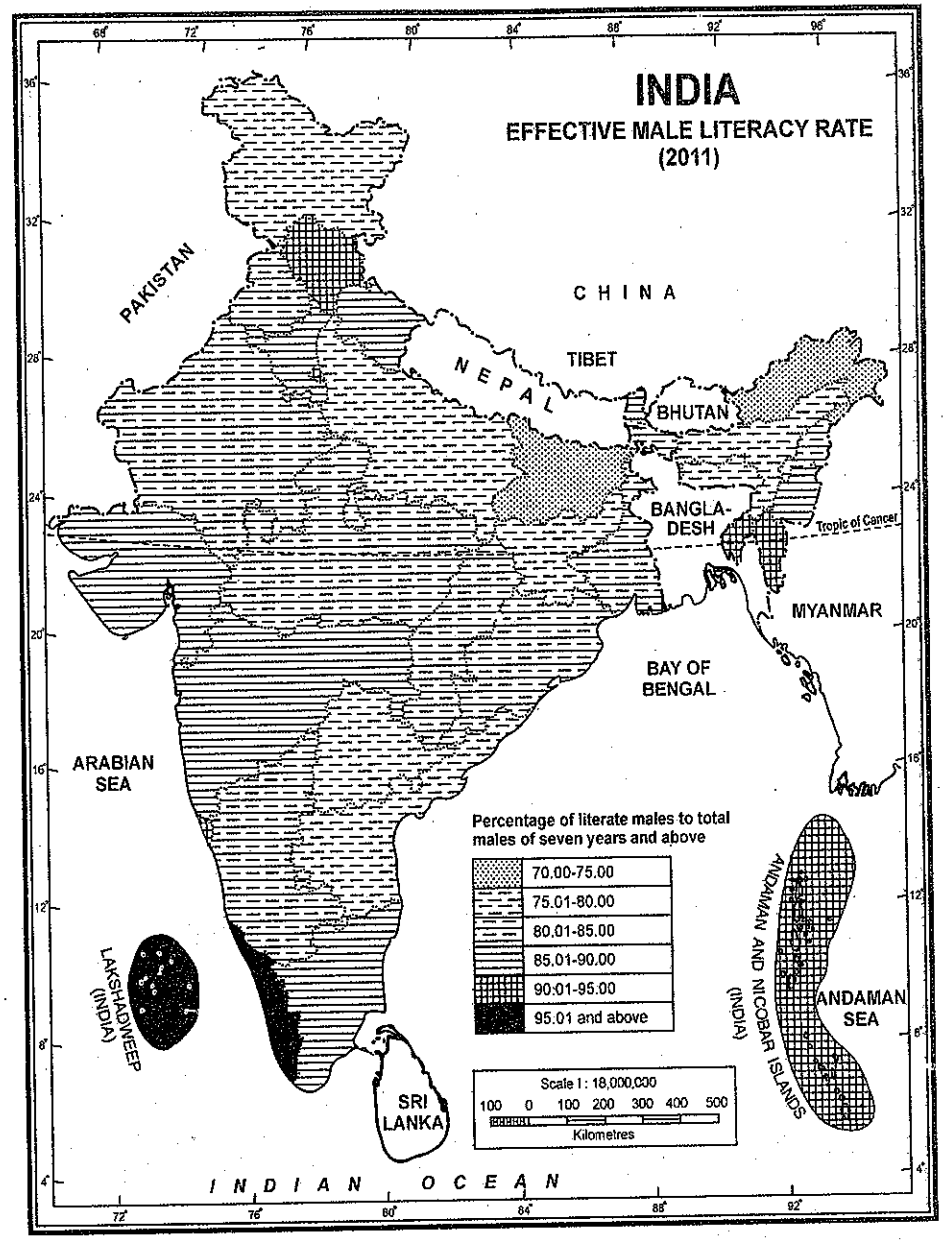


FIG. 11.14. India : Effective male literacy rate (2011).

Overall Effective Literacy Rate

Kerala ranks first in the country with a literacy rate of 93.91 per cent, closely followed by Lakshadweep (92.28 per cent) and Mizoram (91.58 per cent). Bihar with a literacy rate of 63.82 per cent ranks last in the country preceded by Arunachal

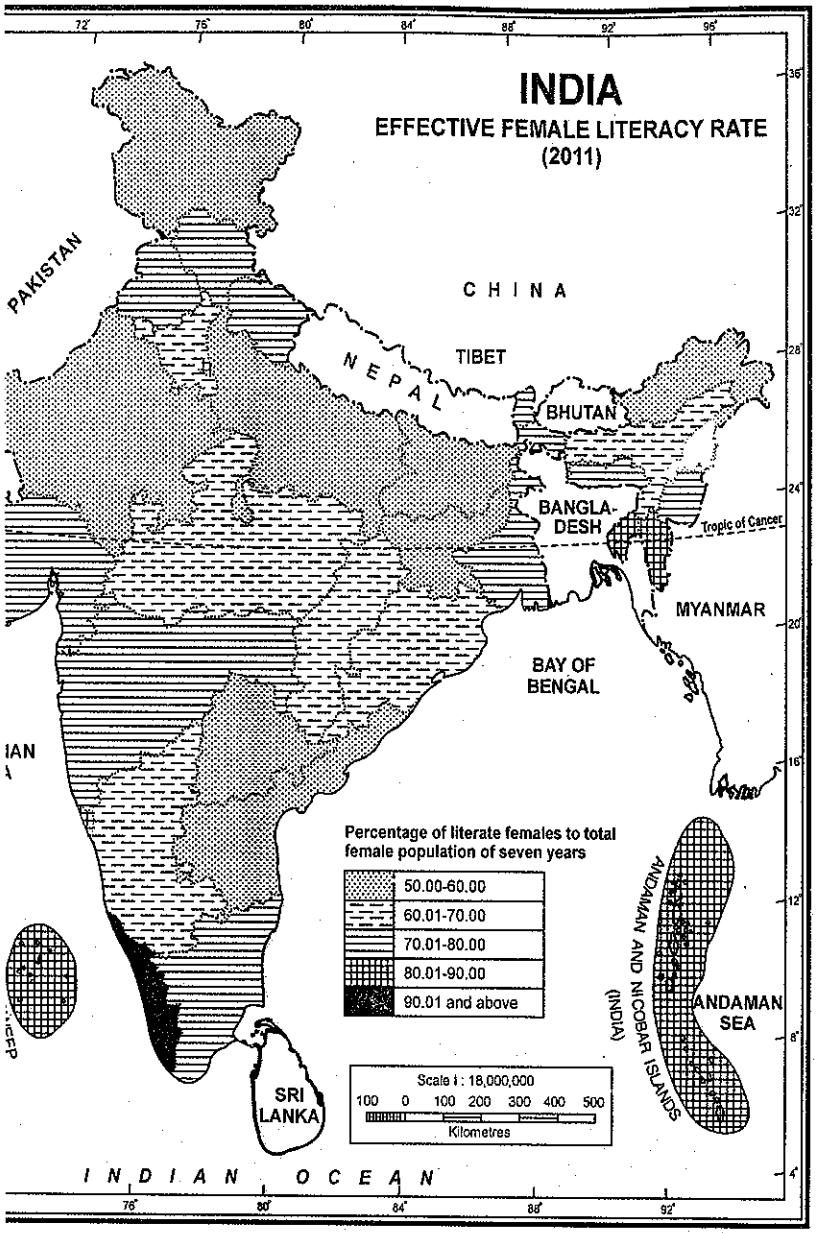


FIG. 11.15. India : Effective female literacy rate (2011)

per cent) and Rajasthan (67.06 per
he major States, Maharashtra (82.91
after Kerala, followed by Tamil Nadu

(80.33 per cent). The States and Union Territories with literacy rates below the National average (74.04 per cent) are Jammu and Kashmir in the North,

Rajasthan in the West, Andhra Pradesh and Telangana in the South, Madhya Pradesh, Chhattisgarh, Uttar Pradesh in Central, Bihar, Jharkhand, Odisha in the East and Arunachal Pradesh and Assam in the North-East of the country. Ten States and Union Territories viz., Kerala, Lakshadweep, Mizoram, Tripura, Goa, Daman & Diu, Puducherry, Chandigarh, NCT of Delhi and Andaman & Nicobar Islands have achieved literacy rate of above 85 per cent, the target set by Planning Commission for the year 2011-2012. The States and Union Territories, which have literacy rate below the National average in respect of all the three categories i.e., persons, males and females are Arunachal Pradesh, Chhattisgarh, Madhya Pradesh, Andhra Pradesh (including Telangana), Bihar, Rajasthan, Jammu and Kashmir, Jharkhand and Uttar Pradesh.

Male Effective Literacy Rate

Lakshadweep (96.11 per cent) holds the first rank in the country with respect to male literacy rate. Kerala (96.02 per cent) ranks second. Bihar (73.39 per cent) has recorded the lowest literacy rate in case of males preceded again by Arunachal Pradesh (73.69 per cent). The States and Union Territories with literacy rates below the National average for males (82.14 per cent) are Madhya Pradesh, Assam, Meghalaya, Arunachal Pradesh, Andhra Pradesh (including Telangana), Bihar, Rajasthan, Jammu and Kashmir, Chhattisgarh, Punjab, Jharkhand and Uttar Pradesh.

Female Effective Literacy Rate

Kerala holds the first rank in the country in female literacy with 91.98 per cent. Rajasthan (52.66 per cent) has recorded the lowest female literacy rate preceded by Bihar (53.33 per cent). Similarly, the States and Union Territories with female literacy rate below the National average (65.46 per cent) are Odisha, Chhattisgarh, Madhya Pradesh, Andhra Pradesh (including Telangana), Arunachal Pradesh, Uttar Pradesh, Jammu and Kashmir, Jharkhand, Bihar and Rajasthan.

Effective Literacy Rate-Gender Gap

At the National level, the male-female gap for Census 2001 stood at 21.59 whereas for Census 2011 it is only 16.68. The decadal difference in literacy rates for males and females stands at 6.88 and 11.79 percentage points respectively, indicating a substantial improvement in respect of females. In Census 2001, in 12 States and Union Territories, the male-female gap was higher than the National average and for 23 States and Union Territories, it was below the National average. In Census 2011, in 11 States, the male female gap is higher than the National average and for 24 States and Union Territories, it is below the National average. The North-Eastern States of Meghalaya and Mizoram and Kerala from the South have reported minimum differentials in male-female gap in Census 2011 as well as in Census 2001. Mizoram had also reported the lowest differential even during 1991 Census followed by Kerala and Meghalaya. These States are consistent forerunners since decades. It is interesting to note that although average literacy rate in Meghalaya (75.48 per cent) is not high the male-female gap (3.39 percentage points) in literacy rate is lowest. Rajasthan, Jharkhand, Chhattisgarh, Madhya Pradesh and Jammu & Kashmir are at the bottom, showing huge gap in male-female differentials in literacy both at 2001 and 2011 Censuses. The States and Union Territories which have achieved male-female gap of literacy rate of 10 percentage points or below, the target set by the Planning Commission to be achieved by year 2011-2012, are Punjab, Chandigarh, NCT of Delhi, Nagaland, Mizoram, Tripura, Meghalaya, Lakshadweep, Kerala and Andaman & Nicobar Islands. Male-female literacy gaps for State sand Union Territories for 2011 and 2011 are depicted in table 11.20.

WORK

Work is defined as participation in any economically productive activity with or without compensation, wages or, profit. Such participation may be physical and/or mental in nature. Work involves not only actual work but also includes effective supervision and direction of work. It even includes part time help or unpaid work on farm, family enterprise or in any other economic activity. All persons engaged in 'work' as defined above are workers. Persons who are engaged in cultivation or milk production even solely for domestic consumption are also treated as workers.

TABLE 11.20. Literacy Rates and Male-Female Gap in Literacy

India/State/ Union Territory	2001		Gap in literacy rate	2011		Gap in literacy rate
	Males	Females		Males	Females	
India	75.26	53.67	21.59	82.14	65.46	16.68
Jammu & Kashmir	66.60	43.00	23.60	78.26	58.01	20.25
Himachal Pradesh	85.35	67.42	17.93	90.83	76.60	14.23
Punjab	75.23	63.36	11.87	81.48	71.34	10.14
Chandigarh#	86.14	76.47	9.67	90.54	81.38	9.16
Uttarakhand	83.28	59.63	23.65	88.33	70.70	17.63
Haryana	78.49	55.73	22.76	85.38	66.77	18.61
NCT of Delhi#	87.33	74.71	12.62	91.03	80.93	10.10
Rajashthan	75.70	43.85	31.85	80.51	52.66	27.85
Uttar Pradesh	68.82	42.22	26.60	79.24	59.26	19.98
Bihar	59.68	33.12	26.56	73.39	53.33	20.06
Sikkim	76.04	60.40	15.64	87.29	76.43	10.86
Arunachal Pradesh	63.83	43.53	20.30	73.69	59.57	14.12
Nagaland	71.16	61.46	9.70	83.29	76.69	6.60
Manipur	79.54	60.10	19.44	86.49	73.17	13.32
Mizoram	90.72	86.75	3.97	93.72	89.40	4.32
Tripura	81.02	64.91	16.11	92.18	83.15	9.03
Maghalaya	65.43	59.61	5.82	77.17	73.78	3.39
Assam	71.28	54.61	16.67	78.81	67.27	11.54
West Bengal	77.02	59.61	17.41	82.67	71.16	11.51
Jharkhand	67.30	38.87	28.43	78.45	56.21	22.24
Odisha	75.35	50.51	24.84	82.40	64.36	18.04
Chhattisgarh	77.38	51.85	25.53	81.45	60.59	20.86
Madhya Pradesh	76.06	50.29	25.77	80.53	60.02	20.51
Gujarat	79.66	57.80	21.86	87.23	70.73	16.50
Daman & Diu#	86.76	65.61	21.15	91.48	79.59	11.89
Dadra & Nagar Haveli#	71.18	40.23	30.95	86.46	65.93	20.53
Maharashtra	85.97	67.03	18.94	89.82	75.48	14.34
Andhra Pradesh (including Telangana)	70.32	50.43	19.89	75.56	59.74	15.82
Karnataka	76.10	56.87	19.23	82.85	68.13	14.72
Goa	88.42	75..37	13.05	92.81	81.84	10.97
Lakshadweep#	92.53	80.47	12.06	96.11	88.25	7.86
Kerala	94.24	87.72	6.52	96.02	91.98	4.04
Tamil Nadu	82.42	64.43	17.99	86.81	73.86	12..95
Puducherry#	88.62	73.90	14.72	92.12	81.22	10.90
Andaman & Nicobar Islands#	86.33	75.24	11.09	90.11	81.84	8.27

erritory
Census of India, Provisional Population Totals, Paper 1 of 2011, Series 1, Pp. 116-17.

Reference period for determining a person as worker and non-worker is one year preceding the date of renumeration.

Main Workers

Those workers who had worked for the major part of the reference period (*i.e.*, 6 months or more) are termed as *main workers*.

Marginal Workers

Those workers who had not worked for the major part of the reference period (*i.e.*, less than 6 months) are termed as *marginal workers*.

Cultivators

For purposes of the census a person is classified as cultivator if he or she is engaged in cultivation of land owned or held from Government or held from private persons or institutions for payment in money, kind or share. Cultivation includes effective supervision or direction in cultivation. A person who has given out her/his land to another person or persons or institution(s) for cultivation for money, kind or share of crop and who does not even supervise or direct cultivation of land, is not treated as cultivator. Similarly, a person working on another person's land for wages in cash or kind or a combination of both (agricultural labourer) is not treated as cultivator.

Cultivation involves ploughing, sowing, harvesting and production of cereals and millet crops such as wheat, paddy, jowar, bajra, ragi etc., and other crops such as sugarcane, tobacco, ground-nuts, tapioca, etc., and pulses, raw jute and kindred fiber crop, cotton, cinchona and other medicinal plants, fruit growing, vegetable growing of keeping orchards or groves, etc. Cultivation does not include the following plantation crops—tea, coffee, rubber, coconut and betel-nuts (areca).

Agricultural Labourers

A person who works on another person's land for wages in money or kind or share is regarded as an agricultural labourer. She or he has no risk in the cultivation, but merely works on another person's land for wages. An agricultural labourer has no right of lease or contract on land on which she/he works.

Household Industry Workers

Household Industry is defined as an industry conducted by one or more members of the household at home or within the village in rural areas and only within the precincts of the house where the household lives in urban areas. The larger proportion of workers in the household industry consists of members of the household. The industry is not run on the scale of a registered factory which would qualify or has to be registered under the Indian Factories Act.

The main criterion of a Household industry even in urban areas is the participation of one or more members of a household. Even if the industry is not actually located at home in rural areas there is greater possibility of the members of the household participating even if it is located anywhere within the village limits. In the urban areas, where oraganised industry takes greater prominence, the Household Industry is confined to the precincts of the house where the participants live. In urban areas, even if the members of the household run an industry by themselves but at a place away from the precincts of their home it is not considered as a Household Industry. It should be located within the precincts of the house where the members live in the case of urban areas.

Household Industry relates to production, processing, servicing, repairing or making and selling (but not merely selling) of goods. It does not include professions such as Pleader, Doctor, Musician, Dancer, Waterman, Astrologer, *Dhobi*, Barber, etc., or merely trade or business, even if such professions, trade or services are run at home by members of the household. Some of the typical industries that can be conducted on a household industry basis are : Foodstuffs : such as production of flour, milking or dehusking of paddy, grinding of herbs, production of pickles, preservation of meat etc. Beverages : such as manufacture of country liquor, ice cream, soda water etc., Tobacco Products : such as bidi, cigars, Textile

ol or Silk, Manufacture of Wood and , Paper and Paper Products, Leather ducts, Petroleum and Coal Products : foot wear from torn tyres and other , Chemical and Chemical Products : ture of toys, paints, colours, matches, mes, ink etc., Service and Repairing uipments : such as cycle, rickshaw, riven carts etc.

rs

, *i.e.*, those who have been engaged in activity during the last one year, but ors or agricultural labourers or in stry are 'Other Workers (OW)'. The s that come under this category of ll government servants, municipal chers, factory workers, plantation ngaged in trade, commerce, business, ıg, mining, construction, political or iests, entertainment artists, etc. In : workers other than cultivators or urers or household industry workers, ers'.

ho did not at all work during the l was treated as a non-worker. The adly constitute students who did not y economic activity paid or unpaid, es who were attending to daily es like cooking, cleaning utensils, ldren, fetching water etc. and are not he unpaid work in the family farm or lching, dependent such as infants or ple not included in the category of ers those who are drawing pension nd are not engaged in any economic s, vagrants, prostitutes and persons ified source of income and with es of subsistence and not engaged in lly productive work during the . Other category includes all Non- nay not come under the above ı as rentiers, persons living on cultural or non-agricultural royalty, l persons who are seeking/available

Work Participation Rate

Work participation rate is defined as the percentage of total workers (main and marginal workers) to total population.

$$\text{Work participation rate} = \frac{\text{Total Workers (Main + Marginal)}}{\text{Total Population}} \times 100$$

According to the 2011 census, the participation rate in India is 39.79 which is a slight improvement over 39.1 in 2001. This leaves a huge 60.21 per cent population as non-workers. Thus a large percentage of non-working population depends upon a low percentage of workers which is less than 40 per cent of the total population. This is not congenial to economic growth of the country. India's low percentage of working force is the outcome of her demographic, socio-cultural and economic structure. Among the major factors responsible for low percentage of work force are high birth rate and consequent large proportion of children below the age of 15, prejudices against females' education, mobility and employment, and incapability of the Indian economic structure to generate enough employment opportunities.

The composition of working force varies with sex, residence and age. The disparity in participation rates of males and females are quite glaring. According to 2011 census figures, while 53.26 per cent of males are recorded as main workers, the corresponding figure for females is only 25.51 per cent. Such a situation is the result of prejudices against females as discussed earlier. In a male dominated society as that of India, earning of bread still continued to rest on masculine shoulders and femineity is given a secondary place in social and economic activities. Similar variations are observed in the participation rates of rural and urban areas. The relatively low participation rates in urban areas is attributed to the differences in the nature of economy and society in urban and rural areas. The nature of jobs in urban areas is such for which education and skill is a pre-requisite. The acquisition of education and skill takes its own time and delays entry into work-force. Moreover, the urban society is comparatively more awakened and the incidence of child participation in the work force is low as compared to that of the countryside. In contrast to

this, education and skill have little relevance in the countryside and the incidence of child and female participation in the workforce is more than that prevalent in the urban areas. This factor contributed a great deal to the relatively low participation rates in urban areas. The participation rates in urban areas would have been still lower, but for large scale in migration of workers from rural areas to urban areas.

The 1971 census divided the entire work force into nine industrial categories which had been adopted till the 1991 census. However, the main categories of work force at the time of 2011 census have been recognised as cultivators, agricultural labourers and household industry workers (*see* **Table 11.21**).

TABLE 11.21. Working Force in India, 2011

Sl. No.	Category	Percentage
1.	Participation rate	39.79
2.	Male participation	53.26
3.	Female participation	25.57
4.	Main workers to total workers	75.24
5.	Marginal workers to total workers	24.76
6.	Cultivators to total workers	47.43
7.	Agricultural labourers to total workers	17.89
8.	Household workers to total workers	2.56
9.	Other workers to total workers	38.7

Source : Data computed from Census of India 2011,. C.D. released in 2014.

Table 11.22 and **Fig. 11.16** depict the areal distribution of participation rate in India in 2011. It is observed that more than half the population is working in Himachal Pradesh and Sikkim. As many as 19 states and union territories have above 40 per cent participation rate which is higher than the national average of 39.79. All states of the peninsular India with the exception of Kerala, Puducherry, Jharkhand and Goa have participation rate higher than the national average. The mountain areas of Mizoram, Himachal Pradesh, Sikkim, Arunachal Pradesh and Nagaland also have sufficiently high participation rate. Almost all the states and union

TABLE 11.22. Participation Rate in India, States and Union Territories (2011)

Sl No.	States/Union Territories	Participation Rate (pecentage of workers to total population)
	INDIA	39.79
01	Jamnu & Kashmir	34.47
02	Himachal Pradesh	51.85
03	Punjab	35.67
04	Chandigarh#	38.29
05	Uttarakhand	38.39
06	Haryana	35.17
07	NCT of Delhi#	33.28
08	Rajashthan	43.59
09	Uttar Pradesh	32.94
10	Bihar	33.35
11	Sikkim	50.47
12	Arunachal Pradesh	42.47
13	Nagaland	49.24
14	Manipur	45.09
15	Mizoram	44.36
16	Tripura	39.99
17	Meghalaya	39.96
18	Assam	38.36
19	West Bengal	38.08
20	Jharkhand	39.71
21	Odisha	41.79
22	Chhattisgarh	47.68
23	Madhya Pradesh	43.47
24	Gujarat	40.97
25	Daman & Diu#	49.86
26	Dadra & Nagar Haveli#	45.72
27	Maharashtra	43.99
28	Andhra Pradesh (including Telangana)	46.61
29	Karnatka	45.62
30	Goa	39.58
31	Lakshadweep#	29.09
32	Kerala	34.78
33	Tamil Nadu	45.58
34	Puducherry#	35.66
35	Andaman & Nicobar Islands#	40.08

Union Territory

Source : Data computed from Census 2011, C.D. released in 2014.

TABLE 11.20. Literacy Rates and Male-Female Gap in Literacy

State/ UT code	India/State/ Union Territory	2001		Gap in literacy rate	2011		Gap in literacy rate
		Males	Females		Males	Females	
	India	75.26	53.67	21.59	82.14	65.46	16.68
01	Jammu & Kashmir	66.60	43.00	23.60	78.26	58.01	20.25
02	Himachal Pradesh	85.35	67.42	17.93	90.83	76.60	14.23
03	Punjab	75.23	63.36	11.87	81.48	71.34	10.14
04	Chandigarh#	86.14	76.47	9.67	90.54	81.38	9.16
05	Uttarakhand	83.28	59.63	23.65	88.33	70.70	17.63
06	Haryana	78.49	55.73	22.76	85.38	66.77	18.61
07	NCT of Delhi#	87.33	74.71	12.62	91.03	80.93	10.10
08	Rajashthan	75.70	43.85	31.85	80.51	52.66	27.85
09	Uttar Pradesh	68.82	42.22	26.60	79.24	59.26	19.98
10	Bihar	59.68	33.12	26.56	73.39	53.33	20.06
11	Sikkim	76.04	60.40	15.64	87.29	76.43	10.86
12	Arunachal Pradesh	63.83	43.53	20.30	73.69	59.57	14.12
13	Nagaland	71.16	61.46	9.70	83.29	76.69	6.60
14	Manipur	79.54	60.10	19.44	86.49	73.17	13.32
15	Mizoram	90.72	86.75	3.97	93.72	89.40	4.32
16	Tripura	81.02	64.91	16.11	92.18	83.15	9.03
17	Maghalaya	65.43	59.61	5.82	77.17	73.78	3.39
18	Assam	71.28	54.61	16.67	78.81	67.27	11.54
19	West Bengal	77.02	59.61	17.41	82.67	71.16	11.51
20	Jharkhand	67.30	38.87	28.43	78.45	56.21	22.24
21	Odisha	75.35	50.51	24.84	82.40	64.36	18.04
22	Chhattisgarh	77.38	51.85	25.53	81.45	60.59	20.86
23	Madhya Pradesh	76.06	50.29	25.77	80.53	60.02	20.51
24	Gujarat	79.66	57.80	21.86	87.23	70.73	16.50
25	Daman & Diu#	86.76	65.61	21.15	91.48	79.59	11.89
26	Dadra & Nagar Haveli#	71.18	40.23	30.95	86.46	65.93	20.53
27	Maharashtra	85.97	67.03	18.94	89.82	75.48	14.34
28	Andhra Pradesh (including Telangana)	70.32	50.43	19.89	75.56	59.74	15.82
29	Karnataka	76.10	56.87	19.23	82.85	68.13	14.72
30	Goa	88.42	75.37	13.05	92.81	81.84	10.97
31	Lakshadweep#	92.53	80.47	12.06	96.11	88.25	7.86
32	Kerala	94.24	87.72	6.52	96.02	91.98	4.04
33	Tamil Nadu	82.42	64.43	17.99	86.81	73.86	12.95
34	Puducherry#	88.62	73.90	14.72	92.12	81.22	10.90
35	Andaman & Nicobar Islands#	86.33	75.24	11.09	90.11	81.84	8.27

Union Territory

Source : Census of India, Provisional Population Totals, Paper 1 of 2011, Series 1, Pp. 116-17.

Reference period for determining a person as worker and non-worker is one year preceding the date of renumeration.

Main Workers

Those workers who had worked for the major part of the reference period (*i.e.*, 6 months or more) are termed as *main workers*.

Marginal Workers

Those workers who had not worked for the major part of the reference period (*i.e.*, less than 6 months) are termed as *marginal workers*.

Cultivators

For purposes of the census a person is classified as cultivator if he or she is engaged in cultivation of land owned or held from Government or held from private persons or institutions for payment in money, kind or share. Cultivation includes effective supervision or direction in cultivation. A person who has given out her/his land to another person or persons or institution(s) for cultivation for money, kind or share of crop and who does not even supervise or direct cultivation of land, is not treated as cultivator. Similarly, a person working on another person's land for wages in cash or kind or a combination of both (agricultural labourer) is not treated as cultivator.

Cultivation involves ploughing, sowing, harvesting and production of cereals and millet crops such as wheat, paddy, jowar, bajra, ragi etc., and other crops such as sugarcane, tobacco, ground-nuts, tapioca, etc., and pulses, raw jute and kindred fiber crop, cotton, cinchona and other medicinal plants, fruit growing, vegetable growing of keeping orchards or groves, etc. Cultivation does not include the following plantation crops—tea, coffee, rubber, coconut and betel-nuts (areca).

Agricultural Labourers

A person who works on another person's land for wages in money or kind or share is regarded as an agricultural labourer. She or he has no risk in the cultivation, but merely works on another person's land for wages. An agricultural labourer has no right of lease or contract on land on which she/he works.

Household Industry Workers

Household Industry is defined as an industry conducted by one or more members of the household at home or within the village in rural areas and only within the precincts of the house where the household lives in urban areas. The larger proportion of workers in the household industry consists of members of the household. The industry is not run on the scale of a registered factory which would qualify or has to be registered under the Indian Factories Act.

The main criterion of a Household industry even in urban areas is the participation of one or more members of a household. Even if the industry is not actually located at home in rural areas there is greater possibility of the members of the household participating even if it is located anywhere within the village limits. In the urban areas, where oraganised industry takes greater prominence, the Household Industry is confined to the precincts of the house where the participants live. In urban areas, even if the members of the household run an industry by themselves but at a place away from the precincts of their home it is not considered as a Household Industry. It should be located within the precincts of the house where the members live in the case of urban areas.

Household Industry relates to production, processing, servicing, repairing or making and selling (but not merely selling) of goods. It does not include professions such as Pleader, Doctor, Musician, Dancer, Waterman, Astrologer, *Dhobi*, Barber, etc., or merely trade or business, even if such professions, trade or services are run at home by members of the household. Some of the typical industries that can be conducted on a household industry basis are : Foodstuffs : such as production of flour, milking or dehusking of paddy, grinding of herbs, production of pickles, preservation of meat etc. Beverages : such as manufacture of country liquor, ice cream, soda water etc., Tobacco Products : such as bidi, cigars, Textile

cotton, Jute, Wool or Silk, Manufacture of Wood and Wood Products, Paper and Paper Products, Leather and Leather Products, Petroleum and Coal Products : such as making foot wear from torn tyres and other rubber footwear, Chemical and Chemical Products : such as manufacture of toys, paints, colours, matches, fireworks, perfumes, ink etc., Service and Repairing of Transport Equipments : such as cycle, rickshaw, boat or animal driven carts etc.

Other Workers

All workers, *i.e.*, those who have been engaged in some economic activity during the last one year, but are not cultivators or agricultural labourers or in Household Industry are 'Other Workers (OW)'. The type of workers that come under this category of 'OW' include all government servants, municipal employees, teachers, factory workers, plantation workers, those engaged in trade, commerce, business, transport, banking, mining, construction, political or social work, priests, entertainment artists, etc. In effect, all those workers other than cultivators or agricultural labourers or household industry workers, are 'Other Workers'.

Non-Workers

A person who did not at all work during the reference period was treated as a non-worker. The non-workers broadly constitute students who did not participate in any economic activity paid or unpaid, household duties who were attending to daily household chores like cooking, cleaning utensils, cooking after children, fetching water etc. and are not even helping in the unpaid work in the family farm or cultivation or milching, dependent such as infants or very elderly people not included in the category of worker, pensioners those who are drawing pension after retirement and are not engaged in any economic activity. Beggars, vagrants, prostitutes and persons having unidentified source of income and with unspecified sources of subsistence and not engaged in any economically productive work during the reference period. Other category includes all Non-workers who may not come under the above categories such as rentiers, persons living on remittances, agricultural or non-agricultural royalty, unpaid work and persons who are seeking/available for work.

Work Participation Rate

Work participation rate is defined as the percentage of total workers (main and marginal workers) to total population.

$$\text{Work participation rate} = \frac{\text{Total Workers (Main + Marginal)}}{\text{Total Population}} \times 100$$

According to the 2011 census, the participation rate in India is 39.79 which is a slight improvement over 39.1 in 2001. This leaves a huge 60.21 per cent population as non-workers. Thus a large percentage of non-working population depends upon a low percentage of workers which is less than 40 per cent of the total population. This is not congenial to economic growth of the country. India's low percentage of working force is the outcome of her demographic, socio-cultural and economic structure. Among the major factors responsible for low percentage of work force are high birth rate and consequent large proportion of children below the age of 15, prejudices against females' education, mobility and employment, and incapability of the Indian economic structure to generate enough employment opportunities.

The composition of working force varies with sex, residence and age. The disparity in participation rates of males and females are quite glaring. According to 2011 census figures, while 53.26 per cent of males are recorded as main workers, the corresponding figure for females is only 25.51 per cent. Such a situation is the result of prejudices against females as discussed earlier. In a male dominated society as that of India, earning of bread still continued to rest on masculine shoulders and femineity is given a secondary place in social and economic activities. Similar variations are observed in the participation rates of rural and urban areas. The relatively low participation rates in urban areas is attributed to the differences in the nature of economy and society in urban and rural areas. The nature of jobs in urban areas is such for which education and skill is a pre-requisite. The acquisition of education and skill takes its own time and delays entry into work-force. Moreover, the urban society is comparatively more awakened and the incidence of child participation in the work force is low as compared to that of the countryside. In contrast to this, education and skill have little relevance in the countryside and the incidence of child and female participation in the workforce is more than that prevalent in the urban areas. This factor contributed a great deal to the relatively low participation rates in urban areas. The participation rates in urban areas would have been still lower, but for large scale in migration of workers from rural areas to urban areas.

The 1971 census divided the entire work force into nine industrial categories which had been adopted till the 1991 census. However, the main categories of work force at the time of 2011 census have been recognised as cultivators, agricultural labourers and household industry workers (*see* **Table 11.21**).

TABLE 11.21. Working Force in India, 2011

Sl. No.	Category	Percentage
1.	Participation rate	39.79
2.	Male participation	53.26
3.	Female participation	25.57
4.	Main workers to total workers	75.24
5.	Marginal workers to total workers	24.76
6.	Cultivators to total workers	47.43
7.	Agricultural labourers to total workers	17.89
8.	Household workers to total workers	2.56
9.	Other workers to total workers	38.7

Source : Data computed from Census of India 2011,. C.D. released in 2014.

Table 11.22 and **Fig. 11.16** depict the areal distribution of participation rate in India in 2011. It is observed that more than half the population is working in Himachal Pradesh and Sikkim. As many as 19 states and union territories have above 40 per cent participation rate which is higher than the national average of 39.79. All states of the peninsular India with the exception of Kerala, Puducherry, Jharkhand and Goa have participation rate higher than the national average. The mountain areas of Mizoram, Himachal Pradesh, Sikkim, Arunachal Pradesh and Nagaland also have sufficiently high participation rate. Almost all the states and union

TABLE 11.22. Participation Rate in India, States and Union Territories (2011)

Sl No.	States/Union Territories	Participation Rate (pecentage of workers to total population)
	INDIA	39.79
01	Jammu & Kashmir	34.47
02	Himachal Pradesh	51.85
03	Punjab	35.67
04	Chandigarh#	38.29
05	Uttarakhand	38.39
06	Haryana	35.17
07	NCT of Delhi#	33.28
08	Rajashthan	43.59
09	Uttar Pradesh	32.94
10	Bihar	33.35
11	Sikkim	50.47
12	Arunachal Pradesh	42.47
13	Nagaland	49.24
14	Manipur	45.09
15	Mizoram	44.36
16	Tripura	39.99
17	Meghalaya	39.96
18	Assam	38.36
19	West Bengal	38.08
20	Jharkhand	39.71
21	Odisha	41.79
22	Chhattisgarh	47.68
23	Madhya Pradesh	43.47
24	Gujarat	40.97
25	Daman & Diu#	49.86
26	Dadra & Nagar Haveli#	45.72
27	Maharashtra	43.99
28	Andhra Pradesh (including Telangana)	46.61
29	Karnatka	45.62
30	Goa	39.58
31	Lakshadweep#	29.09
32	Kerala	34.78
33	Tamil Nadu	45.58
34	Puducherry#	35.66
35	Andaman & Nicobar Islands#	40.08

Union Territory

Source : Data computed from Census 2011, C.D. released in 2014.

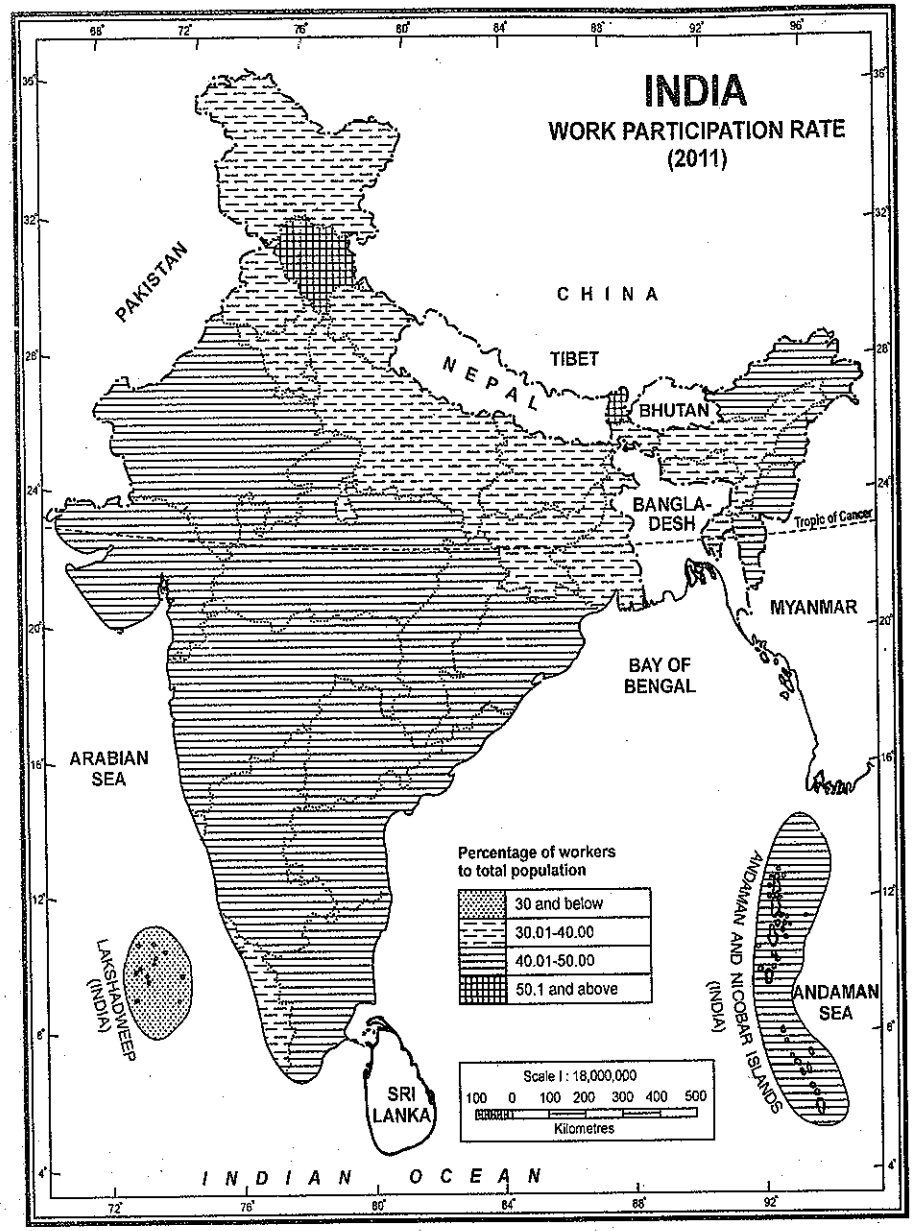


FIG. 11.16. India : Work Participation Rate (2011)

territories in the northern plain of India have participation rate below the national average. Some mountainous states like Jammu and Kashmir and Uttaranchal also have low participation rate. The lowest participation rate of 29.09 is found in union territory of Lakshadweep.

REFERENCES

Bhardwaj, S.M. (1989) : *Hindu Places of Pilgrimage*, Berkelay.

Bhutani, Smita (1995) : *Demographic Dynamism in India*, Discovery Publishing House, New Delhi, Chapt. 5-7.

Bose Ashish (2010) India'a Quest for Population Stabilisation, National Book Trust, New Delhi.

Bose, N.K. (2002) : *Tribal Life in India*, National Book Trust, New Delhi, India.

Bose, N.K. *et al.* (1973) : *The People*, The Gazetteer of India, Vol. one, Ministry of Education and Social Welfare Chapt. VI.

Brush, John E. : "Distribution of Religious Communities in India", *Annals of the Association of American Geographers*, 1948, pp. 81-96.

Census of India (1951) : *Literacy and Education Standard*, Paper 5, 1954.

Census of India (1991) : *Census Atlas*, National Volume-I.

— — *Religion*, Series 1, Paper 1 of 1995.

— — *Union Primary Census Abstract for Scheduled Castes and Scheduled Tribes*, Series-1, Paper 1 of 1993.

— — (2011) : Provisional Population Totals, Paper-1 of 2011 Series-1

— — Primary Census Abstract released on C.D. in 2014.

Census (2001) : The First Report on Religion Data Abstract (2004)

Chakraborti, N. and Mukherji, F. (1971) : *Indian Tribes*, Saraswati Library, Calcutta.

Chandna, R.C. (2012) : *A Geography of Population*, Kalyani Publishers, Delhi.

Chatterji, S.K. (1945) : *Language and Linguistic Problem*, London.

Chatterjee, S.K. (1963) : *Language and Literature of Modern India*, Bengal Publishers, Calcutta.

Chatterjee, S.K. and S.M. Katre (1973) : *Languages*. The Gazetteer of India vol. one, Ministry of Education and Social Welfare, Chapter VII.

Dandekar, K. (1975) : Why has the Position of Women in India's population been declining, *Economic and Political Weekly*, No. 107 October, pp. 1663-67.

Dasgupta, J. (1970) : *Language Conflict and National Development*, Berkeley.

Desai, P.B. (1975) : *A Survey of Research in Demography*, Indian Council of Social Science Research, Popular Prakashan, Mumbai.

Dubey, R.N. and B.S. Negi (1974) : *Economic Geography of India*, Kitab Mahal, Allahabad, pp. 610-622.

Dubey, S.C. (1977) (ed.) : *Tribal Heritage in India : Ethnicity, Identity and Interaction*, Vikas Publishing House Pvt. Ltd., New Delhi.

Dutt, A.K. : "Religious Pattern of India", *Geo-Journal*, Vol. 3 (2), 1979, pp. 201-204.

Ghurye, G.S. (1959) : *The Scheduled Tribes*, Popular Prakashan, Mumbai.

Gopal, R. (1966) : *Linguistic Affairs of India*, Asia Publishing House, Mumbai.

Gosal, G.S. (1964) : *Literacy in India : An Interpretative Study*, Rurat Sociology, Vol. 29, No. 3, pp. 261-277.

Govt. of India (1973) : *The Tribal People of India*, Ministry of Information and Broadcasting.

Haldar, Gopal (2000) : *Languages of India* (Translated by Tista Bagchi), National Book Trust, India, New Delhi.

Hassan, Mohammad Izar, (2005), Population Geography, Rawat Publications, Jaipur.

Husain, Majid (2011) : *Human Geography*, Rawat Publications, Jaipur.

India (2012) : A Reference Annual, Publication Division, Ministry of Information and Broadcasting, GOI, New Delhi.

India (2014) : A Reference Annual, Publication Division, Ministry of Information & Broadcasting, GOI, New Delhi.

Muthaiah, S. *et al.* (eds.) (1987) : *A Social and Economic Atlas of India*, Oxford University Press, New Delhi.

Krishan, G. (1980) : *Non Agricultural Workers in Rural India*, Asian Profile vol. 8, No. 2, April, pp.150-169.

Krishan, G. and Shyam, M. (1977) : *Literacy in India*, Geographical Review of India, Vol. 39, pp. 117-125.

Majumdar, D.N. (1958) : *Races and Cultures of India*, Asia Publishing House, Bombay.

Maurya, S.D. (2012) : *Human Geography*, Prayag Pustak Bhandar, Allahabad.

Premi Mahendra K. (2009), India's Changing Population, Profile, National Book Trust (NBT), New Delhi.

— — 2006) : Population of India (In the New Millennium : Census 2001), NBT, New Delhi.

Premi Mahendra K. and Dipendra Nath Das (2012) : Population of India, B.R. Publishing Corporation, Delhi.

Ramaswami Aiyar, C.P. *et al.* (1973) : *Religion*, The Gazetteer of India, Vol. 1, Ministry of Education & Social Welfare, Chapt. VII.

Raza Moonis and Aggarwal, Y.P. (1986) : *Inequalities in Levels of Literacy in India*, in Shafi M. and Raza M. (eds) *Spectrum of Modern Geography*, Concept Publishing Co., New Delhi, pp. 193-225.

Raza, Moonis and Ahmad Aijazuddin (1990) : *An Atlas of Tribal India*, Concept Publishing Company, New Delhi.

Rubenstein James, M. (2012) : *Contemporary Human Geography*, PHP Learning Pvt. Ltd., New Delhi.

Schermerharn, R.A. (1978) : *Ethnic Plurality in India*, Tuscon.

Schawartzherg, J.E. : The Distribution of Selected Castes in the North Indian Plains, "*Geographical Review*, Vol. 55, 1965, pp. 477-495.

Sharma, O.P. and D. Retherford (1993) : *Literacy Trends in the 1980s in India*, Occasional Paper No. 4 of 1993, Census of India, New Delhi.

Singh, K.S. (1972) (ed.) : *Tribal Situation in India*, Indian Institute of Advanced Study, Shimla.

Sopher David, E. (1967) : *The Geography of Religions*, Prentice Hall Inc., New Jersey.

Verma, R.C. (1995) : *Indian Tribes through the Ages*, Publication Division, Ministry of I & B, Govt. of India.

Migration Patterns

INTRODUCTION AND DEFINITION

Migration is a form of spatial mobility of population between one geographical unit and another involving a permanent change of residence (UN : 1958). The Census of India determines migration by place of birth or residence. *If a person was born at a place other than the place of enumeration, then he is treated as a migrant*. Of the three components of population change, migration holds a place of prominence—the other two components being *fertility* and *mortality*. Migration cannot be considered as a mere shift of people from one place of residence to another, as it is most fundamental to the understanding of continuously changing space-content and space-relationships of area (Gosal, 1961). Gill (1981) is of the opinion that movement over territories is a characteristic feature of all human populations irrespective of their stage of development. Bogue (1959) considers it an instrument of cultural diffusion and social integration, which yields more meaningful redistribution of population. Smith (1960) has talked about three-fold impact of migration on (*i*) the area of out-migration (*ii*) the area of in-migration and (*iii*) the migrants themselves. He has rightly remarked that areas of out-migration, in-migration and the migrants themselves never remain the same. The population of the area of out-migration decreases whereas the population of the area of in-migration increases. Migrants are also affected because there is a change in the residence of the migrants.

The studies regarding migration are seriously hampered due to lack of methodology and data constraints. Most scholars who write about migration theories and models recognise the very imperfect state of present-day theoretical and empirical knowledge of migration phenomenon (Germani, 1964). There is considerable agreement, that the study of migration has been hampered by the grave deficiencies in migration theories, which tend to be *time bound, culture bound and description bound* (Manglam and Schwarzweller: 1968). To some extent, this situation may be attributed to the greater complexity of migration as compared with the other two

components of population change—mortality and fertility. According to **Jones** (1981), "Of the three components of population change, migration is the most difficult to conceptualize and measure". Because, it involves a change from the place of origin to the place of destination, migration has both a separative and an additive effect and both aspects are relevant to an understanding of why people move. The data constraints are no less pronounced than the lack of methodology. The census of India does not provide any direct data on migration. It is only with the help of place of birth data that some idea of magnitude and direction of patterns of migration can be obtained. Although, post-independence censuses have tried to improve the quality and quantity of migration data, yet the census data are far from satisfactory for a reasonable analysis of migration. Census data of 2011 on migration has yet not been published and we have to content ourselves with 2001 census data only.

Migration and Census of India. Along with other things, census data contain information about migration also. In fact, migration data were recorded at the time of first Indian census in 1881. It was based on the place of birth. In 1961, modification was made to include place of birth and duration of residence (if born elsewhere). In 1971, additional information on place of last residence and duration of stay at the place of enumeration were incorporated. Information on reasons for migration were incorporated in 1981 census and modified in consecutive censuses.

Following questions are asked about migration at the time of census enumeration:

- Is the person born in this village or town? If no, then further information is taken on rural/urban status of the place of birth, name of district and state and if outside India then name of the country of birth.
- Has the person come to this village or town from elsewhere? If yes, then further questions are asked about the status (rural/urban) of previous place of residence, name of district and state and if outside India then name of the country.

In addition, reasons for migration from the place of last residence and duration of residence in place of enumeration are also asked.

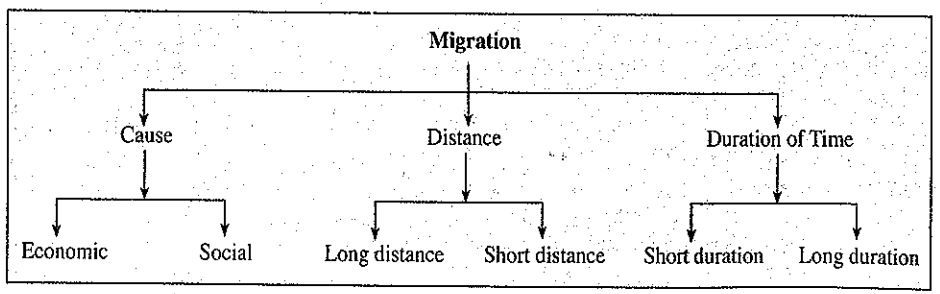
In the Census of India, migration is enumerated on the following two bases.

(*i*) Place of birth, if the place of birth is different from the place of enumeration (known as life-time migrant);

(*ii*) Place of residence, if the place of last residence is different from the place of enumeration (known as migrant by place of last residence).

Definition of Certain Terms Associate with Migration. *Place of origin* is the place which the migrant leaves, and, for that place, the person is an *out-migrant*. *Place of destination* is the place where the migrant arrives and for that place, the person is called in-migrant. Thus the same person is an out-migrant for the place of origin and in-migrant in the place of destination. When the migration takes place across international boundaries, the terms used are *emigration* and *immigration* to describe migration phenomenon, and migrant and immigrant to define a person.

Classification of migration. Migration can be classified on the basis of cause, distance and duration of time as illustrated below :



TYPES OF MIGRATION

Migration may be broadly classified as *international* and *internal*. India has experienced both, though at a much lesser scale as compared to other countries of the world.

International Migration

Movement of population from one country to another, across the international borders, is called ***international migration.*** International migration is of two types *viz.* out-migration of Indians to other countries and immigration into India from other countries.

OUT-MIGRATION

Instances of Indians migrating to other countries have been noticed in the historical times. In fact migration by Indians to other countries has a long history. During the reign of Ashoka the Greate, several preachers travelled to south-east Asian countries to spread the Buddhist religion and popularize Indian art and culture. In the 19th century many Indians migrated to Mauritius, Burma (Myanmar), Sri Lanka, Malaysia, Fiji, Guyana, Surinam, Trinidad, South Africa and East Africa as labourers and settled permanently there. The first group of Indian labourers consisting of convicts and criminals was transported from Kolkata (Calcutta) in 1815 to work in sugarcane fields. After 1934, a large number of free workers were attracted by the mild oceanic climate of Mauritius. At present about three-fourths of the total population of Mauritius consists of people of Indian origin. There is a big colony of about 8000 Indians in the Reunion Islands near Mauritius. A large number of Indians also migrated to West Indies.

Indians also migrated to different countries of Africa during 18th and 19th centuries. Several merchants of Indian origin established their business with the help of Arab traders. A large number of Indians were encouraged by the European rulers to migrate to African countries and work there as labourers to clear the forests and provide land for agricultural purposes, to work in their plantations and to provide labour force for constructing railways. These labourers were followed by other professionals such as traders, shop-keepers and money lenders. Thus large Indian colonies came up in central and southern parts of Africa. The countries where Indian colonies were developed include Kenya, Uganda, Tanganika, Mozambique, Tanzania, Zimbabwe, Somalia, Ethiopia, Zambia, Natal, South Africa, etc. Most migrations to African countries originated from the states of Punjab, Gujarat, Maharashtra, Tamil Nadu and Kerala.

Indians started migrating to West Indies after 1840 and their main destinations were Guinea and Trinidad. Each has over two lakh Indians. Some Indians had migrated to Jamaica, Martinique and Guadeloupe also. Most of the Indians migrated to these islands as labourers to work in the agricultural fields. Majority of such migrants were from Eastern Uttar Pradesh and Bihar. At present, Indians constitute over 50% of the population of West Indies.

THREE WAVES OF INDIAN DIASPORA

There have been three waves of Indian Diaspora at three different times in the history of India. According to Migration Policy Institute diaspora is defined as "people of Indian origin who live outside the country but continue to exhibit some of India's ethnocultural characteristics."

1. The first wave took place during the British period when a large number of labourers were sent to Mauritius, Caribbean islands (Trinidad, Tobago and Guyana), Fiji and South Africa by British from Uttar Pradesh and Bihar; to Reunion Island, Guadeloupe, Martinique and Surinam by French and Dutch and by Portuguese from Goa, Daman and Diu to Angola, Mozambique to work as plantation workers. All such migrations were covered under the time-bound contract known as ***Girmit Act*** (Indian Emigration Act). These labourers were living in inhuman conditions and their living conditions were as bad as those of slaves.

2. The second wave of migrants went to settle in the neighbouring countries like Thailand, Malaysia, Singapore, Indonesia, Brunei and some African countries. This is a recent development under which professionals, artisans, traders, factory workers went out of the country in search of better quality of life. This trend is still continuing. In the 1970s, there was oil boom in West Asia and a large number of skilled and semi-skilled workers went there to avail of the opportunity Some entrepreneurs, store owners, professionals, businessmen etc. went to western countries also.

3. The third wave started in 1960s and still continues to operate. In this period high profile professionals like doctors, engineers etc. migrated out of India. In 1980s, software engineers, management consultants, financial experts, media persons etc. moved out of the country to work in countries like the U.S.A., Canada, U.K., Australia, New Zealand, Germany etc. After liberalisation in 1991, education and knowledge based Indian migration has made Indian Diaspora most powerful in the world.

By the end of the 19th country, a large number of Indians migrated to Sri Lanka and Malaysia to work as labourers in tea and rubber plantations respectively. At present there are about five million Indians in Sri Lanka which account for about one-third of the total population of that country. Similarly about 10 per cent population of Malaysia is of Indian origin. Most of the migrants to Sri Lanka and Malaysia are from Tamil Nadu and they had been fighting a long war for their rights. Some labourers from Bihar, Uttar Pradesh, West Bengal and Odisha also migrated to these countries.

Since 1970s, highly educated and skilled professionals have migrated from India to some of the most advanced countries such as the U.S.A., U.K., Canada, Australia, New Zealand, Japan and some countries of Western Europe, leading to a serious problem of *brain drain*. A less educated work force had earlier migrated to these countries since Independence as labourers. During the last four decades or so, many Indians have migrated to the oil-rich countries of the Middle East. Some migration from India has taken place to South-east Asian and south American countries.

But global recession in 2007-08 dealt a big blow to migration and many Indians had to come back to India due to heavy reduction in job opportunities in North American and European countries. Out migration from India again picked up after normalization of world economy. But Indian migration to Australia has suffered a set back due to racial discrimination and violence against Indians. Migration of people from India during historic times is shown in **Fig. 12.1**.

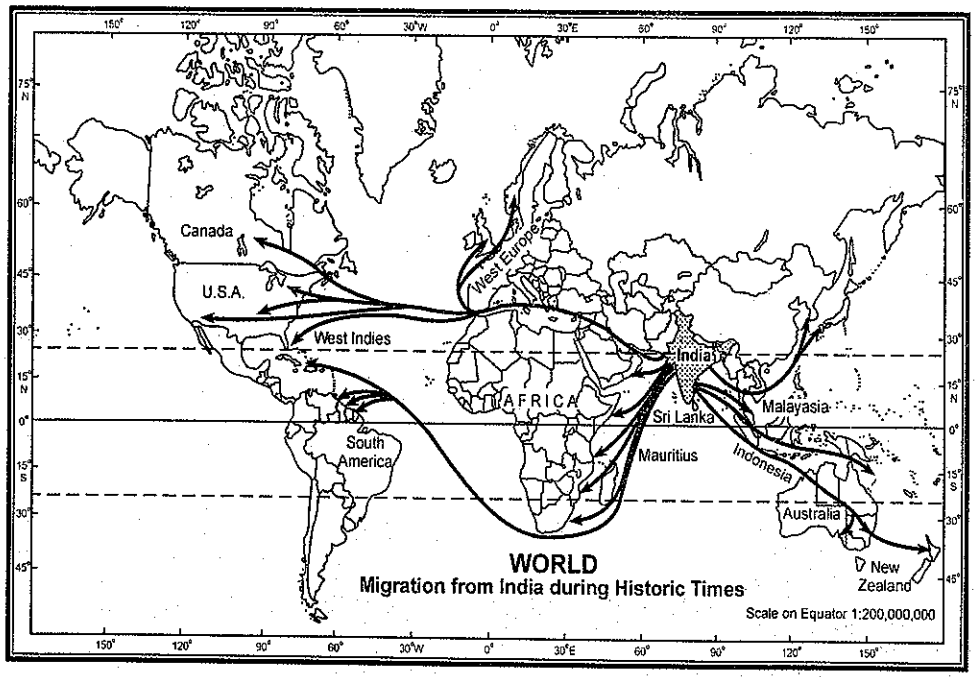


FIG. 12.1. Migration from India during Historic Times

Partition of Indian subcontinent and International Migra tion

Partition of the Indian subcontinent in 1947 resulted in large scale migration of population from India to Pakistan and Bangladesh and *vice versa*. This has been termed as one of the greatest movements of human beings in the history of the world. In spite of its short duration, it had long term consequences for the economy and society of the three concerned countries. About 14.5 million people moved across

the border. Hindus and Sikhs came to India from Pakistan and Bangladesh and Muslims from India went to these countries. In 1951, 7.3 million refugees were enumerated in India (4.7 million from Pakistan and 2.6 million from Bangladesh). The 1951 census of Pakistan enumerated 7.2 million *muhajirs* (refugees) from India. The patterns of migration due to partition of subcontinent are shown in **Fig. 12.2**.

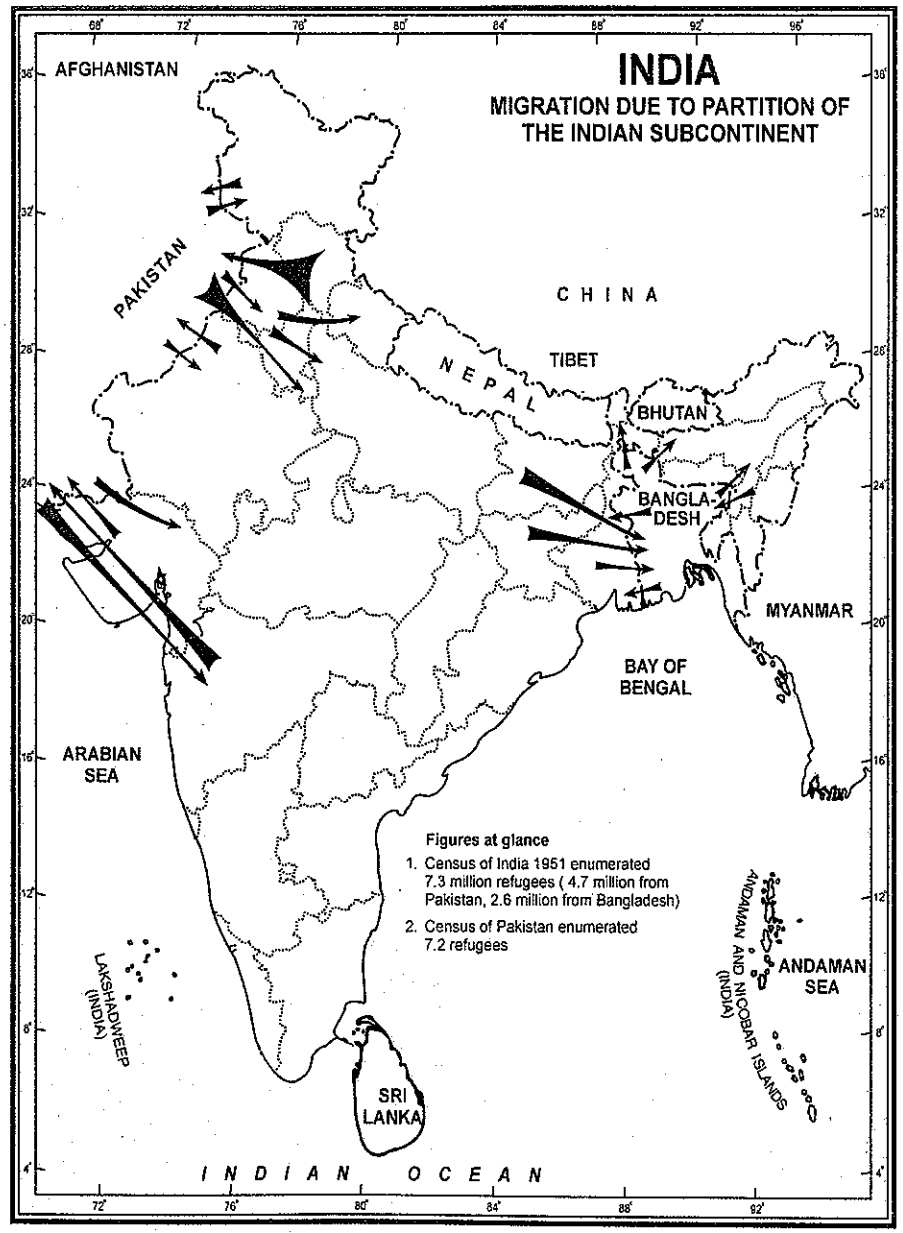


FIG. 12.2. Partition of Indian Subcontinent and International Migration

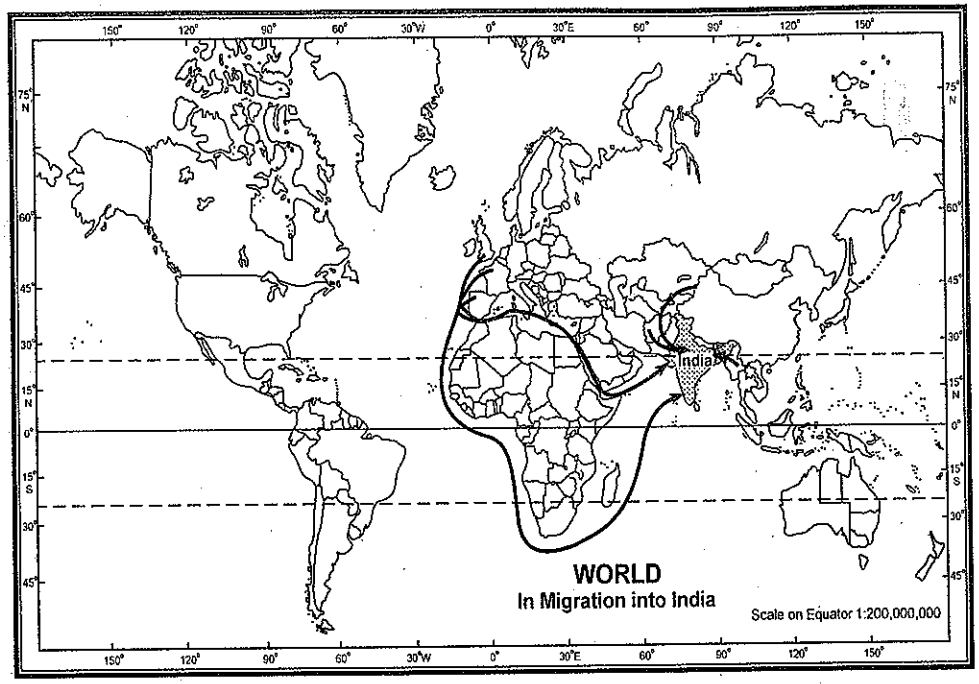


FIG. 12.3. In-migration into India

According to report in 2009 by the Migration Policy Institute, Myanmar is the surprise home largest Indian diaspore. More than 2.9 million out of 18.5 million strong Indian disaspore live there (see region-wise details below):

S.E. Asia—Myanmar 2,902,000, Malaysia 1,665,000, Sri Lanka 855,025.

North America—U.S.A. 1,678,765, Canada 851,000.

Caribbean—Trinidad and Tobago 500,600, Guyana 3,937,350

Persian Gulf—Saudi Arabia 1,500,600, U.A.E. 950,000, Oman, 312,000, Kuwait 295,000.

Europe—U.K. 1,200,600, Netherlands 217,000.

Africa—S. Africa 1,000,000, Mauritius 715,756.

Oceania. Fiji 336,829, Australia 190,000.

IN-MIGRATION

The present day population of India consists of descendants of people who migrated to this country at different pre-historic and historic times from different parts of the world. These include the Dravidians, the Aryans, Muslisms, Moghals, Europeans, etc. Most of the international migrants in India are from the Asian countries, followed by Europeans, Africans, Americans and Australians. The maximum migration in India has taken place from the neighbouring countries like Pakistan, Nepal, Bangladesh and Afghanistan. Most of the immigrants in India from the neighbouring countries mainly from Bangladesh and Nepal, are concentrated in Assam and Uttar Pradesh. Assam receives more Bangladeshis than the Nepalese while Uttar Pradesh has more Nepalese for the obvious reason of significance of distance factor in population migration. Foreign Nationals have settled in West Bengal, Maharashtra, Delhi, Tamil Nadu, Bihar, Punjab, Himachal Pradesh, Madhya Pradesh, Arunachal Pradesh, Odisha, Gujarat, Goa and Kerala.

According to 2001 Census figures, more than 5 million persons have migrated to India from other countries. Out of these, 96 per cent came from the neighbouring countries: Bangladesh (3.0 million) followed by Pakistan (0.9 million) and Nepal (0.5 million). Included in this are 0.16 million refugees from Tibet, Sri Lanka, Bangladesh, Pakistan, Afghanistan, Iran, and Myanmar.

TABLE 12.1. Immigrants by last residence from neigh-bouring countries by all duration in India, 2001

Countries %	No. of immigrants	% of total immigrants
Total international migration	**5,155,423**	**100**
Migration from neighbouring countries	4,918,266	95.5
Afghanistan	9,194	0.2
Bangladesh	3,084,826	59.8
Bhutan	8,337	0.2
China	23,721	0.5
Myanmar	49,086	1.0
Nepal	596,696	11.6
Pakistan	997,106	19.3
Sri Lanka	149,300	2.9

Source : Census of India, 2001.

Refugee Influx into India. Although India has not signed the 1951 Refugee convention, yet, India has been the main destination for refugees during the last about six decades and there has been a surge in refugees from the neighbouring countries like Tibet (China), Afghanistan, Sri Lanka, Myanmar and Bangladesh. The estimated figures say that there are more than 3 lakh refugees in India in 2011 making India one of the top 25 refugee recipients in the world. The following brief description gives an idea of refugee influx into India.

1. Tibetans. Dalai Lama was allowed to set up a government in-exile at Dharamsala (Himachal Pradesh) in 1959. This brought in a wave of Tibetan refugees and currently there are about 1,10,000 Tibetans in India. Of them 80,000 have resident permits and are offered low paying public works jobs by the Indian government.

2. Afghans. In 1979 about 60,000 Afghans fled to India when Soviet Union invaded that country. In 1992 and afterwards, thousands of Afghanistanis took refuge in India when Taliban captured power in that country. In 2007, UNHCR estimated 9,200 Afghans in India and 4,000 asylum seekers in the process of refugees certification.

3. Sri Lanka. The civil war in 1983 triggered first wave of Sri Lanka Tamil refugees to India. By 1995 India and UNHCR repatriated 100,000 Tamil Sri Lankans as the war ended. In 2008, 73,000 Sri Lankan refugees were living in 117 camps mostly in Tamil Nadu.

4. Myanmar. 50,000 people fled from Myanmar into Mizoram in 2004 in the wake of military oppression.

5. Bangladeshis. About 50,000 Chakma refugees fled Bangladesh into Tripura in 1988.

Until December 2008, the Indian policy did not charge refugees a "visa or penalty fee" for a residence permit. This was one of the main reasons for surge of refugees into India. However, since then the numbers are divindling. But thousands of Bangladeshis are sneaking illegally into India, making use of porous border between India and Bangladesh.

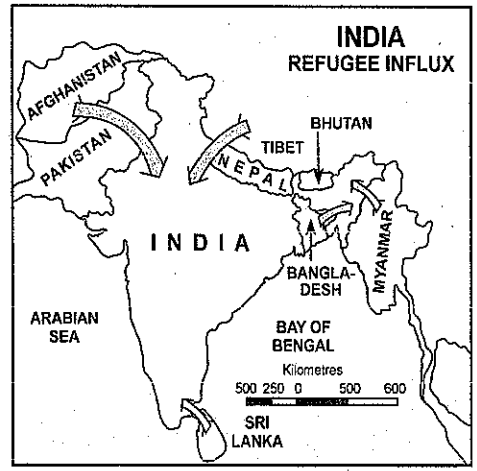


FIG. 12.4. India : Refugee Influx

Figure 12.4 shows that India has been a greater refuge for refugees from the neighbouring countries in the Indian subcontinent.

Reverse Migration. The world wide economic succession in 2008 forced a large number of Indian overseas to return to their home land. This reverse migration gathered momentum in 2008 and countries

to operate till date. An estimated 3 lakh Indian professionals working overseas are expected to return to India between 2011 and 2015. The sustained economic growth and the resilience that India had shown during the slow down has fueled the reverse movement by those who had left the country in search of better job opportunities and higher standard of living. Most of them had been working in the U.S.A., European countries and oil rich Middle East countries. The main reasons assigned by those who planned reverse migration during 2008-11 are given below :

48% felt that there is insecure job market overseas.

29% felt that personal growth opportunities are better back home.

23% felt attraction for the native place is more important than opportunities abroad.

Non-resident Indians see the country's growth story as an opportunity to cash on.

Internal Migration

The Indian population has been considered as one of the least mobile populations of the world (Davis 1951, Gosal 1961, Skeldon 1986). Migration rates in India are desperately low in comparison to most of the European and North American countries. Davis (1951) found from an analysis of place-of-birth statistics from the 1931 census that while 22.5 per cent of the native population in the United States in 1940 lived outside the state in which they were born, only 3.6 per cent of the Indian population in 1931 lived outside the state or province of birth. Blunt (1938) commented that nowhere in the world is the population so immobilised as it is in India. At every census, some 90 per cent of the people are enumerated in the district in which they were born; and of the rest, some seven per cent were born in neighbouring districts. This has been supported by Zachariah (1964) during his study of inter-state migration in India between 1902 and 1931. Several factors have been held responsible for the stubborn immobility of Indian population. These include factors of economic, social, cultural and demographic character. Several scholars like Kamath (1914), Wattal (1934), Chandershekhar (1951), Davis (1951), Gosal (1961), D'Souza (1964) and Majumdar and Majumdar (1978) have tried to elaborate the impact of these factors. The familistic system and agrarian culture and majority of people gripped by widespread poverty in rural society are considered to be the major factors, which impede movement of people. Farming attaches the farmer to the soil and precludes the necessity of widespread travel. Caste system, regional and communal mores, early marriage, diversity in language and culture, low levels of education and literacy and prejudices against female mobility have also contributed a lot to meagre migration in India. Lack of adequate means of transportation and communication and want of knowledge of outside world, especially the area of destination, are also very important impediments to migration (Raju, 1989). A very large section of rural population is completely isolated and has no knowledge of work and wages available elsewhere (Gosal, 1961).

The above description is validated by the fact that interstate life time migration in India was only 3.3 per cent of the total population in 1961. This figure increased marginally to 3.6 per cent in 1981 and 4.1 per cent in 2001. Migration by rural people was not even half of this percentage. Proportionately, it has been much higher for migrants to urban areas than to rural areas (**Table 12.2**).

TABLE 12.2. Size of lifetime interstate migrants (based on birthplace statistics and the same as percentage of total population by sex and by rural or urban place of enumeration, (2001)

Sex	*Total*	*Rural*	*Urban*
Both sexes	42,342 (4.1)	14,020 (1.9)	28,322 (9.9)
Males	19,676 (3.7)	4,390 (2.7)	15,285 (10.2)
Females	22,686 (4.6)	9,629 (2.7)	13,036 (9.6)

Note : Figures in parenthesis are in percentages.
Source : Census of India 2001.

It would be of great interest to examine the states which were net gainers and net lossers with respect to interstate migration. Among the major losers where out migration has been more than in-migration, are Andhra Pradesh, Bihar, Chhattisgarh, Jammu and Kashmir, Jharkhand, Kerala, Madhya Pradesh, Odisha, Rajasthan, Tamil Nadu, Uttar Pradesh and a West Bengal. In contrast, Gujarat, Haryana, Karnataka, Maharashtra, Punjab and all Union Territories have gained in total population where the number in-migrants had been more than the number of out-migrants (**Table 12.3**).

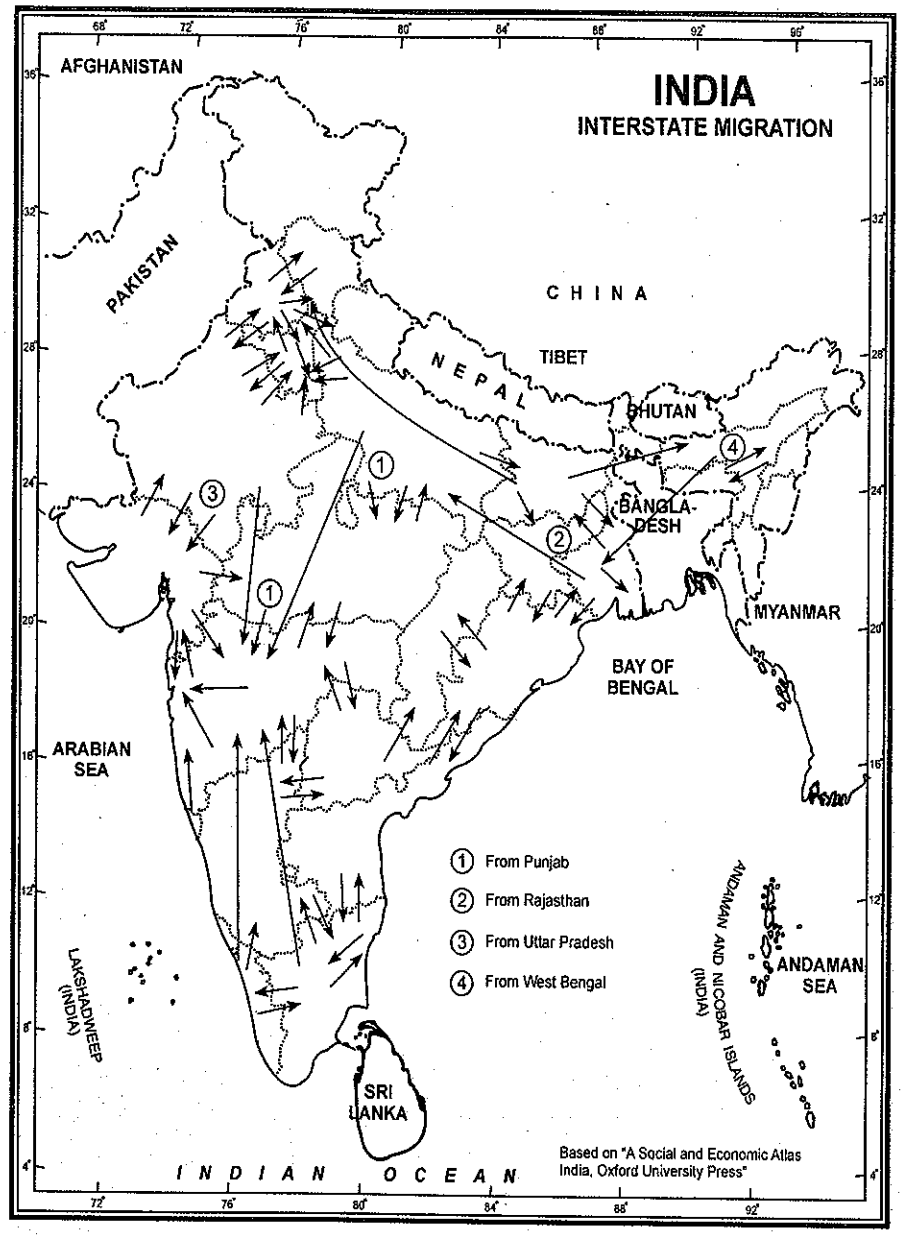


FIG. 12.5. India : Interstate Migration

Net lifetime in-migration in Maharashtra was 3.4 per cent in 2001. All union territories and small states experienced increase in population through net inmigration, barring a few exception. Chandigarh (14.7 per cent) and Delhi (12.8 per cent) experienced substantially high in-migration. Chandigarh has been

TABLE 12.3. Interstate migration trends (2001)

State/U.T.	In-migrants	Out-migrants	Net-migrants
1	2	3	4
India	**16,826,879**	**16,826,879**	**0**
Jammu & Kashmir	86,768	122,175	–35,407
Himachal Pradesh	188,223	165,776	22,447
Punjab	811,060	501,285	309,775
Chandigarh	239,263	106,734	132,529
Uttarakhand	352,496	354,718	–2,222
Haryana	1,231,480	588,001	643,479
Delhi	2,172,760	457,919	1,714,841
Rajasthan	723,639	997,196	–273,557
Uttar Pradesh	1,079,055	3,810,701	–2,731,646
Bihar	460,782	2,241,413	–1,780,631
Sikkim	22,519	6,238	16,281
Arunachal Pradesh	71,789	12,507	59,282
Nagaland	33,594	51,857	–18,263
Manipur	4,529	30,867	–26,338
Mizoram	22,599	31,739	–9,140
Tripura	40,262	23,538	16,724
Meghalaya	33,710	20,434	13,276
Assam	121,803	281,510	–159,707
West Bengal	724,524	730,226	–5,702
Jharkhand	502,764	616,160	–113,396
Odisha	229,687	440,893	–211,206
Chhattisgarh	338,793	444,679	–105,886
Madhya Pradesh	814,670	842,937	–28,267
Gujarat	1,125,818	451,458	674,360
Daman & Diu	48,362	5,401	42,961
Dadra & Nagar Haveli	47,649	3,440	44,209
Maharashtra	3,231,612	896,988	2,334,624
Andhra Pradesh	421,989	637,360	–215,371
Karnataka	879,106	769,111	109,995
Goa	120,824	32,578	88,246
Lakshadweep	4,444	1,149	3,295
Kerala	235,087	431,821	–196,734
Tamil Nadu	270,473	674,304	–403,831
Puducherry	105,208	35,755	69,453
A & N Islands	29,538	8,011	21,527

a new union territory and capital of Punjab and Haryana besides its own capital. This union territory has expanded vary fast and a little more than one-fourth of its population consists of life-time in-migrants. Delhi is the national capital and attracts a large number of people from the surrounding as well from far-off areas who migrate to this city in search of livelihood and better standard of life. In past, also Delhi has been a greater magnet attracting people in large numbers. Uttar Pradesh is the largest contributor to in-migration in Delhi which accounts for about 50 per cent of the total in-migration into Delhi. This is followed by Haryana, Rajasthan, Punjab, Bihar and Madhya Pradesh. In the recent years, migration to Delhi has decreased from the neighbouring states and increased from far off states. There are other states also which have attracted in-migrants from far-off areas. For example, Assam attracted labourers to work in its tea gardens in the past and in the recent years, this state has attracted technicians, professionals and skilled labour for its industries and administration. Maharashtra and Gujarat are two industrially advanced states and have attracted labourers from a number of states like Uttar Pradesh, Bihar, Rajasthan and Odisha. This process of in-migration to these two states started with establishment of industries and still continues to operate. With the advent of Green Revolution, Punjab attracted a large number of labourers from Bihar and eastern part of Uttar Pradesh to work in agricultural fields.

Reasons for Migration

Data on reasons for migration were collected for the first in the 1981 census. These reasons were classified into five categories *viz.* (1) employment, (2) education, (3) family moved (associational), (4) marriage and (5) others. Two new categories of reasons were added at the time of 1991 census. They were (1) business and (2) natural calamities like drought, floods, etc. Reasons for migrations were again revised on the eve of 2001 census. According to this scheme reasons for migration were classified into work/employment, business, education, marriage, moved after birth, moved with household and others. **Table 12.4** gives migrants sex-wise classification according to reason for migration into above categories.

TABLE 12.4. Sex-wise distribution of migrants according to reason of migration in percentages (2001)

Reason	Male	Female
1. Work/employment	28.09	1.66
2. Business	2.55	0.20
3. Education	2.55	0.44
4. Marriage	2.33	69.61
5. Moved after birth	9.94	2.94
6. Moved with household	19.39	11.27
7. Others	35.15	13.88

Source : Census of India, 2001.

Work/Employment. The above table shows that the largest percentage of male migration takes place for the sake of *work/employment*. In 1991 about 27.0 per cent males migrated for work/employment and this percentage increased to more than 28 per cent in 2001. People migrate in large number from rural to urban areas in search of employment. The agricultural base of rural areas does not provide employment to all the people living there. Even the small-scale and cottage industries of the villages fail to provide employment to the entire rural folk. Contrary to this, urban areas provide vast scope for employment in industries, trade, transport and services.

Marriage. Among the females, the largest percentage of 69.61 migrate due to marriage. This is much higher than 56.1% in 1991.

In fact marriage is a very important social factor of migration. Every girl has to migrate to her in-law's place of residence after marriage. Thus, the entire female population of India has to migrate over short or long distance.

Education is another important reason for migration. Rural areas, by and large, lack educational facilities, especially those of higher education and rural people have to migrate to the urban centres for this purpose. Many of them settle down in the cities for earning a livelihood after completing their education.

Lack of security also causes migration. Political disturbances and interethnic conflicts drive people away from their homes. Large number of people have migrated out of Jammu and Kashmir and Assam during the last few years due to disturbed conditions there. A large number of Kashmiri Pandits had to leave Kashmir in wake of prolonged ethnic conflict.

Similarly, thousands of people had to migrate out of Punjab during the period of terrorism by religious fundamentalists. People also migrate on a short-term basis in search of better opportunities for recreation, health care facilities, legal advices or for availing service which the nearby towns provide.

'Pull' and 'Push' Factors

Urban centres provide vast scope for employment in industries, transport, trade and other services. They also offer modern facilities of life. Thus, they act as 'magnets' for the migrant population and attract people from outside. In other words, cities pull people from other areas. This is known as '***pull factor***'.

People also migrate due to '*push factors*' such as unemployment, hunger and starvation. When they do not find means of livelihood in their home villages, they are 'pushed' out to the nearby or distant towns. Millions of people who migrated from their far-off villages to the big cities of Kolkata, Mumbai or Delhi did so because these cities offered them some promise for a better living. Their home villages had virtually rejected them as surplus population which the rural resources of land were not able to sustain any longer.

CONSEQUENCES OF MIGRATION

Consequences of migration are as varied and diverse as its causes. Migration affects both the areas of origin of migration and the areas of destination of the migrant population. Over and above, the people are affected in a number of ways. The consequences of migration can be broadly grouped as demographic, social and economic.

(*i*) Demographic Consequences

Migration brings about changes in the characteristics of the population in both the regions, *i.e.*, region of out migration and region of in-migration. It changes not only the age and sex composition of population but also affects the rate of growth of population. Generally, the proportion of the old, children and females increases in population of source areas due to out-migration. On the other hand, the proportion of these persons in the population of in-migration areas gets generally lowered. Migration

is one of the major causes of high sex ratio in source areas and low sex ratio in the receiving areas. This happens because it is mostly the youthful male population which is involved in migration. Thus not only the number of people but also the structure of population in both the regions involved in migration is changed. This leads to change in rates of fertility, mortality and consequently in the growth of population. The source regions are depleted of the youthful population and this results in lowered rates of births and comparatively lower rates of growth. An inverse impact is observed in case of the population structure of the receiving areas.

(*ii*) Social Consequences

Migrants are very good agents of social change as they bring new ideas related to technologies, family planning, girl education etc.

Migration results in intermixing of diverse cultures and leads to the evolution of composite culture. It breaks the narrow considerations and widens the mental horizon of the people. In the historic times, India received migrants belonging to different cultural groups which led to inter-mixing of one culture with the other. But at the same time, migration has serious negative consequences. These include anonymity, which creates social vacuum and sense of dejection among individuals. Continued feeling of dejection may motivate people to fall in the trap of anti-social activities like crime and drug abuse.

(*iii*) Economic Consequences

The effects on the resource population ratio is one of the major economic consequences of migration. This ratio changes in both the source regions and the receiving regions. The resource-population ratio may be such in an area which might be called either ***under populated*** or ***over populated or optimally populated***. The condition of under population means that population is too low to allow development and utilisation of its resources. On the other hand, over population leads to high pressure of population on resources and this condition generally results in low standards of living. A country having enough number of people to enable development and utilisation of its resources without lowering the quality of life is called ***optimally populated***. If the people are moving from an over populated area to an area of under population, the result is in the balancing of the resource-population ratio. On the other hand, if the migration is from an area of under population to over populated or optimally populated, the consequences may be harmful to both the areas.

Migration affects the occupational structure of the population in both the regions. Generally the proportion of working population in source areas is lowered and the same proportion in the receiving areas is increased. Thus the population of the receiving areas tends to become more productive and in the source areas it results in increasing the dependency ratio by reducing the proportion of the working people in the population. One of the serious consequences of migration is **'brain drain'.** This refers to the migration of the skilled persons from the poorer countries to the developed countries in search of better economic opportunities. An example can be of the migration of doctors and engineers etc. from India to the U.S.A. the U.K. and Canada. This type of migration does not alter the resource-population ratio significantly as the number of people involved in migration is not very large. However the quality of human resources in the source region suffers a lot. The resources of the source regions which are generally poorer countries can not be developed fully because of the huge size of the population.

Most people migrate for economic gain and economic benefit is the most important consequence of migration. People migrating out send remittance to their families at home and add to economic prosperity. Remittances from the international migrants are one of the major sources of foreign exchange. According to World Bank's Migration and Remittances Factbook 2008, India is the top receiver of remittances from abroad and received US $27.0 billion in 2007. This is followed by China (US $25.7 billion), Mexico (US $25.0 billion), Philippines (US $17.0 billion), France (US $12.5 billion), Spain (US $8.9 billion), Beligium (US $7.2 billion), Germany and UK (US $7.0 billion each), and Romania (US $6.8 billion). Punjab, Kerala and Tamil Nadu receive very significant amount from their international migrants. Remittances by internal migrants also plays a significant role in the economic growth of the source regions. These remittances are used for food, repayment of debts, treatment, marriages, children's education, agricultural inputs, construction of houses,

etc. For thousands of the poor villages of Bihar, U.P., Odisha, Andhra Pradesh, Himachal Pradesh, etc. remittance works as life blood for their economy.

With the ushering of the Green Revolution particularly in Punjab, Haryana and western part of Uttar Pradesh, large number of poor people migrated to these states from eastern part of Uttar Pradesh, Bihar, Madhya Pradesh and Odisha. These agricultural labourers had been a great source of remittance to their home villages. But a large number of Bihari labourers working in Punjab have starting going back to their places as prospects of employment opportunities have increased there.

(*iv*) Environmental Consequences

Large scale rural-urban migration leads to overcrowding in the cities and puts tremendous pressure on the infrastructure. It also results in unplanned and haphazard growth of cities in which slums and shanty colonies are very common.

Over-crowding is also related to over-exploitation of natural resources and cities are facing serious problems of water shortage, air and water pollution, problem of sewage disposal and management of solid wastes.

(*v*) Other Consequences

Migration has a deep impact on the status of women. Generally, male members of the family migrate from rural to urban areas and leave their wives behind at home. This puts tremendous physical and mental pressure on the women. Although migration of women enhances their autonomy and role in economy yet it increases their vulnerability.

Migration enhances remittances to the source region but there is heavy loss of human resources, particularly those of skilled people. Market for advanced skills has increased considerably at the international level. As such most dynamic industrial economies are admitting and recruiting significant proportions of the highly trained professionals from poor regions. Consequently, the existing under-development in the source region gets reinforced.

MIGRATION STREAMS

Depending on place of birth (or last residence) and place of enumeration, migrants can be classified into following four migration streams, which are roughly indicative of migration distance.

1. **Intradistrict migrants** are the persons born (or with last residence) outside the place of enumeration but within the same district.
2. **Interdistrict migrants** are the persons born (or with last residence) outside the district of enumeration but within the same state.
3. **Interstate migrants** are the persons born (or with last residence) outside the state of enumeration but within India.
4. **Immigrants** are the persons born (or with last residence) outside the country.

Based on the rural or urban nature of the place of birth (or of last residence) and the place of enumeration, internal migrants can be further classified into following four migration streams :

(*a*) rural-to-rural, (*b*) rural-to-urban, (*c*) urban-to-urban, and (*d*) urban-to-rural.

A combination of the above mentioned two types of migration streams gives rise to twelve streams of **internal migrants.** But there can be only two streams of **international migrants** as the nature of immigrants birth place (or last residence), whether it was rural or urban was not been identified.

(*a*) Rural-to-Rural (Rural Turn Over)

This stream of migration dominates over all other streams in terms of volume of migration. An outstanding feature of rural-to-rural stream of migration is the preponderance of female migrants. Studies made by Zachariah (1964), Bose (1965), Agarwal (1968), Narain (1975), Bhande *et al.* (1976), Premi (1976) and Kumar and Sharma (1979) have shown that this preponderance of female migrants is primarily due to the prevalence of patriarchal residence after marriage (marriage migration). According to Indian tradition, the girl has to move from her parents' residence to the residence of her in-laws and live with her husband.

Apart from marriage migration, there are several other factors which contribute to large scale rural-to-rural migration. Migration of agricultural labourers and movement of people to the newly reclaimed areas for agricultural purposes constitute the most

important component of such migrations. In slack agricultural season, a large number of villagers move out to seek casual employment in irrigation projects, construction of roads, rail-roads and buildings and other miscellaneous menial jobs.

Normally, rural-to-rural migration originates from crowded areas of low productivity and is destined towards sparsely populated areas experiencing large scale developmental activities. Such a migration may take place even for longer distances and may result in permanent redistribution of population. The introduction of Green Revolution in Punjab, Haryana and western Uttar Pradesh in 1960s generated considerable migration of labour force from economically depressed areas of eastern Uttar Pradesh and Bihar to these areas. Neither the innate love of home nor the caste system, that figured in earlier explanations, could hold back the poor labourers from such migration. Similarly, thousands of villagers have moved to plantations in West Bengal and Assam as labourers. Sometimes decisions taken by the government also affect migration pattern. The resettlement of sikh immigrants from Pakistan in the *tarai region* of Uttar Pradesh is an outstanding example of such a migration. The Dandakarnya Project is another such example. A vast area of several thousand square kilometres in the districts of Koraput and Kalahandi (Odisha) and Bastar (Chhattisgarh) was carved out for agricultural development and to resettle thousands of displaced families. Resettlement projects in the northern parts of Rajasthan and in Andaman and Nicobar Islands have also resulted in movement of people. Peasants (owner-cultivators) move to large river valley project areas either on their own or under sponsorship of the government. Peasants who have experience of flow irrigation, voluntarily move to new river valley project areas, where they legally buy land from the locals and establish their settlements called ***camps***. Labourers also move as it becomes labour demand area (Vaidyanathan, 1972).

(*b*) Rural-to-Urban

Rural-to-urban migration is next only to rural-to-rural migration in terms of volume of migration. Rural-urban migration is caused by both *push* of the rural areas as well as *pull* of the urban areas. In rural areas appalling poverty, unbearable unemployment, low and uncertain wages, uneconomic land holdings and poor facilities for education, recreation and other services work as *push factors*. By contrast, the *pull* of urban areas may include better employment opportunities, regular and higher wages, fixed working hours, better amenities of living, facilities for education and socio-cultural activities (Chandna, 1992). The glamour of urban life and rigid caste system in the countryside have given further strength to push and pull factors. Both poor and rich from the countryside migrate to the urban areas under the influence of push and pull factors. While the poor migrate out of economic compulsion to eke out their living, the rich migrate due to their desire for better and greater comforts of life. In brief, rural-to-urban migration is an outcome of interplay of forces hostile to comfortable living in the villages and of availability of lucrative opportunities in urban areas (Raju, 1987).

Both males and females migrate from rural to urban areas but males have always outnumbered females in this stream of migration. *If rural-to-rural migration is women-migration, rural to urban migration is man-migration*. The rural-to-urban migration has substantially affected the areal distribution of population and has contributed a great deal to urban growth in India. It has been estimated that about one-third of the total urban growth in India has been due to migration (United Nations 1984). This had led to over-crowding in urban centres resulting in great population pressure on the urban infrastructure. The growth and spread of slum areas, as a result of population pressure, is quite glaring and painful.

(*c*) Urban-to-Urban (Urban Turn Over)

This is a stream of migration which is believed to be dominated by the middle class people (Singh, 1980). Generally, people migrate from small towns with less facilities to large cities with more facilities. This is the reason that class I cities have grown at a much faster rate as compared to other towns. In fact, *small towns are constantly loosing to big cities*. The vacuum thus caused in small towns is filled by the subsequent in-migration from the surrounding rural areas. This migration forms a part of what is known as ***step-migration.***

(*d*) Urban-to-Rural (Pushback or Reverse Migration)

This stream has the lowest volume of migrants accounting for about five per cent only in 2001. However, there has been slight increase in this stream of migration between in the recent past. Such a movement takes place at the advanced stage of urbanization when urban centres are characterised by over-congestion, haphazard growth, high cost of living, heavy pressure on public utility services, unemployment, etc. Usually females outnumber their male counterparts in this stream of migration. This is largely due to matrimonial alliance (Premi, 1978).

Figures 12.6(*a*) and **12.5(*b*)** show the distribution of male and female migrants in different streams of intrastate and interstate migrations. In both types of migration females predominate the streams of short distance rural-rural migration. This is primarily because of marriage because females have to leave their parents and live with in-laws. In contrast men pre-dominate the rural to urban stream of interstate migration because men migrate to urban areas in search of jobs and better quality of life.

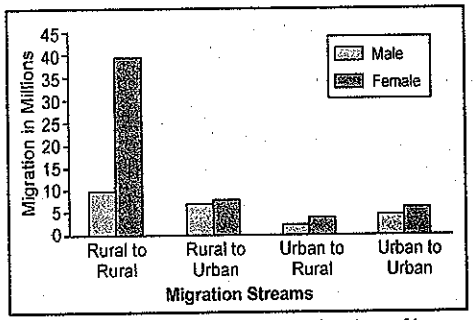


FIG. 12.6.(*a*). Intra state migration by place of last residence indicating migration streams (Duration 0-9 years), India, 2001

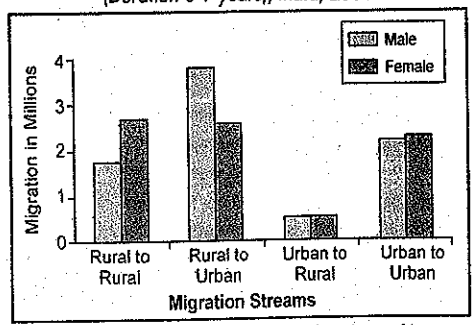


FIG. 12.6(*b*). Interstate migration by place of last residence indicating migration streams (Duration 0—9 years), India, 2001

CONCLUSIONS

Following conclusions can be drawn from the study of migration patterns :

1. Nearly 85 per cent of the intra state migrants were born in rural areas, while 63 per cent were born in rural areas in inter-state migration category.
2. About three fourths of all migrants in the intra-state category were women; mainly because of marriage.
3. Over half of the intra-state migrants moved from rural to rural areas. Such people migrated in search of employment on farms or other establishments located in the rural areas.
4. Rajasthan, Uttar Pradesh, Bihar, Andhra Pradesh and Kerala are the major areas from where out-migration takes place.
5. West Bengal, Maharashtra, Assam, Punjab, Delhi, Chandigarh and Andaman and Nicobar Islands are mostly in migrating states or union territories.
6. Disparities in economic development seems to be the main cause of migration in case of males and marriage in case of females.
7. Densely populated rural areas with increasing pressure of population on land register out migration. Big cities, mining and industrial centres, plantation agriculture etc. are the main "Pull" factors behind in-migration.

Comparatively small states had larger share of inter-state migrants in their populations. By contrast, larger states such as Andhra Pradesh, Odisha, Tamil Nadu, Bihar, Uttar Pradesh displayed relatively smaller proportion of inter-state migrants. Jammu and Kashmir enjoys special status under Article 370 of Indian Constitution which inhibits the permanent settlement of people from other states. Consequently, this state had the lowest proportion of inter-state migrants.

The urbanized and small sized union territories of Chandigarh and Delhi had high percentage of inter-state migration.

REFERENCES

Agarwal, S.N. (1968) : *Socio-Economic and Demographic Characteristics of Rural Migrants*, Journal of the Institute of Economic Research 3(2), July.

Ali, A. (1980) : *Plantation to Politics, Study on Fiji Indians*, Suva.

Bhutani, Smita (1995) : *Demographic Dynamism in India*, Discovery Publishing House, New Delhi, Chapter 4.

Bogue, D.J. (1959) : *International Megration*, in Hauser, P.M. and Dumean, O.D. (Eds). The *Study of Population*, The University of Chicago Press, Chicago.

Bose, Ashish (1965) : *Why do People Migrate to Cities*, Yojana, January 26.

—— (1978) : *Rural to Rural Migration, A New Feature*, in The Hindu, December 13, Chennai.

Census of India, 2001 (2004 b): *Migration Tables* (Released on CD)

Champion, A. and Fielding, A. eds. 1992, *Migration Process and Patterns* Vol. 1. Research Progress and Prospects, London.

Chand, Gyan (1972) : *Population Perspective*, Orient Longman Ltd., New Delhi.

Chandna, R.C. (2014) : *A Geography of Population*, Kalyani Publishers, 2014, New Delhi.

Chakaravarti, N.C. (1971) : *The Indian Minority in Burma : The Rise and Decline of an Immigrant Community*, Oxford Uni. Press.

Clark, H.A.V. 1975). *Migration and Development*, the Hague, Moutn.

Connel *et al.* (1976) : *Migration from Rural Areas : The Evidence from Village Studies*, Oxford University Press, New Delhi.

Davis, Kingsley (1951) : *Population of India and Pakistan*, Princeton University Press, Princeton.

Desai, A.R. and Pillai, S.D. (1970) : *A Profile of Indian Slum*, University of Bombay, Mumbai.

D'Souza, V.S. (1964) : *Some Socio-cultural Aspects of Internal Migration in India in* Ashok Mitra (ed.) Indian Population Bulletin (Vol. 3), Office of the Registrar General of India, New Delhi.

Gill, M.S. (1981) : *Patterns of Migration in an under-developed Tract : Hissar District of Haryana, 1951-71.* Geographical Review of India, Vol. 43, No. 2 June.

Gore, M.S. (1970) : *Immigrants and Neighbourhoods*, Tata Institute of Social Sciences, Mumbai.

Gosal, G.S. (1961) : *Internal Migration in India—A Regional Analysis.* The Indian Geographical Journal, Vol. 36, No. 3, July-Sept.

Gosal, G.S. and Krishan, G. (1975) : *Patterns of Internal Migration in India* in L.A. Kosinki and R.M. Prothers *(ed.) People on the Move*, Methuen and Co. Ltd., London.

Jackson, J.A. (1969) : *Migration*, University Press, Cambridge.

Kumar, A. and Sharma, N. (1979) : *Bihar's Population on Move : Issues on Interdistrict Migration*, in Sinha, V.N.P. and Mandal R.B. (eds.) *Dimensions in Geography*, Associated Book Agency, Patna.

Lewandouski, Susan (1980) : *Migration and Ethnicity in Urban India*, Manohar, New Delhi.

Lewis, C.J. (1982) : *Human Migration*, London, Groom Helm/New York, St. Martin's Press.

Majumdar, P.S. and Majumdar, Illa (1978) : *Rural Migrants in an Urban Setting*, Hindustan Publishing Co., New Delhi.

Mehta, S. (1990) : *Spatial Mobility in India : Evolving Patterns, Emerging Issues and Implications*, Population Geography, Vol. 12 Nos. 1 & 2, June and December.

Mitra, Ashok (1967) : *Internal Migration and Urbanization in India*, Office of the Registrar General of India, New Delhi.

Muthiah, S. *et al.* (ed.) (1987) : *A Social and Economic Atlas of India*, Oxford University Press, New Delhi.

Oberoi, A. (1983) (ed) : *Policies and Internal Migration*, New York.

Ogden, P.E. (1984) : *Migration and Geographical Change*, Cambridge Press, Cambridge.

Prasada Rao, C.R. (1970) : *Rural-Urban Migration, A Clue to Rural-Urban Relations in India*, The Indian Journal of Social Work 30(4), January.

Premi, M.K. (1978) : *Out-migrating Towns : A study into the Nature, Causes and Consequences of Out-migration.* ICSSR, New Delhi.

Premi, M.K. (2009) : *India's Changing Population Profile*, National Book Trust, New Deli.

Raju, B.R.K. (1989) : *Developmental Migration : A Proecessual Analysis of Inter-State Rural-Rural Migration*, Concept Publishing Co., New Delhi.

Rao, Bhaskar N. (1967) : *Estimate of Migration on Four Major Cities of India, 1941-51 to 1951-61*, The Asian Economic Review 10(1).

Robinson Francis (1989) (ed) : *The Cambridge Encyclopaedia of India, Pakisatn, Bangladesh & Sri Lanka*, Cambridge University Press, Cambridge.

Sandesara, J.C. (1964) : *Migration and Metropolitan Living : A Study of Indian Cities*, Economic Weekly, 16(9) May.

Saxena, D.P. (1978) : *Rural-Urban Migration in India : Causes and Consequences*, Popular Prakashan, Mumbai.

Singh, S.N. and Yadav, K.N.S. (1974) : *A Study of Patterns of Rural-Urban Migration.* Demography of India 3(2).

Skeldon, R. (1986) : *On Migration Patterns in India During the 1970s*, Population and Development Review, Vol. 12 No. 4, Dec.

Zachariah, K.C. (1964) : *A Historical Study of Internal Migration in the Indian Sub-Continent, 1901-31*, Asia Publishing House, Mumbai.

Zelinsky, W. (1971) : *The Hypothesis of the Mobility Transition*, Geographical Review 61, No. 2.

Settlements

INTRODUCTION

Shelter is the third most essential and basic need of man after food and clothing. Man builds houses to lead a settled life and the place where he builds houses is known as ***settlement***. Thus settlement is a permanently occupied human dwelling place which indicates a community of dwellings and associated buildings ranging from a small hamlet to metropolitan city or megalopolis. In the opinion of **A.N. Chark** (1989), even a single dwelling may be termed as a settlement although the term is normally applied to a group of dwellings. By constructing settlements, man tries to adopt himself to his physical and cultural environment. According to **Perpillon** (1986 : 433), "Settlement is man's first step towards adopting himself to his environment. A settlement is essentially an occurrence unit consisting of houses, served by roads and streets." According to **R.L. Singh** (1961), "Settlement as an occupance unit represents an organised colony of human beings including the buildings in which they live or work or store or use them otherwise and the tracts or streets over which their movements take place.

CLASSIFICATION OF SETTLEMENTS

Settlements may be classified on the basis of their functions, size, morphology, number and density of houses, etc. but the most widely used criteria is the function carried out by the inhabitants of a settlement. On this basis two types of settlements are recognised *viz.* (1) rural settlements, and (2) urban settlements.

Rural Settlements

Rural settlements refer to clusters of dwellings called 'villages' together with the surrounding land from which the inhabitants derive their sustenance. Village has been defined in different ways by various authors. According to **Richthofen**, "They (Villages) are groups of families, united by common descent, or at least having rites in common, who cleave to one another because of the necessity for cooperating in the cultivation of the same crops." **Blache** has termed the village as the expression of a type of community larger than family or clan. To quote **Bruhnes**, "Village is a term applied to a geographical fact—the collection of houses and residents of the most

numerous aggregations". **Zalinskey** pointed out that an individual village is not simply a collection of farms but a definite social entity. The village has a number of characteristics—territorial, ethnic, cultural—which defines it as an entity. **M. deClerck** describes "a village is above all, a socio-psychological environment, where everybody knows everybody else, where everyone's attitude is strictly controlled by the group; the cultural system defines the patterns of behaviour and the habits of the individuals coincide with village custom".

In India, however, officially a village stands for the area demarcated as a *mauza* meaning "parcel of ground with definite boundaries for revenue purposes without clear and consistent regard for its population". A revenue village thus defined, is a definite administrative unit and includes one or more clusters of dwellings together with the land territory under its possession. Each village has a distinctive place name which helps in distinguishing one village from the other. The hamlet, locally named as *faliya, para, dhana, dhani* etc. means a separate aggregate of houses within the village boundary, sometimes having a name and always forming a part of the whole.

Classification of Villages

Although there are several ways of classifying villages, classification based on size, population and area of land is the most popular and accepted classification of villages. On the basis of this criteria, following classes of villages are recognised.

1. Pura. The place where a habitat had been in ancient days and where chief habitats are all around or nearby areas is called pura. This habitat can thus be called the nucleus of the area. In agricultural areas solitary habitats generally become "puravas" which under favourable circumstances grow into villages.

2. Khas. The word khas is used for the main village or sadar. Sometimes people of the main village settle at some distance and call this new village after their main village. When the population increases, the word khas is used for the village from where people spread around.

3. Kalan. The word kalan is used for large villages and used at the end of the name of the village *i.e.* Bound Kalan. People of several classes and castes live in such villages.

4. Khurd. The word khurd is a degraded form of the urdu word *barkhurdar* (meaning son or small). Therefore this word is used for small villages *i.e.* Dumarkha Khurd.

5. Khera. This word is used for small colonies and also for the higher land of the village. Khera has great social value for the village community because almost all the shows such as *Ramlila, Nautanki,* etc. take place here. In some areas the word khera is used for those places where the ruins of an ancient fort are found.

6. Nanglay. It comprises a group of small villages where one village is surrounded by several satellite villages.

Rural Landscape in India

Rural landscape in India is dominated by the villages and the primary activities carried out by the inhabitants of those villages. Over 6.4 lakh villages are spread all over the country. According to Blache, "*India is par excellence, a country of villages*". Agriculture is the most important of all the primary activities carried out by villagers. Thus villages are *par excellence characteristic of agricultural landscape of the rural India.*

Settlement Types

Before we proceed to discuss settlement types, it is worth making a distinction between settlement types and settlement patterns. In the geographical literature, these terms convey various meanings, sometimes synonymous, at others interchangeable and in yet others as one being element/part of the other. But, actually, these are neither of them. In simple language, *types of rural settlements imply the degree of dispersion or nucleation of the dwellings whereas the patterns refer to geometrical shapes formed by the arrangement of dwellings.*

Various authors have suggested different schemes of discussing settlement types. **Finch** and **Trewartha** *et al.* refer to two primary types of settlements. (*i*) the isolated or dispersed and (*ii*) the nucleated. These are two extreme types of groupings, wherein isolated settlements refer to a single family residence and the nucleated settlements refer to a group of dwellings clustered almost in the centre of the village lands.

D.C. Money has given three broad classes of settlements *viz*. (*i*) the single large nucleated village, (*ii*) hamlets scattered throughout the countryside and (*iii*) single homesteads. **Enayat Ahmed** gives four types : (*i*) compact, (*ii*) cluster and hamlet type, (*iii*) fragmented or hamleted and (*iv*) dispersed settlement. **R.L. Singh** discerns four main types : (*i*) compact settlements, (*ii*) semi-compact or hemleted cluster, (*iii*) semi-sprinkled or fragmented or hamleted settlements and (*iv*) sprinkled or dispersed type. On the basis of number of villages, hamlets and number of occupance units, **R.B. Singh** identified four settlements. They are (*i*) compact, (*ii*) semi-compact, (*iii*) hamleted and (*iv*) dispersed or scattered type.

(*i*) Compact settlements. If the number of villages equals the number of hamlets in an area unit, the settlement is designated as compact. Such settlements are found throughout the plateau region of Malwa, in the Narmada Valley, Nimar upland, large parts of Rajasthan, paddy lands in Bihar, Uttar Pradesh, Vindhyan Plateau and several other cultivated parts of India. In such villages all the dwellings are concentrated in one central site. The inhabitants of the village live together and enjoy the benefits of community life. Such settlements range from a cluster of about thirty to hundreds of dwellings of different forms, sizes and functions. Their size varies from 500 to 2,500 persons in sparsely populated parts like Rajasthan to more than 10,000 in the Ganga plain.

Different geographical factors contribute to the growth and development of compact rural settlements. In the fertile plains of north India they develop in areas of intensive subsistence agriculture. The site of such settlements in this vast plain is generally *bhangar* area free from the annual floods, water points (oisis) in the Thar desert region and Ox-bow lakes in the Middle Ganga Plain. Availability of water is a very important factor in the siting of such settlements. In vast tracts of Punjab, Haryana, western part of Uttar Pradesh, Rajasthan and the Deccan Trap, peasants flock to the perennial sources of water like wells, canals, ponds, etc. In the tribal areas, these settlements are constructed on hill tops, ridges and spurs, etc. Such sites are selected from the defence point of view.

(*ii*) Semi-compact or Hamletted settlements. If the number of villages equals more than half of the hamlets, it is semi-compact settlement. The dwellings in such settlements are not very closely knitted and are huddled together at one common site. It covers more area than the compact settlements; the hamlets occupy new sites near the periphery of the village boundary.

The chief characteristic of these settlements is an early recognised site and one or more than one hamlets which are closely linked with the main site, foot-paths, cart-tracks or roads,. The Purvas and Mazras (hamlets) in the near neighbourhood of the main village grow due to increase in population of the main settlement. The pressure of population on the main site forces many families to shift and built their houses outside the main village. The families which shift outside the main village are generally those of agricultural labourers, artisan castes and other poor people. Care is taken that the *Purvas* and *Mazras* built by such people are located close to the main village considering the close social links among the village communities and the prevailing economic interdependence.

Semi-compact or halmetted rural settlements are found both in plains and plateaus depending upon the environmental conditions prevailing there. These are very common in the *khadar* areas of the Ganga, the Yamuna, the Brahmaputra and several of their tributaries, the *Bet* banks of Punjab, the *Tarai* region of Uttar Pradesh and Uttarakhand and in the deltas of the peninsular rivers of the Mahanadi, the Godavari, the Krishna and the Cauvery.

(*iii*) Hamleted settlements. If the number of villages is equal to half of hamlet number, it is a hamlet settlement. The hamlets are spread over the area with intervening fields and the main or central settlement is either absent or has feeble influence upon others. Often the original site is not easily distinguishable and the morphological diversity is rarely noticed. Such settlements are found in West Bengal, eastern Uttar Pradesh, Madhya Pradesh and coastal plains.

(*iv*) Dispersed settlements. If the number of villages is less than half the number of hamlets, the settlement is regarded as dispersed. The inhabitants of dispersed settlements live in isolated dwellings scattered in the cultivated fields. Individualism, sentiments of living freely, custom of marriage relations are conducive to such settlements. However,

these dwellings are deprived of neighbourhood, communal interdependence and social interaction. Dispersed settlements are found in tribal areas covering central part of India, eastern and southern Rajasthan, Himalayan slopes and land with dissected and uneven topography. Homesteads or farmsteads of wheat producing areas in Punjab, Haryana and western Uttar Pradesh also belong to this category.

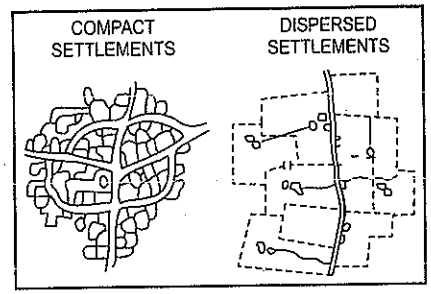


FIG. 13.1. Compact and Scattered Settlements

Difference between Compact Settlements and Dispersed Settlements

Compact Settlements	Dispersed Settlements
1. Compact settlements are mainly found in fertile plains and river valleys.	Scattered settlements are mainly found in hills, plateaus, highlands, and arid and semi-arid lands.
2. The main occupation is agriculture.	Animal grazing and lumbering are the main occupations.
3. Houses are built in close vicinity to each other and have lesser living space.	Houses are isolated and scattered over the land. They provide more living space.
4. Size of the fields is small.	Fields are large.
5. Streets are dirty due to lack of proper drainage.	These settlements are quite neat and clean.
6. The inhabitants of compact settlements work and defend themselves collec-tively.	People of dispersed settlements lead isolated life.

RURAL SETTLEMENT PATTERNS

Pattern refers to geometrical form and shape of the settlement and different settlements have different types of pattern depending on the site and historical background of the settlement. **Embryos Jones** defined pattern of settlement as the relationship between one house or building and another. The pattern of a settlement provides a picture of its shape and a distinct pattern gets its name *i.e.* linear, elongated, square, etc. Pattern also refers to two dimensional geometrical arrangement of rural settlements in an area. Sometimes, a rural settlement may not depict any geometrical shape and the pattern may be termed as ***non-geometrical***. Thus two patterns—geometrical and non-geometrical—are easily discernible on a large scale map or an airphoto of the concerned area.

Following are some of the most common patterns of rural settlements found in India.

1. Linear pattern. This is also known as ***ribbon*** or ***string*** pattern. The main street of the village runs

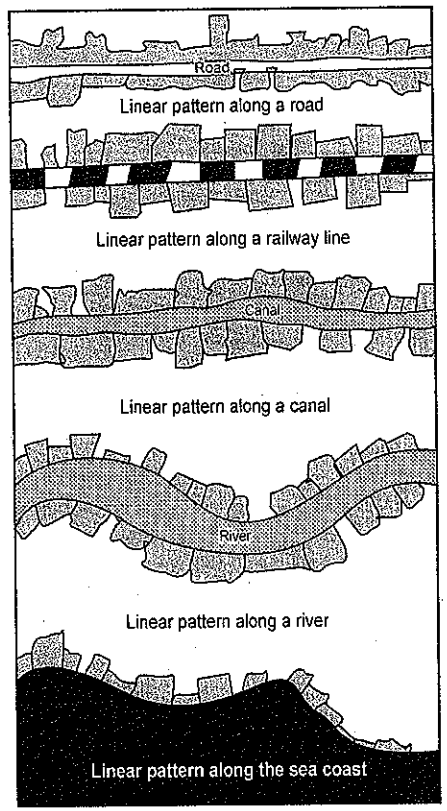


FIG. 13.2. Linear Patterns

parallel to a road, railway line or water front and most of the village shops are located on this road. Some villages of fisherman along the coast have their houses where water level at high tide determines their location (**Fig. 13.2**). Such pattern is found largely in middle and lower Ganga plain, parts of the Himalayan region, along the coasts, especially in Malabar and Konkan and north-east Indian states.

2. Checkerboard Pattern. This pattern develops at a place where two roads or some other mode of transport meet almost at right angles. The point of intersection of two main roads is the focus of growth of the settlement. The other roads or streets are parallel to the main roads and also parallel to each other. They meet each other at right angles (**Fig. 13.3**). Such villages are found in large numbers in the fertile plain of north India. They are highly concentrated in the Ganga-Yamuna Doab. In south India, the checkerboard pattern is a quite common in Tamil Nadu, Karnataka, Andhra Pradesh and Telangana.

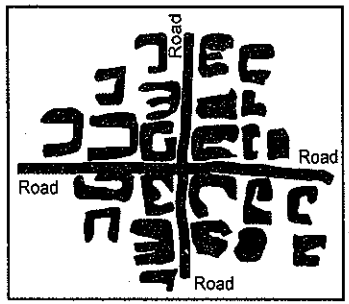


FIG. 13.3. Checkerboard Pattern

3. Rectangular Pattern. The geometry of these settlements is largely rectangular and sometimes square. Such settlements normally develop in the fertile plains of north India where intensive cultivation is practised. These settlements have straight streets which meet each other at right angles. They are connected to each other by roads or foot-paths (**Fig. 13.4**). In India, the rectangular pattern is the heritage of our old system of land measurement in '*Bighas*' which acted as a major factor because the entire cultivated plots and orchards were designed in rectangular shape.

According to **J.P. Misra** (1989 : 126) "The rectangular shape of the fields facilitates ploughing process and making cart-tracts and foot-paths and hence it is maintained by peasants at all costs. Furthermore, the rectangular shape of plots adjusts fairly several rows of houses and render them more spacious." The village streets also confirm to the field patterns and give strength to the rectangular pattern. It may be mentioned that the village is not able to maintain its square shape for a long time because it grows in a particular direction, especially along the transport routes as the time passes.

In certain cases there is a vacant space within the village and the pattern is said to be 'hollow rectangle'. This vacant space may be ascribed to the site of old places, religious places or some water body. This space is the common land and is used by the entire village community.

They are abundantly found in Punjab, Haryana and western part of Uttar Pradesh. In Rajasthan, the Indira Gandhi Canal Command Region has a large number of rural settlements planned as rectangles. Their highest concentration is found in Suratgarh, Hanumangarh and Ganganagar districts. In south India, the deltas of the peninsular rivers have a large number of villages of rectangular shape.

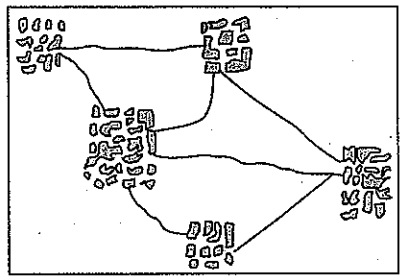


FIG. 13.4. Rectangular Pattern

4. Radial Pattern. Radial pattern develops at a nodal place where number of roads and streets or foot-paths coming from different directions converge at a site. Conversely the roads, streets and foot-paths radiate from a nodal place to different directions and give rise to radial pattern. Houses are built along the transport routes and a radial pattern comes into being. Obviously the central or the nodal part is a vital point in the evolution of the settlement and is occupied by the landlord or village head or some religious place. Some socio-cultural buildings may also come at this place.

About one-third of Indian villages have radial pattern. Most of them are found in the northern plain of India.

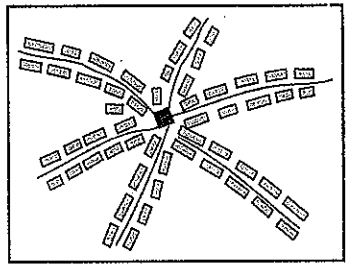


FIG. 13.5. Radial Pattern

5. Star-like Pattern. It is a refined form of radial pattern. It develops when the space between the transport routes like roads, streets and foot-paths is occupied by houses and other buildings. The building process of the houses starts from the nodal place and spreads in all directions. However, the maximum building process takes place along the transport routes and the entire village takes the shape of a star (**Fig. 13.6**).

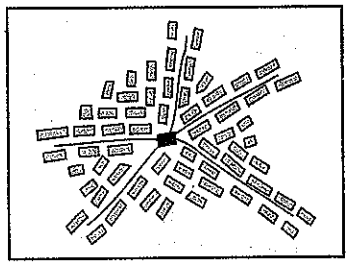


FIG. 13.6. Star-like Pattern

This pattern is mainly found in the fertile areas of Punjab, Haryana and western part of Uttar Pradesh where there is a dense network of roads.

6. Triangular Pattern. This pattern is the result of hindrance occurring on three sides. This hindrance may be physical or cultural or both. The growth of settlement is restricted on three sides by such hindrances and the settlement assumes a triangular pattern. Such a pattern usually develops at the confluence of two rivers or two roads. The lateral expansion of dwellings at the confluence is restricted by the rivers and triangular shape of the dwelling emerges (**Fig. 13.7**).

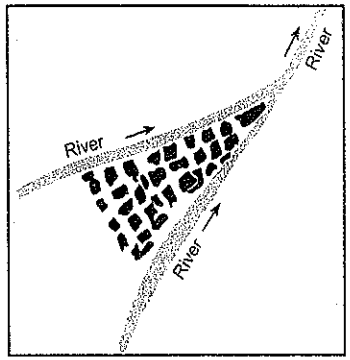


FIG. 13.7. Triangular pattern

7. Circular Pattern. Circular pattern develops around a pond, a lake or a crater. People prefer to construct their houses close to pond or lake because of easy accessibility of water (**Fig. 13.8**). Sometimes a pattern may develop around a temple or a mosque. Villages having circular pattern are found in the upper part of the Ganga-Yamuna Doab, trans-Yamuna region, Madhya Pradesh, Punjab, Maharashtra and Gujarat.

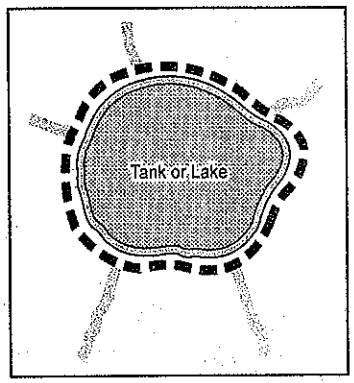


FIG. 13.8. Circular Pattern

8. Semi-circular Pattern. Villages which grow along the river meanders, oxbow lakes or a lake located at the foothill assume semi-circular shape. The Ganga and its several tributaries have semi-circular villages (**Fig. 13.9**).

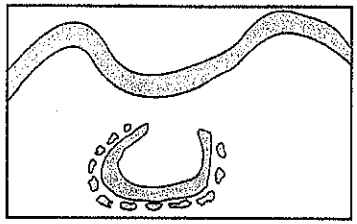


FIG. 13.9. Semi-circular Pattern

9. Arrow Pattern. The villages which grow at the end of a cape, or at a sharp bend of a meandering river or a lake often assume arrow shape. The main concentration of houses is along the roads and the number of houses increases away from the arrow point (**Fig. 13.10**). In India, such settlements are found at Kanniyakumari, Chilka lake, Gulf of Khambhat and along the banks of Sonar river in Madhya Pradesh and Burhi Gandak in Bihar.

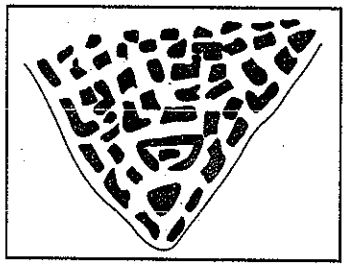


FIG. 13.10. Arrow Pattern

10. Nebular Pattern. Settlements resembling the shape of a nebula are said to have nebular pattern. The roads in such settlements are generally circular which end at the centre or nucleus of the village. These settlements are usually of small size and are found in hilly and undulating areas of Himachal Pradesh, Uttarakhand, Vindhyachal, Kandi lands of Jammu and Kashmir and to a lesser extent in the Ganga-Yamuna Doab.

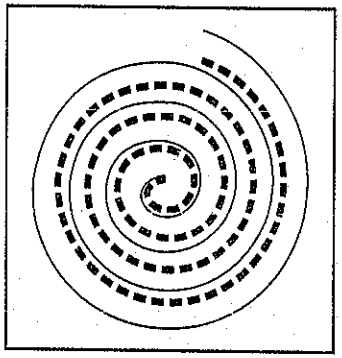


FIG. 13.11. Nebular Pattern

11. Terraced Pattern. Villages having terraced pattern are mostly found on the hill slopes. These slopes are cut and converted into terraces for cultivation. Farmers construct their houses along the terraces and terraced pattern comes into being. Houses in these settlements can be close to each other or they be distant apart. They are constructed at different heights depending on the slope of land. They are usually constructed near a spring or some stream. Such villages may be seen along the hill slopes in Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, Mizoram and Western Ghats.

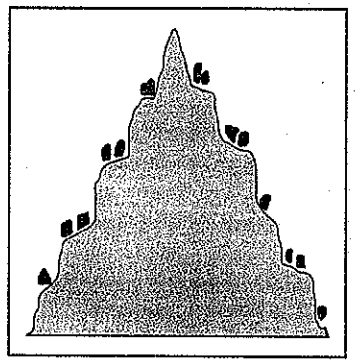


FIG. 13.12. Terraced Pattern

12. T-Shape Pattern. Sometimes the routes meet in such a way that they make a 'T' junction. People start making their houses along the routes extending in all the three directions and T-shape pattern develops.

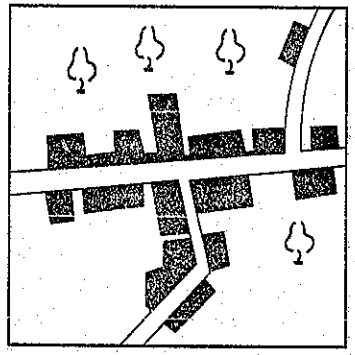


FIG. 13.13. T-shape Pattern

Some villages do not have any particular shape and are called shapeless or amorphous villages. Such villages are found in south-west of Uttar Pradesh, Punjab, Rajasthan, Malwa Plateau, Chota Nagpur Plateau, Madhya Pradesh, Andhra Pradesh, etc.

Size, Spacing and Distribution of Rural Settlements

According to census of India 2011, there are 640,867 villages in the country including un-inhabited villages (**Table 13.1**). The largest number of 106,704 (*i.e.* more than 16.6 per cent) are in Uttar Pradesh alone. In fact the whole of Ganga plain is dotted with villages of varied sizes. In the peninsular plateau, Madhya Pradesh and Odisha have more than fifty thousand villages each. Kerala has only 1018 villages but the size of villages is very large. Goa is a small state and has 334 villages only. This is the minimum number of villages for any state of India. Among the union territories, Chandigarh has the minimum number of 5 villages only, while Andaman and Nicobar Islands have maximum of 555 villages.

According to Census of India, size of villages is determined on the basis of their population. **Table 13.2** shows that the highest number of villages in India are in the population slab of 500-999 persons per village. This category of villages account for about one-fourth of the total villages in India. There is a gradual decrease in number of villages both in higher and lower population slabs. However, this decrease is more conspicuous in the higher population slabs. For example, only 0.78 per cent of the total villages in India are having population above 10,000 persons. There are a few exceptions to this general observation. For example, Kerala has only three villages with population 500-900 but 797 *i.e.* 78.4% of total villages of the state have population more than 10,000 persons. Even some of the larger states like Uttar Pradesh, Madhya Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, etc. having pre-dominantly rural population do not have so many villages with population exceeding ten thousand.

The above mentioned aggregate pattern of the size of the villages varies greatly from one region to another owing to diversified physiography, climate

TABLE 13.1. India : Villages

State Code	India/State/ Union Territory#	Villages*	Area sq. km	Village Density (No. of villages per 100 sq. km)
	INDIA	**640,867**	**32,87,263**	**19**
01	Jammu & Kashmir	6,551	2,22,236	3
02	Himachal Pradesh	20,690	55,673	37
03	Punjab	12,581	50,362	25
04	Chandigarh#	5	114	4
05	Uttarakhand	16,793	53,484	31
06	Haryana	6,841	44,212	15
07	NCT of Delhi#	112	1,483	8
08	Rajasthan	44,672	3,42,239	13
09	Uttar Pradesh	106,704	2,38,566	45
10	Bihar	44,874	94,163	48
11	Sikkim	452	7,096	6
12	Arunachal Pradesh	5,589	83,743	7
13	Nagaland	1,428	16,579	9
14	Manipur	2,588	22,327	12
15	Mizoram	830	21,081	12
16	Tripura	875	10,492	8
17	Meghalaya	6,839	22,429	30
18	Assam	26,395	78,438	34
19	West Bengal	40,203	88,752	45
20	Jharkhand	32,394	79,714	41
21	Odisha	51,313	1,55,707	33
22	Chhattisgarh	20,126	1,36,034	15
23	Madhya Pradesh	54,903	3,08,000	18
24	Gujarat	18,225	1,96,024	9
25	Daman & Diu#	19	112	17
26	Dadra & Nagar Haveli#	65	491	13
27	Maharashtra	43,663	3,07,713	14
28	Andhra Pradesh including Telangana	27,800	2,75,069	10
29	Karnataka	29,340	1,91,791	15
30	Goa	334	3,702	9
31	Lakshadweep#	21	32	65
32	Kerala	1,018	38,863	3
33	Tamil Nadu	15,979	1,30,058	12
34	Puducherry#	90	492	18
35	A&N Islands#	555	8,249	7

*includes un-inhabited villages.

Source : Data computed from Census of India 2011, *Provisional Population Totals* Paper 2 of 2011, Series 1, p. 40.

TABLE 13.2. Distribution of Villages according to Population 2001 Census and Total Number of Inhabited Villages

States/UTs No.	10,000 and above	5,000-9,999	2,000-4,999	1,000-1,999	500-999	200-499	Less than 200	Total No. of inhabited villages.
1. Jammu and Kashmir@	23	212	1152	1641	1521	1275	513	6337
2. Himachal Pradesh	1	12	219	832	2459	5898	8461	17882
3. Punjab	41	330	2227	3471	3237	1903	959	12168
4. Chandigarh	0	3	2	0	0	0	0	5
5. Uttarakhand	21	96	471	824	1826	4684	7823	15745
6. Haryana	121	594	2256	1967	1035	437	232	6642
7. NCT of Delhi	6	9	55	21	6	2	4	103
8. Rajasthan	120	832	5802	10530	12421	8869	4690	43264
9. Uttar Pradesh	545	3432	21013	28020	23381	13591	7832	97814
10. Bihar	1129	3216	10128	10076	7536	4584	2404	39073
11. Sikkim	0	4	42	127	150	75	27	425
12. Arunachal Pradesh	0	1	21	112	325	1026	3773	5258
13. Nagaland	1	30	158	240	337	423	211	1400
14. Manipur	7	28	175	230	377	768	794	2379
15. Mizoram	0	2	43	105	233	236	85	704
16. Tripura	18	131	375	196	80	52	11	863
17. Meghalaya	0	7	82	254	953	2515	2648	6459
18. Assam	21	309	3304	5718	6076	5649	4295	25372
19. West Bengal	417	1716	7552	8731	8574	6848	3640	37478
20. Jharkhand	35	224	2365	5215	7948	8219	5456	29492
21. Odisha	10	195	3058	7902	11978	13271	11263	47677
22. Chhattisgarh	2	88	1913	5392	6142	4252	1778	19567
23. Madhya Pradesh	31	583	5084	12515	16339	11943	5434	51929
24. Gujarat	106	963	4781	5566	3891	1900	576	17843
25. Daman and Diu	0	5	4	5	3	2	0	19
26. Dadra & Nagar Haveli	1	6	28	18	6	5	1	65
27. Maharashtra	310	1175	7170	12154	11144	6426	2582	40961
28. Andhra Pradesh	482	1923	7158	6397	4245	3243	2838	26286
29. Karnataka	164	836	4433	6492	7039	5296	3137	27397
30. Goa	1	14	87	75	57	57	29	320
31. Lakshadweep	0	1	2	0	0	1	2	6
32. Kerala	797	146	58	11	3	1	1	1017
33. Tamilnadu	209	1490	5100	4231	2376	1171	472	15049
34. Puducherry	3	26	46	13	2	0	0	90
35. Andaman and Nicobar Islands	0	2	24	53	61	78	178	396
INDIA@*	**4682**	**18641**	**96388**	**139134**	**141761**	**114730**	**82149**	**597485**

Note :

@ India and Jammu & Kashmir State excludes the villages of the areas under unlawful occupation of Pakistan and China where Census could not be taken.

* India and Manipur figures excludes those of the three sub-divisions viz. Mao Maram, Paomata and Purul of Senapati district of Manipur as census results of 2011 census in these sub-divisions were not included due to technical and administrative reasons.

Source : India 2014, Reference Annual, p. 27

and cultural set up. The hilly areas are not suitable for large villages due to difficult terrain and have small villages, most of them having population less than 1000 persons. States and Union Territories of Sikkim, Arunachal Pradesh, Mizoram, Meghalaya, Diu and Daman, Lakshadweep and Andaman and Nicobar Islands did not have even a single village with population exceeding ten thousand while Himachal Pradesh, Nagaland, Dadra and Nagar Haveli and Goa had one village each belonging to this category. On the contrary, the Great Plain of India has large number of medium and large sized villages.

The spacing of the villages is also affected by physiography and other environmental factors. In the hilly areas of Jammu and Kashmir, Himachal Pradesh, Sikkim, Arunachal Pradesh, Mizoram etc. the spacing of villages is very high and sometimes it reaches upto 5 km. In the Ganga Plain, on the other hand, the spacing of villages is low and is often less than 2 km. To conclude, we can say that *high spacing with low density is the character of mountainous areas while low spacing with high density is the character of plain areas.*

According to 2011 census figures 68.84 per cent or more than two-thirds of India's population lives in more than 6.4 lakh villages and still larger number of purvas, nanglas and isolated houses. For the sake of convenience and simplicity, Indian rural settlements are divided into three categories *viz.* (1) dispersed settlements, (2) nucleated settlements and (3) linear settlements. A brief description of these three types of settlements is given below :

1. Dispersed Settlements

Although India is primarily a country of nucleated settlements, yet dispersed settlements can be found in different parts of the country. Following areas are specifically identified with dispersed settlements :

(*i*) Ridges and spurs in the hilly and mountain areas of Jammu & Kashmir, Uttarakhand, Sikkim and Arunachal Pradesh.

(*ii*) Forest areas of Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram and Tripura.

(*iii*) Higher areas of Western Ghats from Satara in Maharashtra to Kerala.

(*iv*) Flood prone areas in Uttar Pradesh and Bihar.

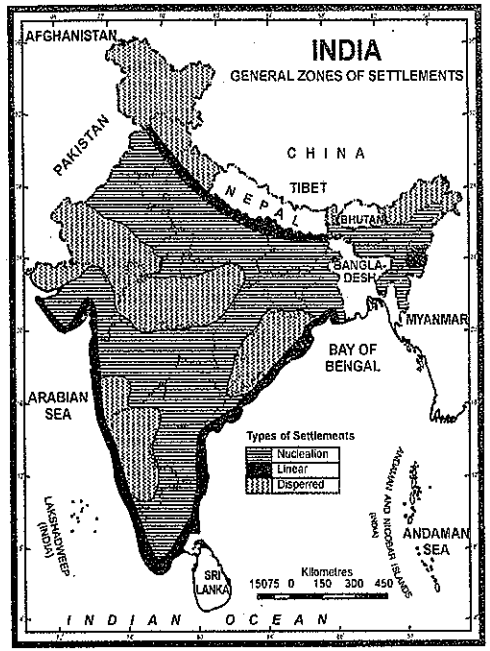


FIG. 13.14. India : General Zones of Rural Settlements

(*v*) Wheat and sugarcane producing areas of Punjab and Haryana.

(*vi*) Western Malwa plateau.

(*vii*) Along small water bodies in West Bengal.

(*viii*) Thar desert, Bikaner, Jaiselmar, Barmer of Rajasthan and adjoining parts of Gujarat.

(*ix*) Hilly areas in Odisha.

It is worth noting that the isolated settlements consisting of one house or farmstead are rarely found in India. Most of dispersed settlements consist of 2 to 5 or 10 huts.

2. Nucleated Settlements

Nucleated settlements are found in most parts of India. The largest concentration of such settlements is found in the northern plain of India consisting of Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal and the Brahmaputra valley of Assam. Level land, fertile soil, water resources, cooperation and interdependence in agricultural operations, small and fragmented agricultural fields, caste and clan considerations, social and economic cohesion, religion and orthodoxy and security considerations in

the past are the main factors contributing to the growth of nucleated settlements. Nucleated settlements of Rajasthan are due to agricultural land, pastures, availability of water at a few selected places and security requirements. Nucleated settlements here appear to be in response to peoples' reaction to political instability and social insecurity which had been prevailing for so many centuries. Here the villages are of larger size and are distant apart. The average distance between these settlements in Jaiselmar is about 10 km which is the largest distance in the whole of Rajasthan.

In south India, the Malwa plateau has nucleated settlements of larger size whose average population varies from 500 to 5000. Sehore, Indore and Betul districts of Madhya Pradesh have still larger settlements with populations varying from 5,000 to 10,000. In certain areas semi-nucleated settlements are also found. Bundelkhand and Baghelkhand also have nucleated settlements of larger size. Settlements of Bundelkhand are comparatively larger and are mostly located near towns. Chhattisgarh plain has comparatively smaller settlements where about two-thirds of the total settlements have population less than 500. In Mayurbhanj, Kendujhar and Sundergarh districts of Odisha, nucleated settlements are found on the valley slopes. Such settlements are found in the Mahanadi basin also. The black cotton soil of Maharashtra also support nucleated settlements. In the Karnataka plateau, the Malnad hills have infertile soil but they are covered with teak, sal and sandal forests. Consequently the nucleated settlements of this area are of small size. But the northern plain of Karnataka has larger settlements having population varying from 2,000 to 10,000. Andhra Pradesh, Telangana and Tamil Nadu also have nucleated settlements of varying sizes. Kerala has the unique distinction of having settlements of large sizes where more than two-thirds of the settlement have population over ten thousand.

3. Liner Settlements

These are elongated settlements with larger length and minimum breadth. Such settlements usually develop along a road, a canal, a river, embankments made by the old course of a river or along the sea coast. In Assam, Tripura, West Bengal and Odisha, linear settlements can be seen stretching for miles together along both the banks of rivers and canals. Houses in these settlements face the sea water front and face each other across the water course. In West Bengal, linear settlements along the courses of the dead rivers in Murshidabad, Nadia, as well as in North and South Twenty Four Parganas can still be seen. Odisha (Balasore), Tamil Nadu (Thanjavur, Ramnathpuram, Tirunelveli) and some parts of Maharashtra also have linear settlements. Over six thousand kilometre long coastline of India is dotted with thousands of fishermen's villages most of which present linear pattern. Deltas and estuaries of big rivers have long queues of linear settlements. In north India, there is continuous belt of linear settlements along the footbills of the Himalayas stretching over the states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Bihar and Sikkim.

Regional Distribution of Rural Settlements

From the physiographic point of view, India can be divided into four major divisions *viz*. The Himalayas, the Northern plains, the Paninsular plateau and the coastal areas and the distribution of rural settlements can be described on the basis of these physiographic divisions.

1. Rural Settlements in the Himalayan Region. The type of rural settlements in the Himalayas region varies according to altitude, slope and general relief of the land as well as on the climatic conditions. In the inter-mountain valleys such as those of Kashmir, Kullu-Manali and Dun valley most of the settlements are either compact or semi-compact. At higher altitudes, the undulating topography, cold climate and shortage of agricultural land favour dispersed or scattered settlements. Some of the migratory tribal people like Gujjars and Bakarwals of Kashmir, Bhutias of Himachal Pradesh and Uttarakhand and Lepthas of Sikkim practise *transhumance i.e.* they move to higher areas in summer to graze their animals and come back to lower areas to avoid severe winter conditions of the higher areas. Thus they are forced to have houses in both the areas. They build permanent houses in lower areas where they spend their winter season and are engaged in agriculture and temporary houses in the alpine pastures at higher altitudes where they graze their animals in summer.

In the Eastern Himalayas, a number of states like Arunachal Pradesh, Nagaland, Mizoram and Tripura have small and widely dispersed settlements. This is due to typical physical and social environment of this region which is reflected by rugged topography, heavy rainfall, dense forests and multiplicity of tribes with different traditions and dialects. In Nagaland, most of the villages are found on the flat tops of hills, spurs and ridges located at altitudes varying from 1,000 to 2,000 metres above sea level. Such sites are selected from the point of view of security against invaders. In Manipur, Kukis tribal people are engaged in shifting agriculture locally known as ***Jhuming*** and construct their temporary huts in Jhum fields. However, some permanent houses may also be found. In Mizoram, linear settlements are found in valleys, on hill tops and along the roads. These settlements are built by the Lushai tribes. The Chakma tribes of Tripura build settlements which are similar to those build by the Lushais of Mizoram. In the Khasi and Jaintia hill regions of Meghalaya, the settlements range from isolated homesteads to dispersed and semi-compact settlements. These settlements are generally located along the hill slopes near springs and other water bodies.

2. Rural Settlements in the Northern Plain of India. The Northern Plain of India has been formed by the depositional work of mighty rivers like the Indus, the Ganga, the Brahmaputra and hundreds of their tributaries. As such, this is one of the most fertile plain of the world which has been intensively cultivated for the last several centuries. People lead settled life and have built permanent settlements. The plain of Punjab, Haryana and western part of Uttar Pradesh has large sized compact settlements which are uniformly spaced. The *Bhangar* tracts are free from floods and have compact and semi-compact settlements while the *Khadar* and *Bet* lands are flooded almost every year during the rainy season and most of the settlements in these areas are semi-compact or scattered. The eastern part of Rajasthan, adjoining Punjab and Haryana also has compact settlements of large size. But the western parts of Rajasthan, to the west of the Aravali range, particularly Jaiselmer and Barmer, are characterised by aeolian topography, especially the sand dunes. Therefore most of the settlements here are of semi-compact type.

In Uttar Pradesh and Uttarakhand, there is terai tract to the south of the Bhabar belt extending in the east-west direction. This tract is marked by marshy lands seasonal floods and thick forests (many of them have been cleared for agriculture). Under these circumstances, the rural settlements in this tract are largely semi-compact and are of medium size.

Most of the rural settlements in the Middle Ganga Plain are semi-compact and are of small size. But since the land is fertile and can support higher density, the settlements in this area are closely spaced. In the Lower Ganga Plain, the types of rural settlements are controlled by the hydrological characteristic and a variety of rural settlement patterns may be noticed. However, scattered settlements are very common in the *Duars* and *Sundarban Delta*.

In the Brahmaputra valley, the villages are of small size and are generally oriented along the river levees and transport routes. The houses are separated by bamboo fences. The low lying areas are prone to annual floods where boat is the only mode of transport during the rainy season. Therefore the *Machan* type of houses are constructed on wooden pillars.

3. Rural Settlements in Peninsular India. Peninsular India is one of the oldest land masses of the world and is characterised by a greater diversity of topography. Therefore, this part of the country has a large variety of rural settlements. The Aravalli Hills receive scanty rainfall and the rocky terrain does not support high density of population and human settlements. Thus the settlements are small and are widely dispersed. Mewar and Alwar have dissected hills where isolated farmsteads are dotted along the narrow valleys. These are called ***Dhanis*** in the local language. Jaipur and its neighbouring areas have compact and semi-compact settlements. In the Udaipur division of Rajasthan, there is preponderance of isolated and dispersed settlements. Settlements of Bundelkhand are by and large scattered.

In Chotanagpur plateau of Jharkhand, there are clustered and semi-clustered rural settlements whereas the settlement of Baghelkhand are largely compact. Compact settlements are also found in the lava plateau of black soils in Maharashtra where most of the settlements are located near the source of water. But the tract between Pune and Solapur is dotted with semi-compact and dispersed settlements.

In Karnataka, the Maidan region had widely spaced compact settlements whereas hilly areas of Malnad has semi-compact settlements. In Andhra Pradesh, the coastal and Rayalseema regions have compact settlements while Telangana has compact and semi-compact settlements. The higher parts of whole of Sahyadris stretching from the Tapi valley in the north to Kanniyakumari in the south is dotted with isolated settlements.

4. Rural Settlements in the Coastal Regions. The entire length of Indian coast-line is dotted with villages of fisherman of varied shapes and sizes. However, there is some difference between the settlements of the east coast and those of west coast. In the east coastal region compact settlements have come up on the elevated basin of deltas of large rivers like the Mahanadi, the Godavari, the Krishna and the Kaveri. These compact settlements are the result of intense cultivation on the fertile lands of these deltas. Since these settlements are located on the elevated levees, they do not seen the danger of flood.

Along the western coast those is Rann of Kachchh in the north where there are semi-compact and scattered settlements of small sizes. The Konkan coastal region is marked by compact and semi-compact settlements. The Malabar coast of Kerala is unique in the sense that it has compact settlements of very large size. However scattered and dispersed settlements are also found in plantations of coconut and cashew nut.

Density of Rural Settlements

Density of rural settlements is defined as the number of village per 100 square kilometres of land area. A look at **table 13.1** reveals that average density of rural settlements in India is 19 villages per 100 sq. km. Among the larger states Bihar has the highest density of 48 villages per 100 sq km. This is followed by Uttar Pradesh and West Bengal (45 each) and Jharkhand (41). These states are said to have some of the highest densities in India. Next in order are Himachal Pradesh (37), Assam (34), Odisha (33) and Uttarakhand (31). The lowest densities of less then ten villages per hundred sq km are found in Jammu and Kashmir (3), Kerala (3), Sikkim (6), Arunachal Pradesh (7), Tripura (8), Mizoram (8), Gujarat (9) and Andhra Pradesh including Telangana (10). The rest of the states have moderate densities varying from 11 to 30 villages per 100 sq km. Among the Union Territories, Lakshadweep has the highest density of 65 villages per 100 sq km which is the highest in the whole of India. The lowest is found in the Union Territory of Chandigarh where there are only 4 villages per 100 sq km.

Morphology of Rural Settlements

Morphology of rural settlements is concerned with their internal and external structure and identification, classification, regionalisation and analysation of its components. Thus rural morphology tries to find answers to meaningful basic questions like what is, where and why ? **Carl Sauer** opines that rural morphology is based on three postulates *viz.* (*i*) organic or quasi-organic, (*ii*) functional equivalent and (*iii*) agglomeration and placement of structural elements. Thus rural morphology deals with the study of built up area consisting of houses and streets etc. and the open land surrounding the built up area where agriculture or some other primary activity is carried on. The famous settlement geographer **C.A. Doxiadis** has suggested four main parts of a rural settlements **(Fig. 13.16)** :

(*i*) Homogenous part, agricultural fields etc.
(*ii*) Central part, built up area of *Basti*.
(*iii*) Circulatory part, roads, streets, footpaths, etc.
(*iv*) Special part, school, temple, mosque, church, *panchayat-ghar*, cultural place, etc.

The built-up area consists of houses, bazars (shops), streets, roads, schools, religious places, cultural places, *panchayat-ghar*, etc.

Almost all the rural settlements have built-up area at the centre which is surrounded by agricultural land or grazing land. These two types of areas are connected to each other by *Chak-roads*, footpaths, etc. Normally the nucleus of the settlement is located on a higher site which is occupied by the first settler (normally people belonging to upper castes or landlords locally known as ***Zamindars***). Once the nucleus is properly inhabited, the village starts expanding around this nucleus with the passage of time. Some hamlets may develop near the main

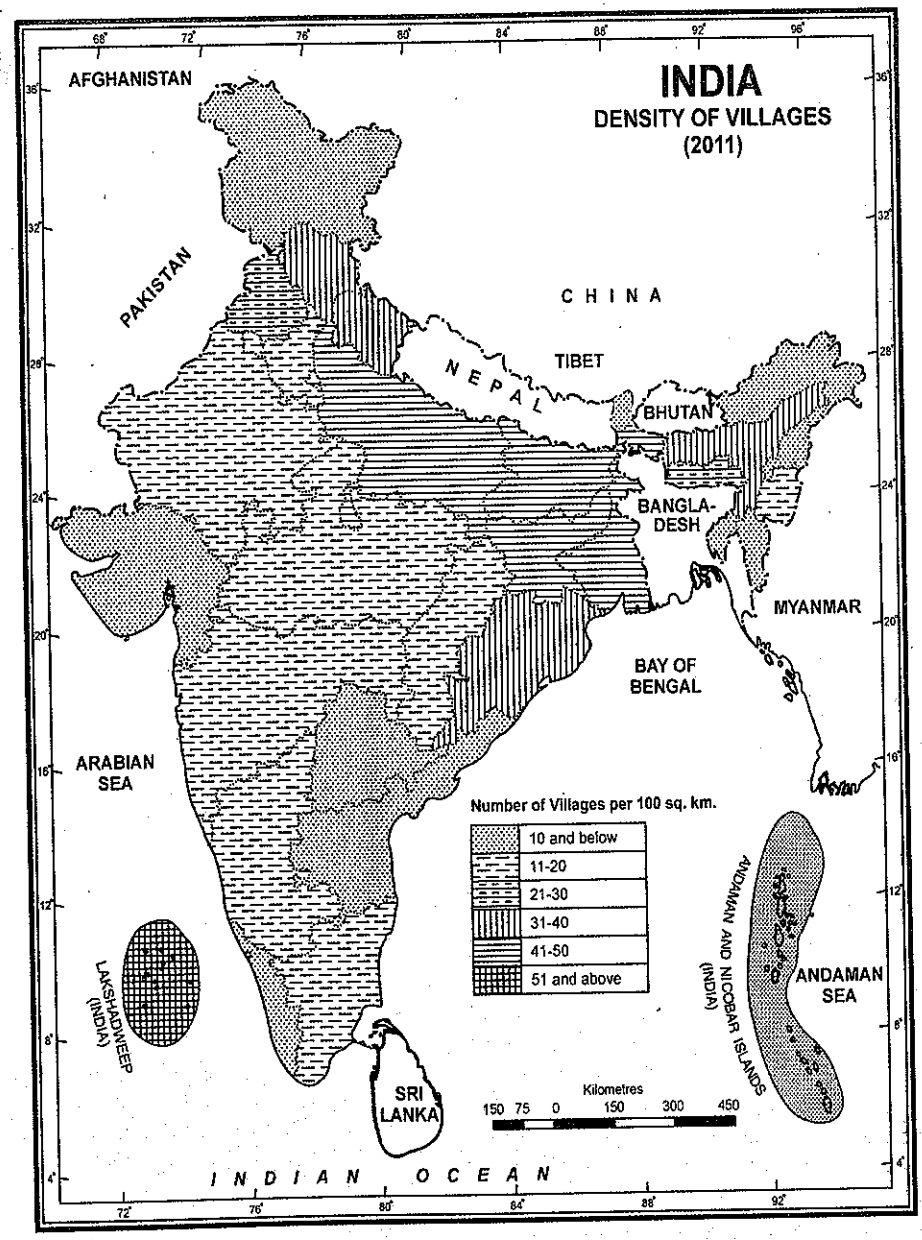


FIG. 13.15. India : Density of Villages (2011)

settlement. Such hamlets are generally inhabited by the people belonging to lower castes and landless agricultural labourers. The socio-economic activities are maximum at the nucleus and their intensity decreases with the increasing distances from the nucleus.

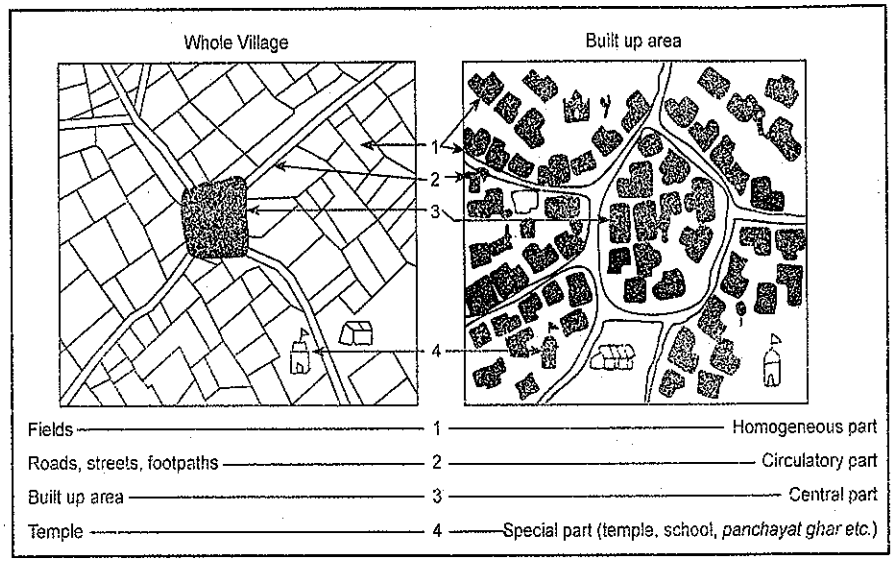


FIG. 13.16. Morphology of an imaginary rural settlement after Doxiadis

Socio-Spatial Structure of Rural Settlements

The socio-spatial morphology of any rural settlement can be explained on the basis of following two concepts :

1. Concept of functional space
2. Concept of social space

According to the views expressed by **Prof. Kashi Nath Singh**, there is almost complete segregation between upper castes (Brahmins, Rajputs, Kayathas) and lower castes (scheduled castes). This segregation is caused due to religious considerations and the distance between two types of castes is maximum. On the contrary, such distances are minimum in a secular set up.

Based on caste considerations, people belonging to upper castes occupy the best site at the central place. Their houses are very large in which each married women is provided with a separate apartment. Such houses have spreading courtyards also. On the contrary, the lower castes, especially the scheduled castes, are generally poor and have a single room hut/house which is share by all the family members. Sometimes the family members have to share these small huts with domestic animals also. These huts are invariably made of locally available cheap materials. Normally houses of low castes are located on the peripheries of the village at a certain distance from the houses of the upper castes. Hamlets of lower castes are called ***Purvas*** which are known by different names in different parts of the country. *Ahyiron, Chamarkheda, Jatvara, Ladhian, Posiwada, Machpara* etc. are some of the common names for ***Purvas***. The hamlets and their inhabitants are closely linked with the main site of the village under *Jajmani* system and act like a single functional unit. Prof. Kashi Nath Singh found both concepts of social discrimination and functional unity in his Socio-Spatial Structure of Rural Settlements and propagated two models based on religious-ritual dominance and secular norms which are briefly described as below :

1. The religious-ritual dominance model of distance maximization. The rural Hindu society is dominated by powerful social structure and is divided into a number of castes. Each caste performs a specific socio-economic function. For example, Brahmins perform religious rituals, Kshatriyas are responsible for security, Vashyas are engaged in trade, commerce and agriculture, and Shudras are supposed to provide low grade services to the other castes. They are debarred from several ritual privileges which are enjoyed by the upper castes. The entire rural society is divided into upper castes and lower caste due to caste system prevailing there which has resulted in the concept of purity-pollution and untouchability. The concept of purity and untouchability led to the growth of *purvas* of lower castes. These *purvas* were separated from the upper castes more by social space them by any appreciable barrier. Normally the *purvas* of low castes are located in the south-east or east of the main settlement because this direction is less conductive for wind movement. This was because it was believed that even air gets polluted after coming in contact with *Shudras* body.

2. Secular Norms as a Model of Distance Minimization. In a secular model, as proposed by Prof. Kashi Nath Singh, people belonging to different castes construct their houses closer to each other due to economic considerations. The upper caste landholders have to depend on lower caste landless labourers to work in their agricultural fields and the lower caste labourers heavily depend on the upper caste landlords for their livelihood. Thus there is inter-dependence between upper and lower castes and the distance between two sections of society is minimized. This leads to the emergence of a compact, nucleated and unified settlement. **Fig. 13.17** shows the religious-ritual model and secular dominance model as proposed by Prof. Kashi Nath Singh. However, it is observed that the power enjoyed by a person in the rural society is not always by the upper castes *i.e.* Brahmins, but by the person who owns land. According to **Oscar Lewis** (1965; 81) "While the land owners are generally of higher caste in Indian villages, it is their position as land owners, rather than caste membership what gives them power and status." For example if *Brahmin* is a land owner in a village, then *Brahmins* will get the place of honour, but if a *Thakur* is the land owner, then *Thakurs* will get the place of honour and they will provide livelihood to *Brahmins* along with other castes.

Both the above mentioned models leave their own impact on the morphology of Indian village independently. But it is the joint impact of these models which gives a distinct morphology to a village. The old socio-economic system is gradually giving way to the new one and *Jajmani* system is becoming a thing of the past. The rigid caste system is losing its grip and new socio-economic structure is coming up. With the spread of education and general awareness, the *Dalits* and other backward classes have become conscious of their rights and the old caste system is crumbling.

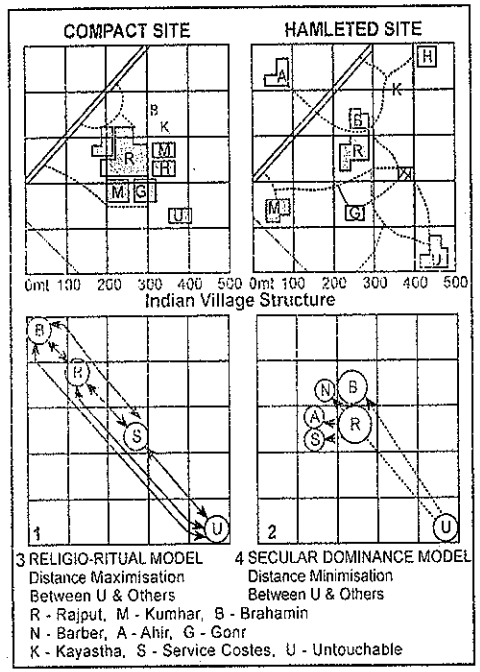


FIG. 13.17. Hypothetical Socio-Spatial Structure of Rural Settlement (After Kashi Nath Singh)

Rural Houses and House Types

House is a shelter built by man to protect himself from the vagaries of climate and to meet the basic physiological requirements of the body. Thus the house is a universal feature of the inhabited world.

Structurally, a house consists of a roof, supported by walls with a door. The census of India defines a 'census house' as a building or a part of a building having a separate main entrance from the road, common courtyard or staircase, etc. used or recognised as a separate unit.

Almost everywhere in rural India, the houses are made of locally available building materials such as stones, mud, unburnt bricks, bamboos, wood reeds, leaves, grasses, etc. This is more true of the poor people who cannot afford the luxury of building materials other than the locally available ones. These

are invariably ***kutcha houses.*** However, some rich people in the rural areas can afford to build houses using burnt bricks and cement. These are called ***pucca houses.***

According to Census of India, houses have been classified as *Pucca*, *Semi-pucca*, and *Kutcha* according to the types of materials used in the construction of walls and roof of the house. For the purpose of this classification, the criteria adopted by National Building Organisation has been made use of. The basis of the classification is as below :

Those houses which have both wall and roof made of pucca materials are classified as *pucca*. When both wall and roof are made of kutcha materials, the house is classified as *kutcha*. If either wall or roof is made of pucca material and the other of kutcha material, then the house is classified as *semi-pucca*.

TABLE 13.3. House types and building materials

Category	Materials used for construction
	Wall
Pucca	Burnt bricks, G.I. sheets or other metal sheets, stone, cement, concrete.
Kutcha	Grass, leaves, reeds, bamboo, mud, wood, un-burnt bricks.
	Roof
Pucca	Tiles, slate, shingle, corrugated iron, zinc or other metal sheets, asbestos, cement sheets, bricks, lime and stone, stone and RBC/RCC, concrete.
Kutcha	Grass, leaves, reeds, bamboo, thatch, mud, un-burnt bricks, wood.

URBAN SETTLEMENTS AND TRENDS IN URBANISATION

What is an Urban Place ?

It will be pertinent to know and understand an urban place before one proceeds to discuss trends in urbanization for which defining an urban place is most essential. What constitutes an urban place and how does it differ from a rural place ? How does one define the boundary separating urban from rural areas ? At the outset, these questions might appear trivial and one may not consider them worthy of proper attention. But it is not as easy to precisely define an urban place, as it appears to be at the first instance. Everybody seems to know what a city is, but no one has given a satisfactory definition although several scholars, both in India and abroad, have tried to define an urban place in their own way. There seems to be rural-urban continuum and the boundary separating urban from rural is often vague and ill defined. It is practically not possible to point out the disappearance of urbanity or the beginning of rurality. Despite widespread use of the terms 'urban' and 'rural' for centuries, they continue to remain vague and elusive, lacking precise definition. Even if we accept the rural-urban dichotomy, it does not in itself, provide us with an adequate frame of reference for defining and identifying urban places. It is almost universally accepted that a single criterion is not enough to define an urban place and the issue has to be settled on the basis of a set of suitable criteria. The multi-dimensional character of urban areas creates hindrance in giving a precise definition for them. The criteria for defining urban areas, in general, fall into five categories : (*a*) demographic, (*b*) economic, (*c*) social, (*d*) morphological, and (*e*) functional.

The census of India has used the above mentioned criteria for defining an urban area. However, there have been changes in the definition given by the Census of India from one census year to another, particularly in the first half of the 20th century. According to the 1901 census, towns included (*a*) every municipality, (*b*) all civil lines not included within the municipal limits, (*c*) every cantonment and (*d*) every other collection of houses inhabited by not less than 5,000 persons that the census superintendent may decide to treat as a town for census purposes. At the 1911 census, the capitals of the princely states of India, irrespective of being urban or not, were adopted as urban. The census operations upto 1951 continued with the same definition of a town. After Independence, the former princely states were mostly merged to form large unions and their erstwhile capitals were not treated as towns in 1951 if they did not possess the requisite urban characteristics. The 1961 census adopted a strict definition which has been applied more rigorously and uniformly and has been followed in the consequent census years of 1971, 1981 and 1991.

The only exception related to the exclusion of certain economic activities like fishing, livestock, logging, plantations, orchards, etc. in 1981 from the category of non-agricultural activities for computing the percentage of male workers engaged in such activities. In 2001 census of India the definition of urban area adopted is as follows :

(*a*) All places with a municipality, corporation, cantonment board or notified town area committee, etc.

(*b*) All other places which satisfy the following criteria :

(*i*) a minimum population of 5,000;

(*ii*) at least 75 per cent of male working population engaged in non-agricultural pursuits; and

(*iii*) a density of population of at least 400 persons per sq km (1000 per sq mile).

Besides, the Directors of Census Operation in States/Union territories were allowed to include, in consultation with the State Governments/Union Territory Administrations and the Census Commissioner of India, some places having distinct urban characteristics as urban, even if such places did not strictly satisfy all the criteria mentioned under category (*b*) above. Such marginal cases include major project colonies, areas of intensive industrial development, railway colonies, important tourist centres, etc.

The definition of urban areas has been refined in 2011 according to which urban areas are comprised of two types of administrative units—Statutory Towns and Census Towns.

(*a*) **Statutory Towns.** All administrative units that have been defined by statute as urban like Municipal Corporation, Municipality, Cantonment Board, Notified Town Area Committee Town Panchayat, Nagar Palika etc., are known as Statutory Towns.

(*b*) **Census Towns.** Administrative units satisfying the following three criteria simultaneously are treated as Census Towns:

(*i*) It should have a minimum population of 5,000 persons*;

(*ii*) At least 75 per cent of the male main working population should have been engaged in non-agricultural pursuits; and

(*iii*) It should have a density of population of at least 400 persons per sq km (1,000 per sq mile).

*For the purpose of identification of places that qualify to be classified as 'Census Towns', all villages with a population of 4000 and above as per the Census 2001, a population density of 400 persons per sq km and having at least 75 per cent of male main working population engaged *in non*-agricultural activity were considered.

Source : Census of India, 2011, Tables on Houses, Household Amenities and Assets, Series 1, p. lix.

(*c*) **City.** Towns with population of 1,00,000 and above are categorised as cities.

Out Growth. An Out Growth (OG) is a viable unit such as a village or a hamlet or an enumeration block made up of such village or hamlet and clearly identifiable in terms of its boundaries and location. Some of the examples are railway colony, university campus, port area, military camp, etc., which have come up near a statutory town outside its statutory limits but within the revenue limits of a village or villages contiguous to the town. While determining the outgrowth of a town, it has been ensured that it possesses the urban features in terms of infrastructure and amenities such as pucca roads, electricity, taps, drainage system for disposal of waste water etc. educational institutions, post offices, medical facilities, banks etc. and physically contiguous with the core town of the UA. Each such town together with its outgrowth(s) is treated as an integrated urban area and is designated as an 'urban agglomeration'. In Census 2011, 474 UAs with 981 OGs were identified as against 384 UAs with 962 OGs in Census 2001.

Urban Agglomeration

Each town together with its outgrowth(s) is treated as an *urban agglomeration*. Thus the concept of *Town Group*, which was adopted in 1961 to obtain a broad picture relating to urban spread, was refined and replaced by the concept of *urban agglomeration in 1971* to obtain better feed back in regard to urban contiguity, process and trends of urbanization and

other related matters. An "urban agglomeration" denotes *a continuous urban spread and normally consists of a town and its adjoining urban outgrowths (OGs), or two or more physically contiguous towns together with contiguous well recognised outgrowths, if any, of such towns*. This concept has remained operative in the later censuses without any change or modification.

For the purpose of delineation of Urban Agglomerations, following criteria are taken as pre-requisites :

(*a*) The core town or at least one of the constituent towns of an urban agglomeration should necessarily be a statutory town.

(*b*) The total population of all the constituents (*i.e.* towns and outgrowths) of an urban agglomeration should not be less than 20,000 (as per 2001 Census). In varying local conditions, there were similar other combinations which have been treated as urban agglomerations satisfying the basic conditions of contiguity. Examples are Greater Mumbai UA, Delhi UA etc.

With the above mentioned basis two criteria having been met the following are the possible different situations in which Urban Agglomerations should be constituted :

(*i*) a city or town with one or more contiguous outgrowths

(*ii*) two or more adjoining towns with their outgrowth

(*iii*) a city and one or more adjoining towns with their outgrowths all of which form a continuous spread.

Although big towns and cities stand conspicuously, anomalies do arise in the population size band of village: 5,000 to 10,000 and above, and towns : less than 5,000 to 20,000 in the whole settlement pattern ranging from the smallest village to the largest metropolitan city. According to Prakasa Rao, it could be hypothesized that some of the accessible large villages (5,000-10,000 size class) are more urban than some of the equally accessible small towns (less than 10,000) which are more rural. Rural settlements with population size ranging from 5,000-10,000 and above, and small towns with a population size ranging from less than 5,000 to 20,000 could be classified as *urban* settlements: semi-rural and semi-urban. The definition given by the Census of India has some inherent weakness so far as marginal settlements are concerned. Part (*a*) of the definition includes all places which have a legal/administrative status and are called ***statutory towns***. These towns may not satisfy the criteria listed in part (*b*) of the definition. In particular, a legal/administrative town may have a population of less than 5,000 persons. On the other hand, hundreds of revenue villages satisfied the criteria listed in part (*b*) of the definition, but were not legally/administratively recognised as towns. According to 2001 census figures, there were about two thousand places with 10,000 or more persons which were identified as rural.

The second criterion given by the Census is that 75 per cent of male working force should be engaged in non-agricultural pursuits. Surprisingly, the Census data reveal that at least 25 per cent of the Census towns have agriculture as the dominant activity. **R. Ramachandran** has suggested that all places with 50 per cent or more workers in non-agricultural activities should be treated as urban. Further it is not clear as to why female workers are not considered by the Census of India while suggesting this criterion.

The third criterion relates to the density of population, according to which all places having minimum density of 400 persons per sq km are to be treated as urban. This is indeed an unrealistically low density value in the Indian context. The average density of population in India in 2011 was 382 persons per sq km and 14 states and union territories had densities well over 400 persons per sq km According to the Census criteria, all these states and union territories should be treated as urban which is far from the ground reality. In the opinion of R. Ramachandran, a much higher value of around 1,000 persons per sq km would be more appropriate in the Indian situation.

Besides, the Census of India has given wide powers of discretion to the Directors of Census Operations in States/Union Territories which is totally illogical and unscientific. This leads to some element of subjectivity as some officers exercise their discretion in an arbitrary manner. Consequently, the comparisons of the number of towns and the total urban population in different states becomes misleading.

While the Census definition of a town is standardized and is a welcome move, its rigidity leads to both declassification and re-classification of villages and towns. Application of different criteria as mentioned in the definition given by the Census of India as well as the use of discretionary powers by the Directors of Census of States/Union Territories leads to sudden increase or decrease in the number of towns in different states, from one census to the next as several towns are classified and declassified at each census enumeration. Certain places are treated as new towns by virtue of their being qualified to be treated so due to statutory notification or due to attainment of the minimum population size, density and required proportion of male working population engaged in non-agricultural pursuits and are added to the existing list. Simultaneously, some urban places which either lose their civic status due to statutory notification or fail to qualify the prescribed eligibility tests are deleted from the said list besides the merger of certain adjoining rural-urban areas due to extension of statutory limits of the existing places. For example, there were 4,029 towns in India as per 1981 census. Out of these 93 towns were declassified and 103 towns were fully merged with other towns by statutory notifications of the concerned State/Union Territory Governments during 1981-91. As many as 856 new towns (277 statutory and 579 census towns) were added to urban frame of the 1991 census.

Number of statutory towns, census towns, urban agglomerations and outgrowth in 2011 and 2001 is given in **Table 13.4.**

TABLE 13.4. Number of UAs/Towns and Out Growth (OGs)

Type of Towns/UAs/OGs	Number of Towns	
	2011 Census	2001 Census
1. Statutory Towns	4,041	3,799
2. Census Towns	3,892	1,362
3. Urban Agglomerations	474	384
4. Out Growths	981	962

Source : *Census of India 2011*, Tables on Houses, Household Amenities and Assets, Series 1, p. lx.

Metropolitan Cities. Cities with population of one million and over are known as ***metropolitan cities***. The main activities in these cities are industries, trade, commerce, transport, cultural and political. The number of metropolitan cities increased from 12 in 1981 to 53 in 2011.

Mega Cities. Cities with population of 5 million and above are known as mega cities according to Census of India. But United Nations consider mega cities as those that have a population of 10 million and above. In India, Greater Mumbai, Kolkata and Delhi are examples of mega cities.

Conurbation. This term was coined by Patrick Geddes. It comes into being by coalescence of urban settlements which were separated by open space in the past. The coalescence usually occurs through Ribbon Development along the main inter-urban transport routes. Mumbai, Delhi and Kolkata are good examples of conurbation in India.

Megalopolis. It is a Greek word which is derived by combining two terms 'great' and 'city'. It is just like conurbation and is formed when a large city sprawls and brings into its fold, the smaller adjacent towns and cities. This term was first used by **Gottman** in 1964 to describe the urban scene of the north-eastern board of the U.S.A. He identified a large conurbation like mass of linked built-up areas (and yet containing much more open land) extending over 960 km (600 miles) from north of Boston to Norfolk in Virginia.

Size Class of Cities. The Census Department of Government of India has classified the urban places under the following six categories :

Size class	Population
I	100,000 & above
II	50,000-99,999
III	20,000-49,999
IV	10,000-19,999
V	5,000-9,999
VI	Less than 5,000

Urban Growth and Development in India

1. Cities of Ancient and Medieval Periods. India has a long history of urbanization. The first phase of urbanization is traced in the Indus valley which is associated with the Harappa urbanism. The cities of Harappan civilization flourished for about 600 years, between 2350 B.C. and 1750 B.C. Two

major towns of the Indus civilization *viz.* Harappa and Mohenjodaro are in Pakistan now. Important towns of the Harappan culture located in India are Lothal, Surkotada, Rangpur and Rojdi (Gujarat), Kalibangan (Rajasthan), Banwali (Haryana) and Rupar (Punjab). This period was followed by a prolonged period of about one thousand years in which there is no evidence of urbanization. From around 600 B.C. onwards, towns and cities grew in association with two cultural streams *viz.* the Aryan civilization in the North and the Dravidian civilization in the South. The major cities which grew during this period were Hastinapur, Mathura, Ayodhya, Kapilavastu, Kusinagar, Vaishali, Patliputra, Varanasi, Rajgir and Champa in north India and Ujjain, Mahishamati, Nagarjunakonda, Kancheepuram, Puhar, Uraiyur, Madurai, Korkai and Vanji in south India. Cities grew both in number and size during the Mauryan and post Mauryan periods (from 300 B.C. to A.D. 600) in north, as well as in south India. Northern part of the country saw a decline in urban growth during the post-Gupta period from A.D. 600 to about A.D. 1000. Later on, the invasion of Turks followed by the Sultanate rule helped in revival of urban development in India. This phase started around 11th century A.D. and continued with some changes till the fall of the Mughal Empire *i.e.* till the 17th century A.D. The cities which grew and flourished during this period are Ludhiana, Hisar, Bikaner, Jaipur, Jodhpur, Udaipur, Kota, Chittaurgarh, Moradabad, Agra, Jaunpur, Ahmedabad, Indore, Raipur, Aurangabad, Ahmadnagar, Pune, Gulbarga, Bijapur, Vijaynagar, Hyderabad (Golcunda) and Mysore.

2. Cities of British Period. With the arrival of the British East India Company, the nature of urbanization process changed remarkably. The major contribution of the British to the Indian urban scene were : (1) the creation of three metropolitan port cities of Mumbai (Bombay), Kolkata (Calcutta) and Chennai (Madras), (2) creation of a chain of hill stations in the Himalayan region and in South India, (3) the modification of the urban landscape of the existing cities with the introduction of civil lines and cantonments, (4) the introduction of railways and modern industry, and (5) the improvements in urban amenities and administration. Some of the major towns that came up during the British period are :

Hill stations. Shimla, Mussoorie, Dehradun, Almora, Nainital, Darjeeling and Shillong in the north and Ooty, Kodaikanal in the south.

Port cities. Mumbai, Panaji, Marmagao, Cannanore, Alleppey, Karaikal, Puducherry, Chennai and Kolkata.

Industrial cities. Kanpur, Dhanbad, Jamshedpur, Asansol, Bhadravati.

Transportation cities. Bhusawal, Jalgaon, Siliguri.

Other cities. Sriganganagar, Bhilwara, Ranchi.

It may be mentioned here that all the above cities were not built by the Britishers alone but were the result of efforts made by the Britishers, the Portuguese, the Dutch, the French and the Indians.

It is clear from the above discussion that urbanization in India passed through different phases of history and around the year 1800, India had 16 cities with a population of one lakh or more and about 1,500 towns. About 11 per cent of the total population of the country lived in urban areas at that time. At the time of first Census in 1872, the urban population declined to 8.7 per cent. The number of cities with a population of one lakh or more still remained at 16 and only 43 places had a population of 50,000 or more. Thus major part of the 19th century was marked by stagnation or decline in urbanization in India. This was primarily due to the lack of interest on the part of Britishers and ushering of the *Industrial Revolution in England* in the latter half of the 18th century. As a matter of fact, the cities of Kolkata, Mumbai and Chennai built by the Britishers showed remarkable growth while most of the pre-British cities desperately declined.

3. Cities of Post-Independence Period. After India got Independence in 1947, a greater need for economic development was felt and efforts were made for the overall growth of the country. This naturally called for establishing new towns and cities and growth of the pre-existing cities. The central and state governments made strenuous efforts to set-up new towns. Many new states were created and such states preferred to have new planned cities as their capitals. Chandigarh is the best example of such cities. Gandhinagar, Itanagar, Dispur, and Bhubaneshwar are other examples of capital cities. The industrial sector also progressed rapidly after

Independence and many industrial towns come up after Independence. Iron and Steel Industry gave birth to new towns of Durgapur, Rourkela, Bhilai and Bokaro. Vishakhapatnam and Vijaynagar (Hospet) also grow due to growth of iron and steel industry.

Noonmati, Barouni, Haldia, Digboi, Koyali etc. are some of the towns which originated or grew because of oil refineries. Pinjore in Haryana owes its origin and growth to Hindustan Machine Tools. Some of the towns and cities have a large number of industries working simultaneously. The list of such towns and cities is very large. However, names of Sundri, Chittaranjan, Nangal, Neyveli, Modinagar, Ghaziabad, Faridabad, Yamunagar, Dalmiapuram, Pimpri, Namrup etc. are worth mentioning. Some of the old towns have grown in due course of time around metropolitan cities and are known as satellite towns. Ghaziabad, Faridabad, Gurgaon, Noida, Bahadurgah, Sonipat around Delhi are some of such satellite towns. Towns of small and medium size have developed in almost all parts of the country.

Urbanisation

The process of society's transformation from a predominantly rural to a predominantly urban population is known as ***'urbanisation'***. It includes two things—an increase in the number of people living in urban settlements, and an increase in the percentage of the population engaged in non-agricultural activities, living in such places.

Trends in Urbanisation. Trends in urbanistion in India from 1901 to 2011 are shown in **Fig. 13.15** and **13.16** and are further elaborated in **table 13.5**. This table shows that the number of towns/urban agglomerations increased by more than four times from 1,915 in 1901 to 7,935 in 2011. There was steady increase in number of towns till 1951, but due to more rigorous tests applied in 1961 to determine whether a place qualified to be treated as a town or not, many urban places were declassified and hence, the number of towns declined from 3,035 in 1951 to 2,657 in 1961.

Table 13.5 also shows that the total population living in urban areas as well as the percentage of urban population to total population of India had been gradually increasing since 1901. For example, only 25.94 million people lived in towns till 1911 and by 2011 the urban population of India increased by more than fourteen times to 377.11 million. At the time of the first census after Independence *i.e.* 1951, the population living in towns was 62.44 million. Since the 1961 census, however, the urban population and number of towns/urban agglomerations had increased steadily. There has been more than three times growth in urban population in four decades which increased from 109.11 million in 1971 to 377.11 million in 2011.

The percentage of urban population to total population has also recorded a gradual increase from one decade to another with the only exception of a decline from 10.84 per cent in 1901 to 10.29 per cent in 1911. This decline is largely attributed to the devastating plague epidemic of 1911 which spread mainly in urban areas and brought an exodus of urban population to rural areas. On the other hand, the World War II (1939-45) and partition of the country in 1947 were mainly responsible for a sudden spurt in

TABLE 13.5. Urbanization in India, 1901-2011

Year	Population (in million)		Urbani-sation rate (per cent)	No. of cities/ towns	Decadal growth
	Total	Urban			
1901	238.40	25.85	10.84	1915	–
1911	252.09	25.94	10.29	1864	0.35
1921	251.32	28.09	11.18	2018	8.27
1931	278.98	33.46	11.99	2188	19.12
1941	318.66	44.15	13.86	2392	31.97
1951	361.10	62.44	17.29	3035	41.42
1961	439.09	78.94	17.97	2657	26.41
1971	548.23	109.11	19.91	3081	28.23
1981	683.33	159.46	23.34	3981	46.14
1991	846.39	217.55	25.70	4615	37.52
2001	1028.61	286.12	27.82	5161	31.52
2011	1210.19	377.11	31.16	7935	31.80

Notes 1. As the 1981 census was not conducted in Assam, the 1981 total and urban population figures for India include interpolated figures for that state.

2. The 1991 census was not held in Jammu and Kashmir. The 1991 total and urban population figures for India include the interpolated figures for that state.

Source : (*i*) Premi (2012 : 69); (*ii*) Census of India 2011, Series 1, India, *Provisional Population Totals*, Paper 2 of 2011.

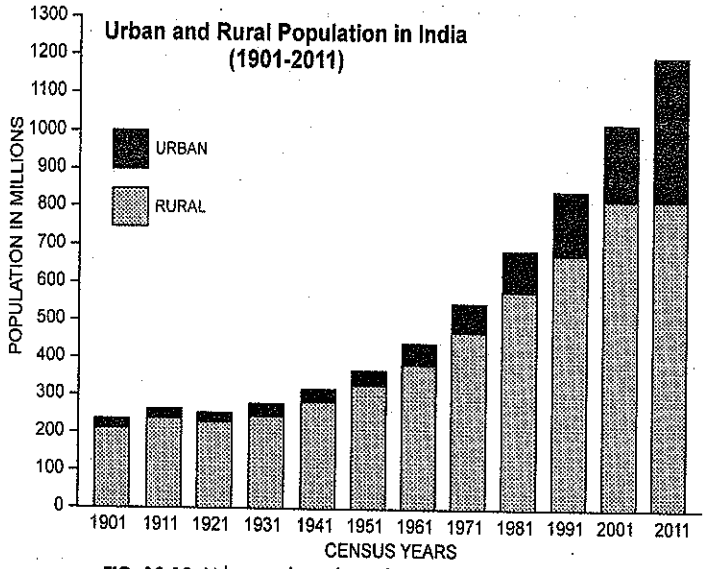


FIG. 13.18. Urban and Rural Population in India (1901-2011)

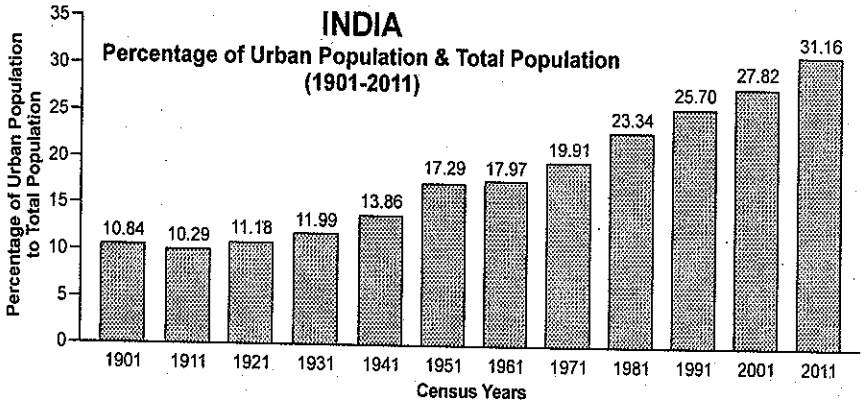


FIG. 13.19. Percentage of Urban Population to Total Population

urban growth during 1931-41 and 1941-51. Partition of the country resulted in a massive influx of refugees into India from West Pakistan (now Pakistan) and East Pakistan (now Bangladesh). Refugees from West Pakistan settled down mainly in Delhi and Punjab (including present Haryana) and to a lesser extent in western Uttar Pradesh, while those from East Pakistan found their way in Kolkata and its suburbs as well as in Assam and Tripura. In all, 14 new towns were built to accommodate refugees migrating from Pakistan. In addition, refugee colonies (new townships) were established near existing cities. As many as 19 places in Punjab, Haryana and Delhi were selected for locating these townships (generally called Model Towns). However, the pace of urbanization slowed down during 1951-61 as a result of declassification of large number of towns. The percentage of urban population to total population increased only by 0.68 per cent from 17.29 percent in 1951 to 17.97 per cent in 1961. As mentioned earlier, the number of towns/urban agglomerations actually declined during this period. Further, it is worth

mentioning that the pace of urbanization slowed down during 1981-91. The decennial growth rate had declined from 46.14 per cent in 1971-81 to 37.52 per cent in 1991. According to 2011 census, 377.11 million persons or 31.16 per cent of the total population of India is termed as ***urban***.

In spite of the above mentioned developments, India is still one of the least urbanised countries of the world. Only 31.16% of India's population (census 2011) is urban whereas world's 48% population (according to 2004 figures) lives in urban areas. India was previously more urbanised than China where 21% population was urban. But that country has left India far behind with 41% of its population as urban. Even Pakistan has 34% of its total population living in urban areas and is more urbanised than India. India's less than one-third of urban population is no comparison with 79% of the USA, 78% of Japan, 74% of European countries, 73% of Russia, 78% of New Zealand and 91% of Australia.

India is still considered to be a country of villages. But **R. Ramachandran** (1995) holds altogether a different view. According to him, "India is often portrayed as a land of villages and hamlets, nevertheless, in reality, it is equally a land of towns and cities. With over 12,000 settlements with populations of 5,000 persons or more, India has an urban infrastructure of gigantic magnitude". In terms of absolute numbers, India's urban population far exceeds the total population of the U.S.A. which is the third most populous country of the world. Further, it may be mentioned that India's urban population is the world's second largest after that of China.

Table 13.5 shows that there had been gradual growth of urban population before independence. The decennial growth rate was at a very low level of 0.35 per cent in 1901 which shot up to 41.42 per cent in 1951. Thereafter, varying trends have been observed with respect to growth rates. The maximum 46.14 per cent in 1981 which declined to 31.80 per cent in 2011. However, such percentages can be misleading because the total urban population was much less in the pre-independence period as compared to the post-independent period.

The number of cities/towns increased rapidly from 1,864 in 1911 to 3,035 in 1951. But this number fell sharply to 2,651 in 1961 due to declassification of several towns. Thereafter, there has been steep rise in the number of cities/towns and the time of 2011 census, there were as many as 7,935 cities/towns in India.

The forgoing discussion brings us is the conclusion that where have been three distinct phases of urban growth in India.

1. Period of Slow Urban Growth (before 1931). The period of 50 years extending from the first complete census in 1881 to 1931 is considered as the period low urban growth in India. In 1881, only 9.3 per cent of India's population was living in urban areas which slowly increased to 11.99 per cent in 1931. Thus the growth rate during the first fifty years of census increased only by 2.69 per cent which is negligibly small as compared to the later increase in growth rates. This slow rate of urban growth is attributed to a large number of factors, but natural disasters like drought, floods, famines, epidemics had been the major causes. These factors led to high mortality rate and retardation of urban growth.

2. Period of Medium Growth Rate (1931-61). Period of thirty years from 1931 to 1961 is termed as period of medium growth. There was more than two-fold increase in urban population from 33.46 million in 1931 to 78.94 million in 1961 and the percentage of urban population to total population also increased from 11.99 to 17.97 during the same period. This was because of major thrust given by the Government of India and many industrial towns and state capital towns came up immediately after Independence. World War II (1939-45) and partition of the Indian subcontinent in 1947 gave a major thrust to urbanisation in India. Several new towns were set-up to accommodate displaced persons from Pakistan. As a result of declassification of several towns in 1961, the number of towns fell from 3035 in 1951 to 2657 in 1961. Therefore *1951-61 is termed as inactive decade from urbanisation point of view.*

3. Period of Rapid Growth (1961-2011). During the period of 50 years from 1961 to 2011, India witnessed rapid growth in urbanisation and urban centres. The urban population saw more than four-fold increase from 78.94 million in 1961 to 377.11 million in 2011 and the percentage of urban population also shot up from 17.67 in 1961 to 31.16 in 2011. The number of towns which fell from 3,035

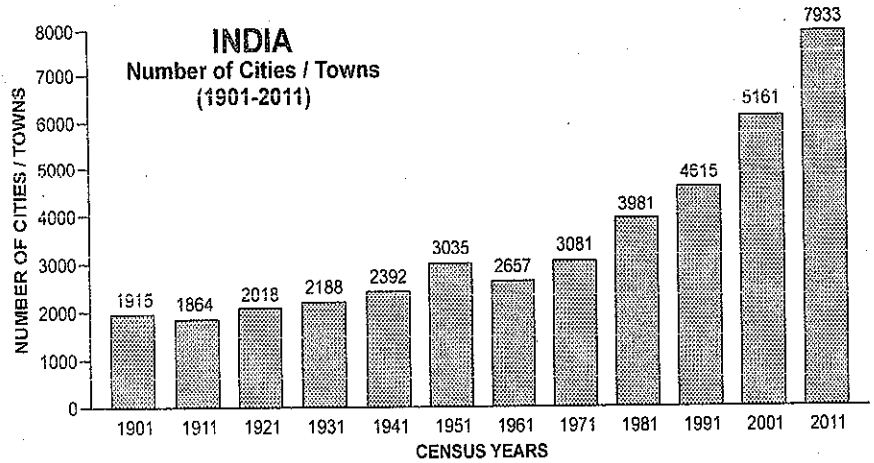


FIG. 13.20. India : Number of Cities/Towns

in 1951 to 2,657 in 1961 sharply increased in to 7,933 in 2011. This is a reflection of India's economic growth history and a major change in the demographic set up of the country as a large number of people are migrating from rural to urban areas in search of livelihood and better quality of life.

Spatial Patterns of Level of Urbanisation

Table 13.6 and **Fig. 13.21** show that the level of urbanisation varies widely among the states. Goa is the most urbanised state where 62.17 per cent of the population lives in urban areas. This is followed by Mizoram where 51.51% of total population of the state lives in towns/cities. Among the larger states Tamil Nadu with 48.45 of its urban population is the most urbanised state. This state is followed by Kerala (47.7%), Maharashtra (45.23%), Gujarat (42.58%), Karnataka (38.57%) and Punjab (37.49%). The other states with percentage of urban population more than the national average of 31.16 are Haryana, West Bengal and Andhra Pradesh. On the other end of the scale, Himachal is the least urbanised state where 10.04 per cent of the population lives in urban areas. The other states where level of urbanisation is below 20 per cent are Bihar (11.30%), Assam (14.08%), and Odisha (16.68%). The other states with level of urbanisation below the national average are Jammu and Kashmir, Uttar Pradesh, Sikkim, Arunachal Pradesh, Nagaland, Tripura, Meghalaya, Chhatisgarh and Madhya Pradesh.

Among the Union Territories, Delhi is the most urbanized where 97.50 per cent of the population is classified as urbanised. Next in order of level of urbanisation are Chandigarh (97.25%), Lakshadweep (78.08%), Daman and Diu (75.16%), Puducherry (68.31%) and Dadra and Nagar Haveli (46.62%). The Union Territories of Andaman and Nicobar Islands is the least urbanised where only 35.67% of the population lives in urban areas.

Of the total urban population of India, more than one-half lives in just five states. These states are Maharashtra (50.8 million), Uttar Pradesh (44.5 million), Tamil Nadu (34.9 million), West Bengal (29.1 million) and Andhra Pradesh (28.4 million). The other five states of Madhya Pradesh, Gujarat, Karnataka, Bihar and Rajasthan, account for one fourth of India's total urban population. Thus, the total for these two sets of states comes very high—over three-fourths of the total urban population of India. It is interesting to note that U.P. figures in this list, although it is one of the least urbanised states of India with only 22.28 per cent of its population living in urban areas. This happens because its size of urban population is very large (44.5 million) even though its urban percentage is low. One may compare Uttar Pradesh with Maharashtra where the degree of urbanisation is one of the highest in the country but its absolute urban population (50.8 million) is slightly more than that of Uttar Pradesh.

TABLE 13.6. Spatial patterns of urbanisation in India

State/ UT Code	India/State/Union Territory#	Population 2011			Percentage share of Total Population 2011		Percentage Decadal Growth 2001-2011		
		Total	Rural	Urban	Rural	Urban	Total	Rural	Urban
	INDIA	**1,210,193,422**	**833,087,662**	**377,105,760**	**68.84**	**31.16**	**17.64**	**12.18**	**31.80**
01	Jammu & Kashmir	12,548,926	9,134,820	3,414,106	72.79	27.21	23.71	19.77	35,66
02	Himachal Pradesh	6,856,509	6,167,805	688,704	89.96	10.04	12.81	12.50	15.64
03	Punjab	27,704,236	17,316,800	10,387,436	62.51	37.49	13.73	7.58	25.72
04	Chandigarh#	1,054,686	29,004	1,025,682	2.75	97.25	17.10	-68.51	26.86
05	Uttarakhand	10,116,752	7,025,583	3,091,169	69.45	30.55	19.17	11.34	41.86
06	Haryana	25,353,081	16,531,493	8,821,588	65.21	34.79	19.90	10.00	44.25
07	NCT of Delhi#	16,753,235	419,319	16,333,916	2.50	97.50	20.96	-55.61	26.56
08	Rajasthan	68,621,012	51,540,236	17,080,776	75.11	24.89	21.44	19.05	29.26
09	Uttar Pradesh	199,581,477	155,111,022	44,470,455	77.72	22.28	20.09	17.81	28.75
10	Bihar	103,804,637	92,075,028	11,729,609	88.70	11.30	25.07	23.90	35.11
11	Sikkim	607,688	455,962	151,726	75.03	24.97	12.36	-5.20	153.43
12	Arunachal Pradesh	1,382,611	1,069,165	313,446	77.33	22.67	25.92	22.88	37.55
13	Nagaland	1,980,602	1,406,861	573,741	71.03	28.97	-0.47	-14.59	67.38
14	Manipur	2,721,756	1,899,624	822,132	69.79	30.21	18.65	10.58	42.74
15	Mizoram	1,091,014	529,037	561,977	48.49	51.51	22.78	18.20	27.43
16	Tripura	3,671,032	2,710,051	960,981	73.82	26.18	14.75	2.13	76.08
17	Meghalaya	2,964,007	2,368,971	595,036	79.92	20.08	27.82	27.04	31.03
18	Assam	31,169,272	26,780,516	4,388,756	85.92	14.08	16.93	15.35	27.61
19	West Bengal	91,347,736	62,213,676	29,134,060	68.11	31.89	13.93	7.73	29.90
20	Jharkhand	32,966,238	25,036,946	7,929,292	75.95	24.05	22.34	19.50	32.29
21	Odisha	41,947,358	34,951,234	6,996,124	83.32	16.68	13.97	11.71	26.80
22	Chhattisgarh	25,540,196	19,603,658	5,936,538	76.76	23.24	22.59	17.75	41.83
23	Madhya Pradesh	72,597,565	52,537,899	20,059,666	72.37	27.63	20.30	18.38	25.63
24	Gujarat	60,383,628	34,670,817	25,712,811	57.42	42.58	19.17	9.23	35.83
25	Daman & Diu #	242,911	60,331	182,580	24.84	75.16	53.54	-40.18	218.37
26	Dadra & Nagar Haveli#	342,853	183,024	159,829	53.38	46.62	55.50	7.64	216.73
27	Maharashtra	112,372,972	61,545,441	50,827,531	54.77	45.23	15.99	10.34	23.67
28	Andhra Pradesh (including Telangana)	84,665,533	56,311,788	28,353,745	66.51	33.49	11.10	1.64	36.26
29	Karnataka	61,130,704	37,552,529	23,578,175	61.43	38.57	15.67	7.63	31.27
30	Goa	1,457,723	551,414	906,309	37.83	62.17	8.17	-18.56	35,15
31	Lakshadweep#	64,429	14,121	50,308	21.92	78.08	6,23	-58.08	86.55
32	Kerala	33,387,677	17,455,506	15,932,171	52.28	47.72	4.86	-25.96	92.72
33	Tamil Nadu	72,138,958	37,189,229	34,949,729	51.55	48.45	15,60	6.49	27.16
34	Puducherry#	1,244,464	394,341	850,123	31.69	68.31	27.72	21.07	31.07
35	Andaman & Nicobar Islands#	379,944	244,411	135,533	64.33	35.67	6.68	1.86	16.64

Source : Census of India 2011, Paper 2, Volume 1 of 2011, India Series 1, pp. 2, 8.

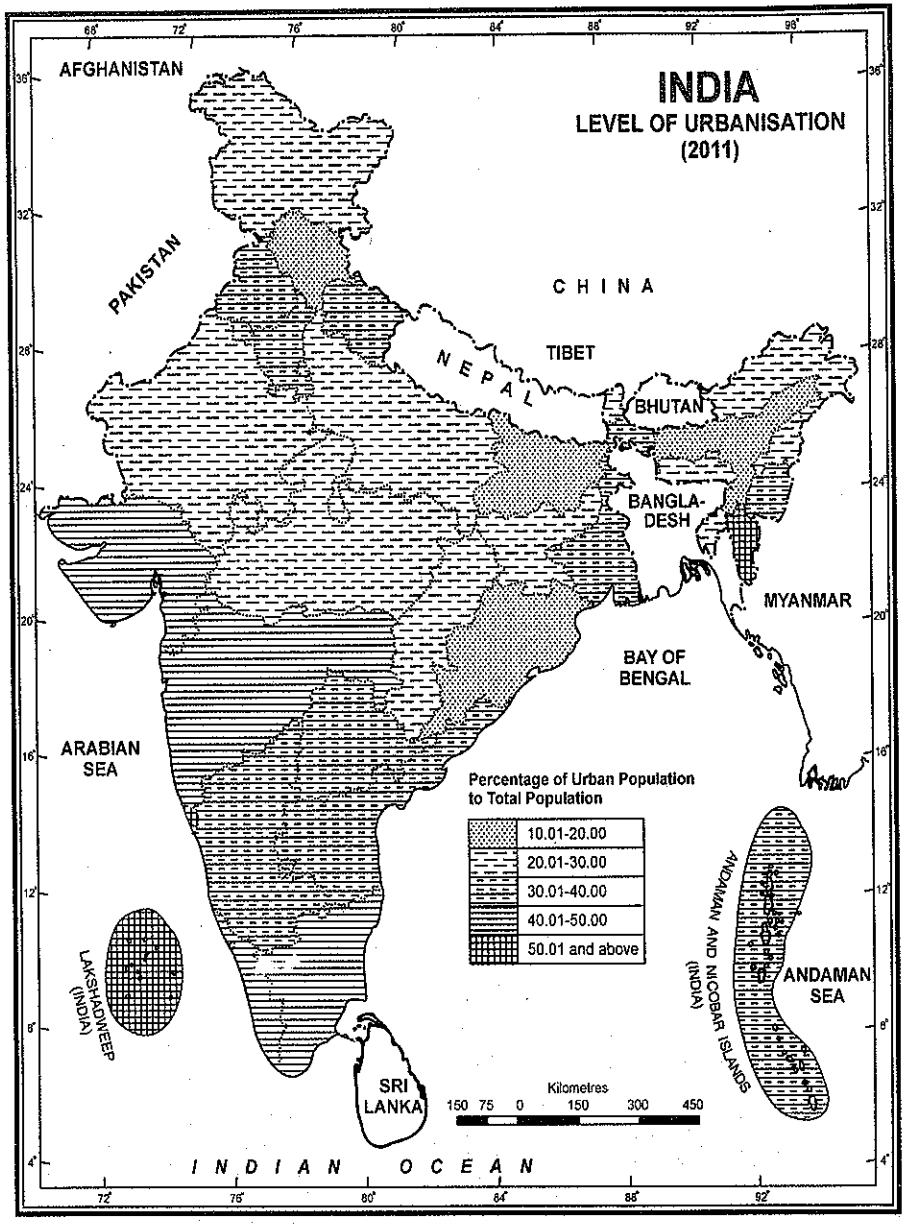


FIG. 13.21. India : Level of Urbanisation (2011)

Table 13.7 gives an idea of distribution of statutory and census towns in 2001 and 2011, new towns in 2011 as well as denotified/declassified towns in 2011. It is obvious that Tamil Nadu has the largest number of 1097 towns among the big states. This means that over 13.8 per cent of India's towns are in Tamil Nadu alone. This state is followed by Uttar Pradesh (915), West Bengal (909), Maharashtra (535)

TABLE 13.7. Statewise distribution of 2001 and 2011 censuses, new towns of 2011 census and denotifies/declassified towns in 2011

State/ Union Territories	2001 Number of Towns			2011 Number of Towns			New Towns in 2011 census		2011 towns minus new towns		Denotified/ declassified towns		
	Total	S	C	Total	S	C	S	C	S	C	Total	S	C
India	5,161	3,799	1,362	7,935	4,041	3,894	289	2,740	3,752	1,154	255	47	208
Big States													
Andhra Pradesh (including Telangana)	210	117	93	353	125	228	19	159	106	69	35	11	24
Assam	125	80	45	214	88	126	8	86	80	40	5	0	5
Bihar	130	125	5	199	139	60	17	56	122	4	4	3	1
Chhattisgarh	97	75	22	182	168	14	93	10	75	4	18	0	18
Gujarat	242	168	74	348	195	153	41	106	154	47	41	14	27
Haryana	106	84	22	154	80	74	11	52	69	22	15	15	0
Himachal Pradesh	57	56	1	59	56	3	0	3	56	0	1	0	1
Jammu & Kashmir	75	72	3	122	86	36	14	33	72	3	0	0	0
Jharkhand	152	44	108	228	40	188	2	107	38	81	33	6	27
Karnataka	270	226	44	347	220	127	4	94	216	33	21	10	11
Kerala	159	60	99	520	59	461	0	362	59	0	1	0	1
Madhya Pradesh	394	339	55	476	364	112	26	64	338	48	8	1	7
Maharashtra	378	251	127	535	256	279	7	171	249	108	21	2	19
Odisha	138	107	31	223	107	116	0	86	107	30	1	0	1
Punjab	157	139	18	217	143	74	7	60	136	14	7	3	4
Rajasthan	222	184	38	297	185	112	0	80	184	32	6	0	6
Tamil Nadu	832	721	111	1097	721	376	0	272	721	0	1	–16	17
Uttar Pradesh	704	638	66	915	648	267	9	208	639	59	6	–1	7
Uttarakhand	86	74	12	116	74	42	0	31	74	11	1	0	1
West Bengal	375	123	252	909	129	780	5	537	124	243	8	–1	9
Small States													
Arunachal Pradesh	17	0	17	27	26	1	10	1	16	0	1	–16	17
Goa	44	14	30	70	14	56	0	26	14	30	0	0	0
Manipur	33	28	5	51	28	23	0	19	28	4	1	0	1
Meghalaya	16	10	6	22	10	12	0	6	10	6	0	0	0
Mizoram	22	22	0	23	23	0	1		22	0	0	0	0
Nagaland	9	8	1	26	19	7	10	7	9	0	0	–1	1
Sikkim	9	8	1	9	8	1	0	1	8	0	1	0	1
Tripura	23	13	10	42	16	26	3	23	13	3	7	0	7
Union Territory													
A & N Islands	3	1	2	5	1	4	1	2	0	2	1	1	0
Chandigarh	1	1	0	6	1	5	0	5	1	0	0	0	0
D. & N. Haveli	2	0	2	6	1	5	0	5	1	0	1	–1	2
Daman and Diu	2	2	0	8	2	6	0	6	2	0	0	0	0
Lakshadweep	3	0	3	6	0	6	0	3	0	3	0	0	0
NCT of Delhi	62	3	59	113	3	110	0	55	3	55	4	0	4
Puducherry UT	6	6	0	10	6	4	0	4	6	0	0	0	0

Note: S—Statutory. C—Census.
Source **:** Mahendra Premi and Dipendra Nath Dass (2012 : 93-95)

and Kerala (520). Thus more than half the towns are located in just five states. Kerala has 520 towns although it is comparatively small state with respect to area when compared with other large states.

As expected, small states have lesser number of towns. Among the small states Goa has the maximum number of 70 towns while Sikkim has to content with only 9 towns of small sizes.

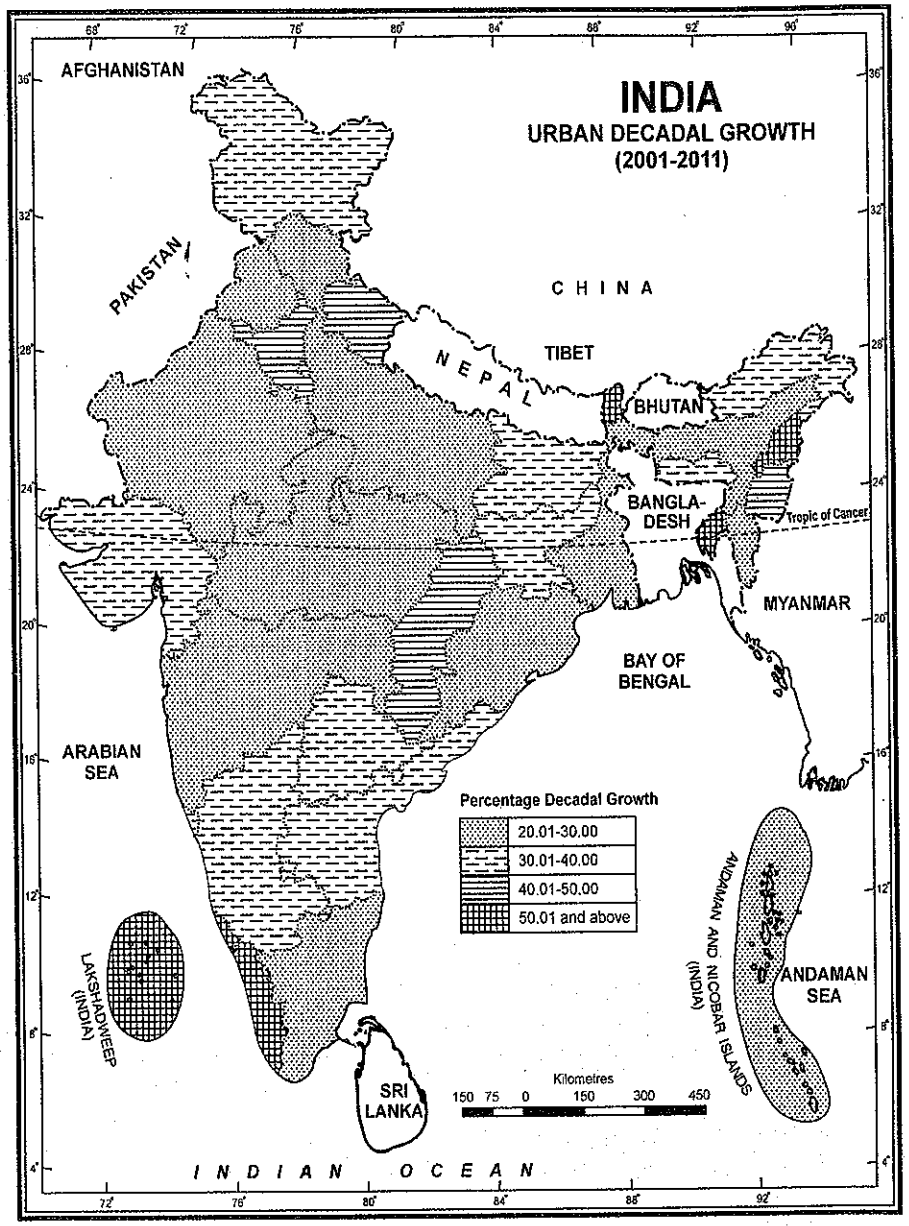


FIG. 13.22. Urban Decadal Growth

Statutory Towns and Census Towns. Census of India had classified Indian towns into two broad categories *viz.* statutory cities of towns and census towns. According to Census of India, statutory towns are those towns which have a local self government like municipal corporation, municipal committee/board, contonment board, notified area committee, town (nagar) panchayat etc. established by the local self government of the state after testing for the requirements laid down in their respective Acts in this regard. Besides, there are a number of other urban settlements that meet certain criteria specified by the census organisation on the eve of a particular census.

According to 2011 census, there is a net addition of 2,774 towns in India between 2001 and 2011. Out of these 2,774 towns, 242 are statutory towns and the remaining 2,532 are census towns. West Bengal tops the list with 537 towns followed by Kerala (362), Tamil Nadu (272) and Uttar Pradesh (208). The recognition of these new towns has resulted in the accelerated rate of urbanisation and have changed the urban map of some states substantially.

Table 13.7 also reveals that 47 statutory towns have been denotified and 208 census towns have been declassified on the eve of 2011 census. Of these 27 towns each belong to Jharkhand and Gujarat and 24 towns to Andhra Pradesh. However this has not affected the urban scene of the concerned states to any great extent.

Decadal Growth (2001-2011). Table 13.6 shows that at all India level, there has been 31.80 per cent growth in the urban population in contrast to only 12.18 per cent in the rural population during 2001 and 2011. This phenomenal growth in the urban population is largely attributed to migration of a large number of people from rural to urban areas. Great regional variations are noticed in the decadal growth of urban population during 2001-11. Among the states, Sikkim has recorded maximum decadal urban growth of 153.43 per cent. This phenomenal growth seems to be the result of mass migration of people from rural to urban areas because this state recorded negative growth rate of 5.20 per cent in the rural population. Similar is the case with Nagaland which recorded 67.38 per cent growth in urban and –14.59 per cent growth in rural population. In the south, Kerala has recorded 92.72 per cent growth in the urban and –25.46 per cent growth in its rural population. The other states with high growth rate in urban population are Tripura (76.08%), Haryana (44.25%), Manipur (42.74%), Uttarakhand (41.86%) and Chhattisgarh (41.83%).

The other states which recorded decadal growth rate higher than the national average of 31.80% are Jammu and Kashmir, Bihar, Arunachal Pradesh, Jharkhand, Gujarat, Andhra Pradesh and Goa. Among all the states, Himachal Pradesh has recorded the minimum growth rate of 15.64% and this is also the least urbanised state in India. The other states with less than the national growth rate are Punjab, Rajasthan, Uttar Pradesh, Mizoram, Meghalaya, Assam, West Bengal, Odisha, Madhya Pradesh, Maharashtra, Karnataka, and Tamil Nadu.

Among the Union Territories, Daman and Diu as well Dadra and Nagar Haveli have recorded exceptionally high growth of 218.37 and 216.73% respectively. This is largely due to large scale migration of the people from rural to urban areas both from within these territories and from the surrounding areas. Lakshadweep has also recorded very high growth rate of 86.55 per cent. Puducherry had recorded below national average growth rate. In the north Chandigarh and Delhi have recorded low percentage of growth rates of 26.86% and 26.56% respectively which may be due to larger number of people already living in these union territories. Andaman and Nicobar Islands have recorded the lowest urban growth rate of 16.64 per cent. **Fig. 13.22** shows the areal variations in the urban decadal growth rate.

METROPOLIZATION (OR METROPOLITANIZATION)

Metropolization refers to the growth of metropolitan centres rooted in industrial and tertiary economic base. A metropolis is a distinct form of settlement, charateristically with sprawling of its built-up area and includes its inter-dependent nearby villages and even towns. The metropolitan centres are a class by themselves, characterized by large scale consumption and a large quantum of flows of people, goods, services and information (Prakasa Rao, 1983). According to **R. Ramchandran** (1995), "Metropolization is essentially a product of the

centralization of administrative, political and economic forces in the country at the national and state capitals. Metropolization is also a product of intense interaction between cities and the integration of national economy and urban centres into a viable inter-dependent system". The pace of metropolization depends upon the rate of direct migration of rural folk to metropolitan cities as well as from the smaller towns. In fact migration constitutes the very foundation of the process of urbanization and is recognised as the chief mechanism by which urban centres continue to grow. One view is that urbanization stops when migration to urban centres stops (Prakasa Rao, 1983). However, natural growth cannot be overlooked. Sixty per cent of the urban growth during 1981-91 is attributed to the factor of natural increase (Premi, 1991).

The Census of India has defined metropolitan *as an urban agglomeration/city having a population of one million and above*. These are also called the *million plus cities*. Metropolization in India is primarily a phenomenon of the post-independence era. In 1901 Kolkata (Calcutta) was the only metropolitan city in the whole of India. In 1911, Mumbai (Bombay) joined Kolkata. The number of such cities remained at 2 for another three decades till 1941. But at the time of the first census after independence in 1951 their number increased to 5 with population of Delhi, Chennai (Madras) and Hyderabad crossing one million mark. In the next 30 years from 1951 to 1981, the cities which joined the million plus group of cities were Ahmedabad and Bangalore in 1961, Kanpur and Pune (Poona) in 1971 and Lucknow, Nagpur and Jaipur in 1981. Thus the number of million plus cities rose to 7 in 1961, 9 in 1971 and 12 in 1981. The decade 1981-91 recorded a phenomenal growth and the number of such cities rose to 23 in 1991. The growth of metropolitan cities was further accelerated in the decade 1991-2001 and the number of metropolitan cities stood at 35 in 2001 (**Table 13.8**). Obviously these cities are characterised by high concentration of population. Together, these cities provided home to 107.88 million people in 2001 which accounted for about 37.81 per cent of the total urban population of India. The average population per urban agglomeration/city of million plus category has almost doubled from 1.51 million in 1901 to 3.08 million in 2001. The decadal variation had also changed largely from 8.86 per cent in 1931 to 121.32 per cent in 1951. The exceptional increase in 1951 is

TABLE 13.8. Urban Agglomerations/Cities having Population of more than a Million, 1901-2001

Census Year	Number of metropolitan cities	Population (in million)	Average Population per UA/city (in million)	Population of million plus urban agglomerations/cities as percentages of India's urban population	Decadal variation of population (per cent)
1901	1	1.51	1..51	5.84	—
1911	2	2.76	1.38	10.65	83.02
1921	2	3.13	1.56	11.14	13.24
1931	2	3.41	1.70	10.18	8.86
1941	2	5.31	2.65	12.02	55.79
1951	5	11.75	2.35	18.81	121.32
1961	7	18.10	2.59	22.93	54.10
1971	9	27.83	3.09	25.51	53.75
1981	12	42.14	3.51	26.41	51.35
1991	23	70.66	3.07	32.54	67.76
2001	35	107.88	3.08	37.81	58.83
2011	53	—	—	—	—

attributed to influx of refugees from West Pakistan (now Pakistan) and East Pakistan (now Bangladesh) to metropolitan cities of Mumbai, Kolkata and Delhi.

According to 2011 Census, India has 53 metropolitan cities. They are, in descending order, Greater Mumbai, Delhi, Kolkata, Chennai, Bengaluru, Hyderabad, Ahmedabad, Pune, Surat, Jaipur, Kanpur, Lucknow, Patna, Nagpur, Ghaziabad, Indore, Coimbatore, Kochi, Kozhikode, Bhopal, Thrissur, Vadodara, Agra, Vishakhapatnam, Malappuram, Thiruvananthapuram, Kannur, Ludhiana, Nashik, Vijaywada, Madurai, Varanasi, Meerut, Rajkot, Faridabad, Jamshedpur, Srinagar, Jabalpur, Asansol, Allahabad, Dhanbad, Vasai-Virar, Aurangabad, Amritsar, Jodhpur, Ranchi, Raipur, Kollam, Gwalior, Durg-Bhilainagar, Chandigarh, Tiruchirapalli and Kota. As many as 160 million people are living in these 53 metropolitans (Census 2011). Greater Mumbai tops the lists with 18.4 million people and Delhi stands at second position with 16.3 million population. It was quite surprising to find the Kolkata and Mumbai are the slowest growing metros. Conversely, smaller metropolitan cities such as Malappuram, Thrissur, Kannur, Kollam, Kozhikode and Thiruvananthapuram (all in Kerala), Ghaziabad (Uttar Pradesh), Visal-Virar (Maharashtra), Dhanbad (Jhakhand), Surat (Gujarat) and Raipur (Chhattisgarh) are galloping ahead in quest for expansion. Cities with most rapidly growing municipal corporations include Vasai-Virar, Dhanbad, Surat, Bengaluru and Hyderabad. The slow growth of some of the largest metropolitans of India shows that the big infrastructure was never meant to cater to the needs of such a huge inflow of migrants. Very little town planning has been involved, so even the existing infrastructure is rapidly crumbling under the weight the multitudes that are flocking to the metros. Gurgaon has been cited as another urban catastrophe by centre for Policy Research. According to its finding, "The Millennium City has walls but no commensurate parking, it is residential hub but lacks proper drainage system and social waste management. The best corporate addresses are located here, yet they run on generators and packaged water and even major roads get water-logged after a few showers."

According to projections made by the Census Department, India will have 87 metropolitan cities in 2039 in which 255 million people will be living. In 2011, India's top ten metropolitan cities had 93 million people and this figure is likely to be 149 million in 2039.

MORPHOLOGY OF INDIAN CITIES

The term 'morphology' has been derived from two Greek words which literally means, "to describe the shape or layout." According to **L.D. Stamp** (1961), "Morphology is the science of form and structure and development which influence the form. **R.E. Murphy** (1966) suggests, "In morphological studies the form elements of the urban area are of chief concern; the arrangement of streets and rail-roads, the form of building, infact, the whole urban landscape." These introductory definitions of morphology help us to conclude that morphology includes three major constituents : (1) internal layout and external shape, (2) internal functional structure or land use and (3) demographic structure. Thus there are three forms of urban morphology. Prof. Enayat Ahmed (1957) has rightly described the urban morphology when he says "from the view point of morphology we are mainly concerned with the ground plan built and aspect of town..... Plan may be viewed from two angles, many concentrate on the internal plan pattern of the town by which is meant the relative arrangements of streets and built-ground. We may also concentrate on the external outline of the plan." In short urban morphology comprises the structure of the city, residential areas, industrial estates, central business district (main market), open space, down town (old city), railways, roads and streets, parks and play grounds, cultural centres water bodies, etc. Prof. Enayat Ahmed has attached great importance to morphology of towns. According to him "The morphological aspect is highly important and diagnostic. As geomorphic landscape is function of structure, process and stage, the morphology of a town is largely the function of site factors, historical viscissitutes, impact of successive cultures and economic settings and development".

Morphology of Indian towns and cities has changed considerably with reference to time and space. In fact no two towns have same morphology and morphology of the same town changes with the passage of time. For sake of simplicity, the morphological study of Indian towns can historically be described in the following three phases :

1. Morphology of Ancient Towns. Most of the ancient towns of India are associated with the Indus Valley Civilization, ample proof of which is available from the excavations of Harappa and Mohenjodaro. Towns of Indus valley civilization has gridiron type of morphology which is also known as chequer board morphology. In this type of morphology, the main streets are parallel to one another and meet at right angles. They are generally oriented north-south and east-west direction and the town is generally of rectangular shape. These roads divide the town into different rectangular blocks of almost equal sizes and buildings are constructed on both sides of the roads. The rectangular plan of the towns was designed to meet the needs some sort of ceremony—religious or secular or both in which the terrace or terraces played a significant role, and to which the professional access was required. This type of morphology can be seen in towns like Ayodhya, Kanchipuram, Lumbini, Madurai, Mathura, Rajgir, Varanasi and Ujjain.

This type of morphology has its merits and demerits. The greater merit is that all the roads receive almost equal amount of air and sun-shine. Since the roads are parallel to and intersect each other at right angles, it requires lots of time and labour to reach from one place to another. Visibility at the road crossings is limited and accidents occur frequently. Sometimes diagonals are used across the rectangles. This provision increases visibility but the shape of buildings is distorted and they often become triangular in shape.

2. Morphology of the Medieval Towns. In majority of the medieval towns, the grid-pattern of the ancient towns was adopted in which forts, city walls, markets, religious places to water bodies and *chowks* were added. This morphology is found in cities of Agra, Ahmedabad, Ahmadnagar, Aligarh, Aurangabad, Bijapur, Bulandshahr, Delhi, Chittaurgarh, etc.

3. Morphology of Modern Towns. Rapid pace of industrialisation and urbanisation in India after Independence gave birth to a large number of new towns and changed the landscape of several pre-existing towns. Large scale migration from rural to urban areas in search of livelihood drastically changed the morphology of the Indian towns. Many old cities became over-crowded and rich people from old cities constructed their houses in the peripheral areas to escape over-crowding in the centre and to enjoy the open environment which the peripheries offered them. The negative impact of rural-urban migration was the growth of slum and squatter colonies in different parts of the cities and disparity between the rich and poor become quite conspicuous. The British rulers built many towns reflecting British architect and after Independence, these towns grew according to Indian architect. Thus, these towns reflect a mixture of British and Indian architect. Unplanned and unchecked growth of some cities has led to degradation of urban life and different parts of such cities are marked by narrow tortuous lanes often with blind curves.

The most outstanding feature of cities built by the Britishers is the Central Business District (CBD). CBD is also known as ***Central Traffic District, Down Town Commercial Core, City Centre*** etc. It lies at the heart of the city where one finds the greatest concentration of offices and retail stores reflected in the city's highest land values and tallest buildings. This is also the chief focus of transport routes. Different floors of the multi-storeyed buildings are used for different purposes. The ground floor is invariably used by the retailers while other floors may be used by wholesalers, offices and even for residential purposes. There is almost a complete absence of independent residential buildings and permanent population. This *area throbs with activity during the day time and is a dead heart at night.* Usually the CBD is at the centre of the city but growth of city in due course of time may result in location of CBD at a place other than its centre. Thus CBD should not necessarily to be located at the centre of the city but should be the business centre of the city. Most of the million cities to have more than one CBD. For example, Connaught Place, Karol Bagh and Chandni Chowk can be treated as three different CBDs of Delhi.

CHIEF CHARACTERISTICS OF CBD

- Dominance of trade
- Concentration of transportation routes
- Concentration of offices
- Multi-storey buildings
- Different use of each floor of multi-storey buildings
- High land values
- High intensity of land use
- Absence of manufacturing industries, residential buildings and permanent population

The British ruler built in or near the pre-existing towns several features such as cantonments, civil lines, educational institution, hospitals, railway colonies, barracks, big bungalows, residential quarters, etc. These were well planed and equipped with modern facilities available at that time. Such structures clearly left the impact of the British architect. Since these towns have both the Indian and the British architect, a greater variety is noticed in their morphology.

Morphology of Allahabad. Located the confluence of the holy rivers of the Ganga and the Yamuna in Uttar Pradesh, this cultural, education and administrative urban centre was known as ***Prayag*** in the ancient time and this name is still popular with many social and religious organisations. Prayag became an important city in the third century B.C. The construction of the present city was initiated by Akbar in the last quarter of the 16th century. However, the actual development of the present city began in the 19th century during the British rule. This city progressed very fast when it became capital of United Provinces of Agra and Awadh in 1858. Establishment of High Court in 1868 further boosted its growth. New colonies come up after Independence and the city expanded considerably. It now covered an area of more than 85 sq km and is the home of more than one million people.

Following are some of the important functional zones of this city (**Fig. 13.23**).

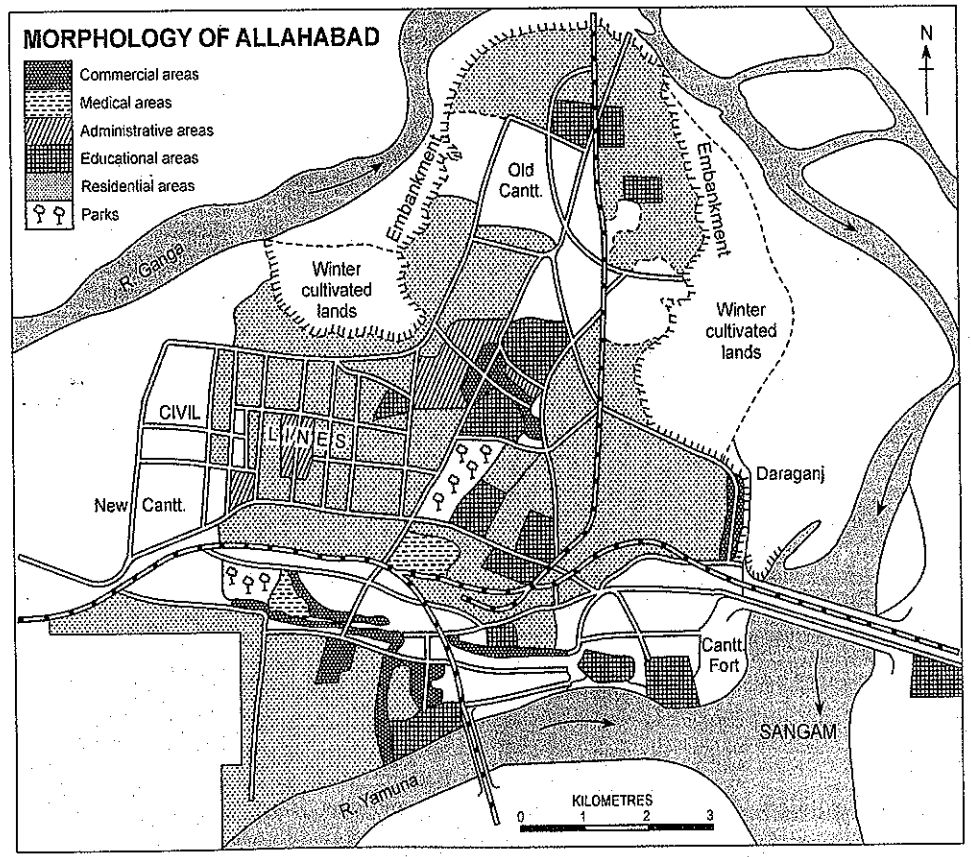


FIG. 13.23. Morphology of Allahabad

1. Commercial Area. Locally known as ***Chowk Area,*** the commercial area of Allahabad is located around clock tower (Ghantaghar) along the Grand Trunk (G.T.) Road. This area may be called the Central Business District (CBDF) of Allahabad. Roads radiate in all directions from the Chowk area. Shops and business establishments are located along the roads and in the area between the roads. Civil Lines business area is about 3 km north-west of Chowk area. Another business area, known as ***Katra***, lies at a distance of about 3 km north-east of Civil Lines. The expansion of city has given birth to additional business area like Phaphaman grain market and Transport Nagar. Business areas on a small scale have come up in the residential areas such as Allahpur, Teliarganj, Rajapur, etc.

2. Residential Area. The main residential area of Allahabad is in the old city. This is an over-crowded area with very high density of population. On an average, more than 10 inhabitants live in one house and more than 40 per cent households live in one room only. Some new colonies have been built, particularly between the Ganga and the Yamuna rivers. Of these, Civil Lines is a planned area which provides most of the facilities required for a reasonably good living. However, most of the new colonies have been built in an unplanned and haphazard manner and lack the basic facilities of markets, schools, hospitals, play grounds, parks, parking areas for vehicles, wide roads and open space, community centres, etc.

3. Educational Area. Allahabad holds a position of pride in the field of education, and educational institutes cover a substantial part of urban land-use of the city. Almost all important educational institutes are located in the eastern part of the city extending from Phamphamau in the north to Naini in the south. The major institutions located in this area University of Allahabad, Engineering College, I.E.R.T. Medical College, Purushotam Das Tandon Open University, Agricultural Institute, Indian Institute of Information Technology and a number of degree colleges, intermediate colleges, training institutes and high schools.

4. Administrative Area. Allahabad is an important centre of administration where several offices of the state and central government are located. The main administrative area lies in the western part of the Civil Lines. This area hosts the Allahabad High Court, Board of Revenue, Offices of the Accountant General, Director of Education, Intermediate Board, Higher Education Commission, etc. Some of the administrative areas are in the northern and eastern sides of old city also. Besides, these are offices of Nagar Nigam, Divisional Police Superintendent, P.W.D., etc. Main branch of State Bank of India is also located here. Some of the district level offices are also located here.

5. Industrial Area. Allahabad proper does not have well defined industrial area although some industries are located in Naini, in the trans-Yamuna area. Some of the important industries located here are glass, textiles, telephone. Ayurvedic medicine, machines and tool making. In the Multhiganj and Chowk areas, there are food processing industries such as pulse mills, flour mills, oil mills, etc. A considerable number of printing press industries are scattered in different parts of the city.

FUNCTIONAL CLASSIFICATION OF INDIAN CITIES

No two cities are identical in the world. All cities are different from one another with respect to their size, location, population, architect and function. Cities can be classified on the basis of their size, location, population, morphology, formation, etc. But from the geographic point of view, functions performed by a city are of paramount important for classifying cities. According to **R.E. Dickinson**, "Functions are the driving force of city life, and influence to a very large extent its growth and morphology. It is the function of the town, rather than its size, which provides some basis for comparison.

Classifying cities on the basis of their functions is a very difficult task because people performing different functions live in almost all the cities. Cities are often classified on the basis of the most important function performed by them. For example, Chandigarh is an administrative city, while Gurgaon is an industrial city and Kurukshetra is a city of religion, culture and education. But this type of classification is not based on some scientific method, rather it is based on general observation. There is need to apply some scientific methods so that a clear picture of functional classification of cities emerges.

Methods used to classify towns on the basis of functions performed by them are categorised into following three classes :

1. Empirical or Qualitative Methods
2. Empirical-cum-Statistical Methods
3. Pure Statistical or Quantitative Methods

1. Empirical or Qualitative Methods

This category of methods denote the initial stage for classifying urban centres on the basis of their functions. M. Aurousseau (1921) was perhaps the first to use empirical method and recognised six classes of towns according to their functions described as under :

1. **Administration Towns :** Capital cities and revenue towns.
2. **Defence Towns :** Fortress, garrison, and naval towns.
3. **Cultural Towns :** University, cathedral, art, pilgrimage and religious towns.
4. **Production Towns :** Manufacturing towns.
5. **Communication Towns :** Collection, transfer and distribution towns.
6. **Recreation Towns :** Health resorts, tourist resorts, holiday resorts and hill stations.

Following Aurousseau, R.D. Mackenzie (1925) classified American communities into four broad categories : (*i*) primary service community, (*ii*) commercial community, (*iii*) industrial community, and (*iv*) other communities.

James divided Indian towns into six categories : (1) capital towns, (2) religious centres, (3) army centres, (4) market, (5) industrial towns, and (6) port towns. **V. Nath** divided Indian towns into eight categories in his essay on "Urbanization in India with special reference to Growth of Cities." But this division was based on the economic aspect of towns.

2. Empirical-cum-Statistical Methods

Also known as Semi-quantitative methods, these methods are mixture of empirical or qualitative methods on one hand and pure statistical or quantitative methods on the other hand. As such, these methods symbolize a transition phase between the earlier empirical and later quantitative methods.

Ogburn (1937), presented a functional classification of towns on the basis of percentage of population engaged in trade, manufacturing and transportation. **Chancy D. Harris** (1943) presented "A Functional Classification of Cities of the United States" in which he recognised nine functions performed by towns. He argued that all cities were more or less multi-functioal and based his classification of the cities on the function of the greatest importance. Each of the nine principal types was designated by a latter : (*i*) Manufacturing cities (M' and M), (*ii*) Retail centres (R), (*iii*) Diversified cities (D), (*iv*) Wholesale centres (W), (*v*) Transport centres (T), (*vi*) Mining towns (S), (*vii*) University towns (E), (*ix*) Resort and retirement towns (X), (*x*) Other towns including political (P). He fixed varied minimum percentages of workers for different functional groups. For example, a city was considered ***manufacturing*** if atleast 60 per cent of the total employees are engaged in manufacturing. For retail centre at least 50 per cent of the total employment should be in retail business. If the employment is less than 60% in manufacturing, 20% in wholesale and 50% in retail, the town is considered to be multi-functional.

Harris method was followed with some modifications by **Kneedler Ohlson** (1945), Victor Jones (1954) and Hart (1955).

The greatest disadvantage of these methods is that the parameters adopted are arbitrary and are not applicable in all the circumstances.

3. Pure Statistical or Quantitative Methods

As their name indicates, these methods are dependent purely on statistical analysis and are used for each type of cities. Statistical methods are fixed, reliable and easy to understand and have become very popular by virtue of these qualities. Although attempts to use these methods were made earlier also, the first popular attempt was made by **L.L. Pownall** in 1953 for studying the functions of New Zealand towns. He classified towns into six functional groups : (*i*) manufacturing, (*ii*) building and construction, (*iii*) primary industry, (*iv*) transport and communications, (*v*) distribution and financial, and (*vi*) personal services.

The most popular scheme was put by **Howard J. Nelson** when he present his scheme, "A Service

Classification of American Cities" in 1955. He based his classification on the data derived from the 1950 census and selected 897 towns each with population over 10,000. He recognised 24 different activities and divided them into 9 major functional groups. The percentage of the total labour force in each of the 897 cities was calculated and thus, arithmetic mean was determined for each functional group for all the cities together. The average employment in different groups ranged from 1.62 per cent for mining to 27.07 per cent for manufacturing. He selected **standard deviation (S.D.)** and calculated S.D. from the mean for each of the nine functional groups. In this way cities were grouped in their appropriate categories : Nine functions recognised were (*i*) mining, (*ii*) manufacturing, (*iii*) transport and communication, (*iv*) wholesale trade, (*v*) retail trade, (*vi*) finance, (*vii*) insurance and real estate, (*viii*) personal service, and (*ix*) professional service and public administration.

Contribution of Indian Geographers

Indian geographers have made their own contribution in classifying Indian cities. Some of the outstanding contributions are briefly described as under :

V.A. Janki (1954) in essay on "Functional Classification of Urban Settlements in Kerala" divided urban settlements into five categories : (*i*) Administration Towns, (*ii*) Commercial and Industrial Towns, (*iii*) Trade Towns (centre for collection and distribution of agricultural products), (*v*) Religious Towns and (*v*) Plantation Towns. Following Nelson **Kashi Nath Singh** (1959) presented "Functional Classification of Towns of U.P. in which many towns remained unclassified the to shortcomings in the methodology. **Amrit Lal** (1959) adopted a new technique while presenting his essay on "Some Aspects of Functional Classification of Cities and Proposed Scheme of Classifying Indian Cities." He used location quotient (LQ) method for functional classification of Class I cities of India and concluded that most of Class I cities of India are multifunctional. **V.L.S. Prakash Rao** (1965) used "Least Square Regression" method for classifying towns. **A. Ramesh** (1965) adopted Nelson's method for classifying towns of Tamil Nadu. **Quazi Ahmed** (1965) used 62 variables for classifying 102 Indian cities according to functions performed by them. **S.M. Raffullah** (1965) adopted a new technique and methodology and suggested that cities perform not one function but many functions simultaneously. Therefore, cities should be classified not on the basis of just one function, rather the classification should be based on a number of functions performed by the cities. He suggested that functions can be categorised into a number of classes : (*i*) Monominal function, (*ii*) Binominal function, (*iii*) Trinominal function, (*v*) Quadrinominal function, and (*v*) Polynominal function. **M.P. Saxena** (1966) presented a new formula for classifying towns of the Yamuna-Hindon region. He based his classification on Census 1961 data and divided the functions into nine classes and presented four combinations of those nine classes. They are: (*i*) primary, (*ii*) trade, (*iii*) industry and (*iv*) miscellaneous. **Onkar Singh** (1967) also used 1961 Census data and expressed the view that urban function are : (*i*) isolated and (*ii*) integrated. He used the functional index and specialisation index as explained below :

$$\text{Functional Index} = \frac{P \times P}{MP}$$

$$\text{Specialisation Index} \sum \left[\frac{P \times P}{MP}\right] \div 100$$

where P = No. of workers in a particular function in the city

MP = No. of workers in a particular function in all the cities.

Om Prakash Singh (1968) followed Nelson's method for classification of towns of Uttar Pradesh. He introduced following two formulae :

(*i*) Functional Specialization Index or F.S.I.

$$= \frac{Cs \times 100}{Rs} \times Mf$$

(*ii*) Functional Centrality Index or F.C.I.

$$= \frac{Cf \times 100}{Rf}$$

where Cs = Total population of the town

Mf = Mean functional percentage of the function of all towns in the region

Rs = Total population of the region

Rf = Population of the region engaged in the same function.

Ashok Mitra (1971) also used 1961 Census data for classifying towns of India. Census of India gives details of population engaged in nine different types of functions. Ashok Mitra excluded first two functions in his classification of towns because they are concerned with agriculture and agricultural labourers which are purely rural functions. He considered the remaining seven functions *viz.* (3) lumbering, fishing, mining, plantation, (4) house-hold industry, (5) manufacturing industry, (6) construction, (7) trade and commerce, (8) transport and communication, and (9) service. Considering the number of people engaged in these seven functions to be 100, calculation for people engage in each function was made. Based on these calculations he classified 2462 towns/cities of India. According to his findings 83 were mining and plantation towns, 496 were household industry towns, 374 were manufacturing towns, 24 were construction towns, 244 were trade and commerce towns, 78 were transport towns and 1163 were service towns.

V.P.P. Sinha (1976) recognised the significance of regional elements while classifying the towns of the Chhotanagpur Plateau. **R.N. Singh** and **Saheb Deen** (1976) successfully removed the shortcomings of Nelson's method in their essay entitled "A Functional Typology of Urban Centres of Eastern Uttar Pradesh." **Ram Pyare** (1980) followed more or less similar methodology in his article entitled "Functional Classification of Towns of Bundelkhand." Like Ashok Mitra he based his classification on nine functions suggested by Census of India and used the Functional Specialization Index (Si) = 100 *e/w* where *e* is the number of people engaged in one function and *w* is the number of total workers in the town. Based on his calculations, he classified 37 towns of Bundelkhand. He used index for different classes of towns explained as follows : A = Agriculture, M = Mining, H = House-hold industry, Mf = Manufacturing, C = Construction, Tc = Transport and communication, T = Trade.

On the basis of different methodologies suggested by different scholars, following simple functional classification of Indian cities is suggested :

1. Administrative Cities. The main function of an administrative city/town is to administer a given area which may be a district, a state or the whole country. From this point of view all the state capitals in India are administrative cities. Some of the district headquarters may also fall in the category of administrative city. In India, New Delhi is the largest administrative city because it is the capital of the whole country. At the state level, Chandigarh, Bengaluru, Chennai, Hyderabad, Jaipur, Lucknow, Mumbai, Patna, Bhopal, Gandhinagar, Itanagar, Dispur, Jaipur, Aizawl, Kohima, Raipur, Panaji, Ranchi, Thiruvananthapuram, Imphal, Shillong, Shimala, Bhubaneshwar, Gangtok, Agartala, Kolkata are important administrative centres.

2. Production Centres. Cities/towns associated with industrial production are often referred to as production centres. Since they are concerned with industrial production they are popularly known as ***industrial cities/towns***. These towns are well connected with their surrounding areas because industries depend on raw materials and transport facilities. Indian industries have progressed a lot after Independence and a large number of industrial towns have come up in the post-Independence era. Ahmedabad, Jamshedpur, Durgapur, Rourkela, Bhilai, Bokaro, Bhadravati, Sindri, Coimbatore etc. are important industrial towns of India.

3. Transport Centres. These centres develop at the following locations :

(*i*) Where rail transport ends and road transport starts. Most of such towns are located up the foothills of the Himalayas. Kalka, Rishikesh, Kotdwar, Kathgodam, Tanakpur are examples of such towns.

(*ii*) Where sea route ends and inland water or land route starts. These towns have facilities of loading and unloading and are equipped with godowns. Mumbai, Kolkata, Chennai, Kandla, Calicut, Vishakhapatnam etc. are cities of this type.

(*iii*) Where inland transport routes converge for example Agra, Dhulia, Mughalsarai, Itarsi, Katni, etc.

4. Trade Centres. Trade centres primarily depend upon trade for their growth. India has hundreds of big and small towns/cities which can be termed as ***trade centres***. Small towns depend on agricultural commodities and develop as grain markets. Big cities carry on various types of trade. Mumbai is the largest trade centre and is known as

the *'Commercial Capital'* of the country. Kolkata, Chennai, Bengaluru, and a large number of other cities are popular as trade centres.

5. Mining Towns. Many towns have developed due to mining and are known as ***mining towns***. For example, Jharia, Raniganj, Singrauli, etc. have developed due to coal mining. Digboi, and Ankleshwar due to oil drilling and Khetri due to copper mining.

6. Defence Towns. The main function of defence towns is to provide security and arrange for defence of the country. In the mediaeval period Mughals and Rajputs had built castles for defence purposes, and those castles developed into towns at a later stage. Chittaurgarh, Ajmer, Jodhpur, Ranthambhor, Gwalior, Chanderi etc. are example of fort towns. If a town has '*garh*' attached to its name, then if must be fort town because 'garh' in Hindi is used for a fort.

Latter on British rulers had set-up a large number of contonments for defence purposes. Then came the age of air battles and air-fields in various parts of the country were built. In addition harbours and navel headquarters were also built to strengthen the defence preparedness of the country. Ambala, Jalandhar, Ferozepur, Meerut, MOHO, Pathankot, Udhampur, Adampur, Halwara, Jamnagar, Vishakhapatnam, etc. are some of the examples of defence towns.

7. Education Centres. Some towns grow due to educational facilities and become popular because they import quality education. Roorkee, Varanasi, Aligarh, Pilani, etc. are famous as educational centres.

8. Religious and Cultural Centres. Some towns/cities are famous for religious, culture and spirituality and attract devotees even from far-off places. Even during the ancient period, towns have been built around religious places like temples, mosques and churches. Some towns have come-up near *gurudwaras* also. Some of the major places of religious importance are Hardwar, Rishikesh, Mathura, Vrindavan, Allahabad, Varanasi, Dwarka, Rameshwaram, Ayodhya, Badrinath, Kedarnath, Kurukshetra, Ajmer, Pushkar, Nashik, Amritsar, Bodh-Gaya, etc.

9. Tourist Resorts. Tourist resorts are generally located in areas of healthy climate, natural beauty or some man-made features which provide facilities for enjoyment, fun and sports. Such places are usually found in hilly areas or on the bank of a water body. Among the hill stations, Srinagar, Pahalgam, Gulmarg, Dalhousie, Dharamsala, Leh-Ladakh, Kullu, Manali, Nainital, Darjeeling, Gangok, Shimla, Ooty, Mt. Abu, Panchmadhi, Ranikhet, Khandala, Matheran, Mahabaleshwar, etc. are important. On the sea coast of India there are beautiful beaches at Gopalpur, Chennai, Goa, and Mumbai.

10. Residential Towns. Some of the town are developed with the primary purpose of providing residential accommodation to urban people. A large number of colonies and satellitic towns have been built to accommodate the growing population of big cities like Delhi, Mumbai, Kolkata, Chennai, Bengaluru, Hyderabad, etc. Panchkula and Mohali near Chandigarh and Partapur near Meerut are primarily residential towns.

11. Seaports. Seaports are developed to facilitate imports and exports. Kandla, New Mangalore, Kochi, New Tuticorin, Paradweep etc. are some of the examples of seaports.

12. Multifunctional Cities. Most cities of India are performing more than one or two functions simultaneously and are termed as multifunctional cities. For example a capital city may also be a centre for trade and commerce, industry, transport, tourism, Big cities like Delhi, Mumbai, Kolkata, Chennai, Bengaluru, Hyderabad, etc. are performing highly diversified functions and are known as multifunctional cities.

CONURBATIONS

As mentioned earlier in this chapter, the term conurbation was coined by Patrick Geddes in 1915 for an extensive urban area, usually resulting from the coalescence of several originally separate expanding towns or urban nuclei. This coalescence is usually along the main inter-urban transport routes. The term conurbation perhaps has been formed by compounding two words 'continuous' and 'urbation'. Thus a conurbation means a continuous stretch of urban development over a considerable area. According to **Mayer and Kohn** (1967), "Tentacles of urbanization, in many areas, have reached towards one another, and numerous cities have converged into larger masses, conurbation or megalopolitan concentrations. **C.B. Fawcett** devoted much attention

to the studies of conurbation during his studies of population of Britain on the basis of 1921 and 1931 census figures. According to his definition "A conurbation is an area occupied by continuous series of dwellings, factories and other buildings, harbours and docks, urban parks and playing fields etc., which are not separated from each other by rural land; though in any cases in this country such an area includes exclosures of rural land which is still in agricultural occupation."

Currently different expressions are used to express large urban area in view of the rapidly increasing urban sprawl. These terms are ***'urban agglomeration', 'urban aggregate', 'urban complex', 'metropolitan area', 'megalopolis', 'metropolitan labour area', 'conglomeration', 'urban region', 'town aggregate', 'urban tract'***, etc. However, the term conurbation is commonly used only for that group of contiguous towns or cities which are under separate civic administrations.

Process of formation of conurbation. Conurbation is an indication of climax in the growth of an urban area. There is rapid growth of industries, trade, transportation and economic activities with the development of science and technology and growth as well spread of urban areas is a natural sequel. Interaction between two neighbouring cities increases and distance between them is reduced. There comes a time when continuity between the neighbouring cities is complete and there is practically no agricultural rural land in-between them. Normally a conurbation is formed under the following three situations :

1. When only one city expands and encompasses the neighbouring rural and urban areas, for example London.
2. When two neighbouring cities expand and meet each other leaving practically no open space between the two, for example Hyderabad-Secunderabad and Kolkata-Haora.
3. When more than two cities expand and meet one another, for example Delhi, Faridabad, Ballabhgarh, Palwal, Gurgaon, NOIDA.

A.E. Smailes has termed these conurbations as uninuclear, binuclear and polynuclear (**Fig. 13.24**).

The world's first and the largest conurbation is in the eastern sea-board of the USA which represents the

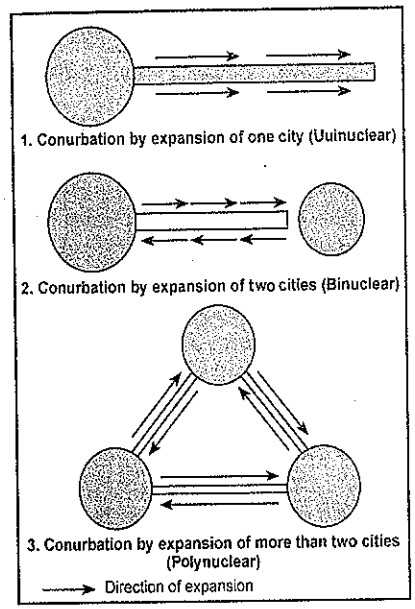


FIG. 13.24. Origin and Growth of Conurbation

coalescence of million cities of Portland, Boston, New Haven, New York, Philadelphia, Baltimore, Washington D.C., New Port, Columbia, Richmond and Columbus.

Conurbations in India

With only 31.16 per cent of her total population as urban as per 2011 census figures, India is considered to be one of the least urbanised countries of the world. But her massive urban population of over 377 millions is more than the total population of any country of the world except that of China and India boasts of her 53 million cities. As such, it is but natural to expect the growth of conurbations in different parts of the country. One such conurbation has developed in West Bengal along the banks of the Hugli river where Kolkata is the main city. Most of the cities of this conurbation are based on jute industry. Most of the jute mills of West Bengal are located in a narrow belt about 100 km long and 3 km wide. Besides Kolkata, Haora, Titanagar, Jagatdol, Budge Budge, Bhadreshwar, Rishra, Bansbaria, Shamnagar, Naihati, etc. are other important cities of this conurbation (**Fig. 13.25**). Group of experts making geographical study of this conurbation have

taken into account the administrative units while demorcating the boundaries of the conurbation. This group has also considered the villages located in the non-municipal corporation for this purpose. Accordingly Kolkata conurbation embraces 30 municipal corporations, 2 corporations, 2 contonment areas and 2 areas without contonment spread in four districts.

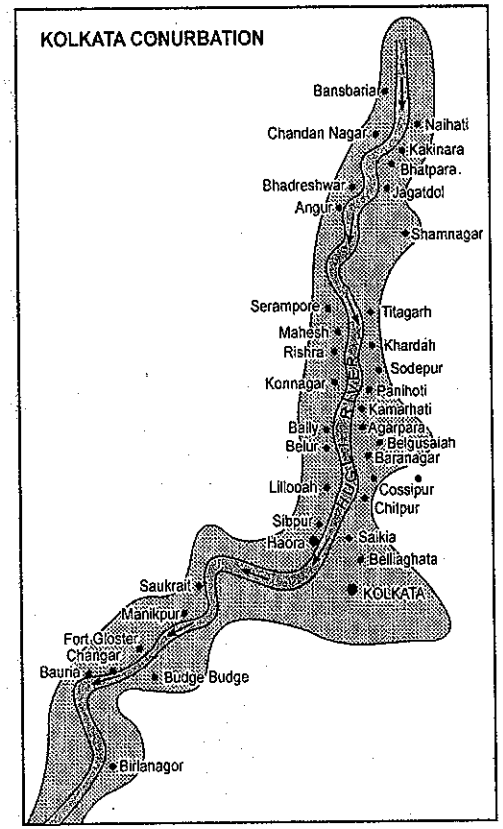


FIG. 13.25. Kolkata Conurbation

A similar conurbation is coming up in the north-western part of India. It extends from Agra in the south to Delhi in the north. At Delhi it is bifurcated into two branches. One branch goes via Meerut and Muzaffarnagar to Saharanpur in U.P. and to Dehra Dun in Uttarakhand while the other branch goes to Ambala in Haryana. At Ambala it is further bifurcated in two sub-branches, one sub-branch goes to Amritsar through Ludhiana and Jalandhar and the second sub-branch goes to Chandigarh and Kalka. Currently these cities/towns appear to be at certain distances and some agricultural land is also seen between them. But these towns/cities are fast spreading and are likely to form a very big conurbation in the near future (**Fig. 13.26**)

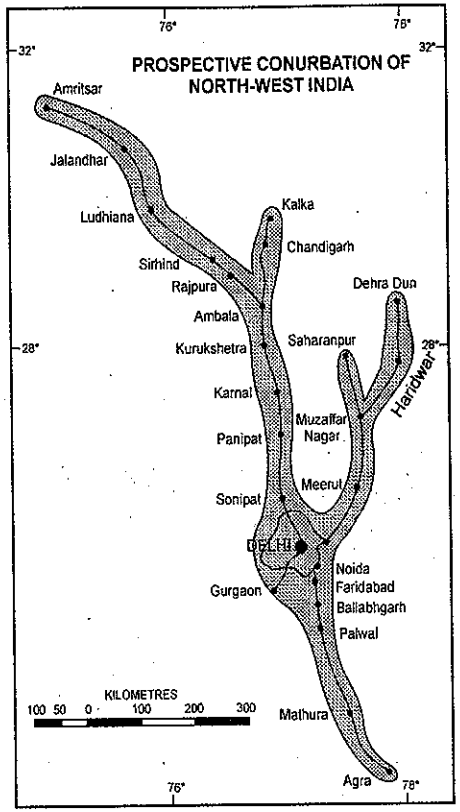


FIG. 13.26. Prospectus Conurbation of North-west India

Problems of Conurbation

1. Most of the conurbations are growing at an alarming rate and the growing population puts great pressure on the urban infrastructure. The basic facilities are not available to the people and life in conurbation is less enjoyable and more tense.
2. There is unplanned growth of urban areas due to large scale rural to urban migration of the people. This process creates lots of problems for the urban people.
3. Most of the people who migrate from rural to urban areas are unskilled and semi-skilled who often fail to find a reasonably good place to live in. Consequently there is rapid growth of slums and squatters and life becomes miserable in these areas.
4. There are growing trends of poverty, unemployment, insecurity and crimes among the conurbation dwellers due to rapidly increasing population.
5. Sphere of influence of the neighbouring cities/towns often overlap which creates serious problems of administration. Criminals cross the territory of sphere of influence of one city and enter the sphere of another city. Thus taking proper action against the criminals becomes difficult.
6. Because of large size and high population density of conurbation, there is always shortage of water, electricity as well as facilities of transport, sewer, open space and the problem of environmental pollution becomes acute.

Metropolitan Regions of India

Metropolitan region is a vast urbanised region which consists of a large city and its surrounding or accompanying towns or suburbs. It is till now an obscure, unclear and loosely used term because no precise parameters have been fixed to define and delineate such regions in India. However, this term is used in the U.S.A. which may be treated as equivalent to a conurbation.

Three metropolitan cities of India, namely Mumbai, Kolkata and Chennai were developed on the Indian sea coast by the British rulers for their own benefit. They used these three cities as ports for international trade. Britain used to carry raw materials from India to Britain and send back the manufactured goods from Britain to India. As a result of the trade benefits, these three port cities become the economic hubs of the country in the beginning of 19th century and ruled over the economic scene of the country till the beginning of 20th century. In the year 1911, the British rulers shifted British India's capital from Kolkata to New Delhi and this city soon became the largest centre of political, economic and social activities in India. In fact Delhi recorded the growth rate which was much faster than any other large city of India and today it overshadows the remaining three coastal metropolitan cities of the country. Thus, at present there are four metropolitan cities in India which together, account for over 85 per cent of the richest people of the country. They cover all the four directions of the country. In the north is Delhi, in the south there is Chennai, the west is dominated by Mumbai and east is served by Kolkata. These four cities are indicators of India's accelerated rate of urbanisation and economic growth. The areas of influence of these four major cities are determined on the basis of the following four parameters and are shown in **Fig. 13.27.**

1. Air travel.
2. Railway passengers and commodity flow.
3. Long distance telephone calls.

However, the landline phones have lost much of their relevance as the mobile phones are becoming more popular.

1. Delhi. Being the capital of India, Delhi is the largest centre of politics and administration. Its economic influence is also felt over large areas of north-western and in some parts of central India. It covers the whole of Jammu and Kashmir, Punjab, Haryana, Himachal Pradesh, Uttarakhand and large parts of Rajasthan, Madhya Pradesh and Uttar Pradesh.

2. Mumbai. This is the largest city of India and is popular as the commercial capital of the country. This metropolitan region covers the whole of Maharashtra, Gujarat and Goa, southern part of Madhya Pradesh and contiguous parts of Chhattisgarh, Karnataka and Rajasthan.

3. Kolkata. This is the first city which was developed by the East India Company and remained the capital of British India upto 1911. This was the first city of India to cross one million mark at the time of 1901 census and remained the largest city of India till 1981 after which it was superseded by Mumbai. The Kolkata metropolitan region covers most parts of East India which encompasses all the north-eastern

states (Sikkim, Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Bihar, Jharkhand, West Bengal, Odisha and eastern parts of Uttar Pradesh and Chhattisgarh.

4. Chennai. Chennai is the fourth largest city of India which is on the eastern coast of the peninsular India. Its metropolitan region covers five southern states of Tamil Nadu, Andhra Pradesh, Telangana

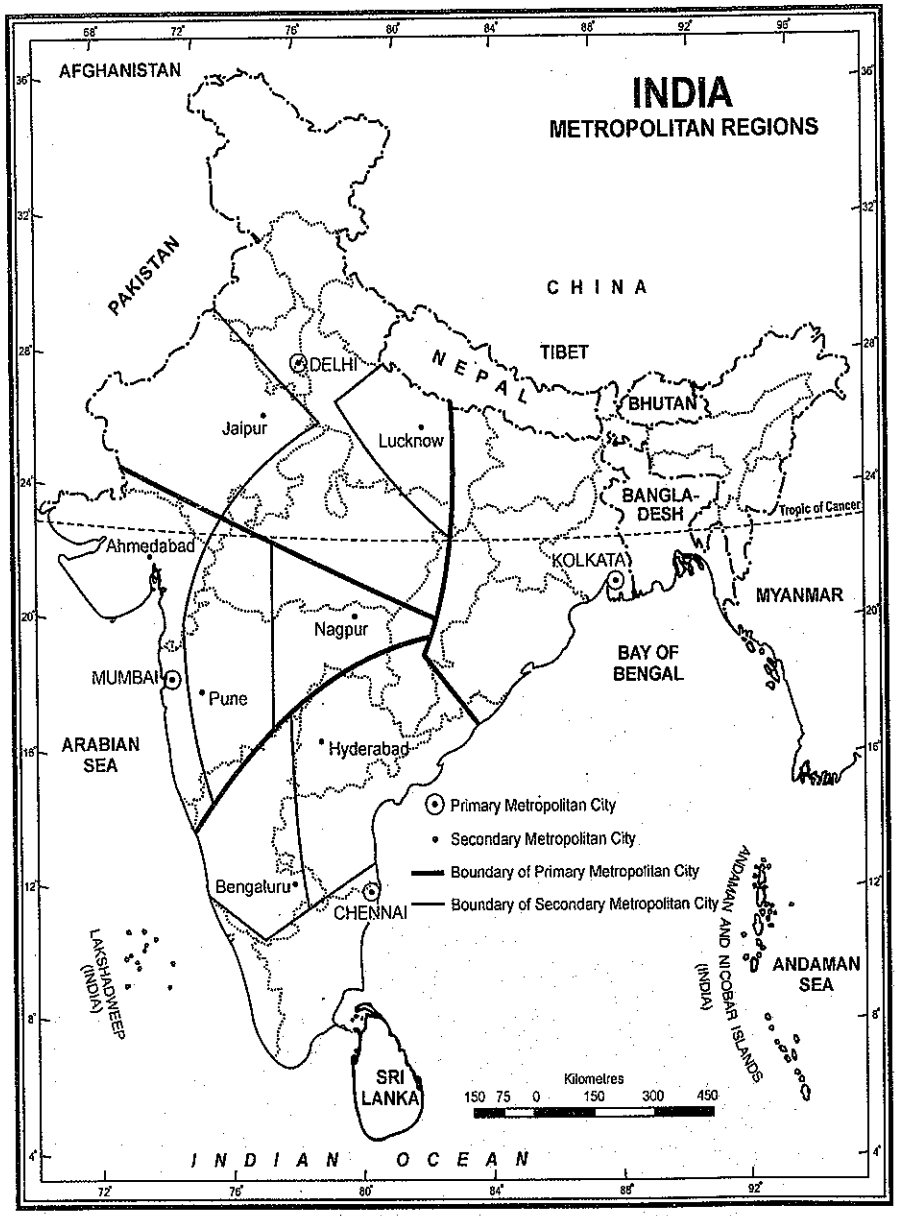


FIG. 13.27. India : Metropolitan Regions

Karnataka and Kerala as well as southern tips of Chhatisgarh and Odisha.

Within the above mentioned four primary metropolitan areas, there are several secondary metropolitan areas also. For example Delhi primary metropolitan area has Lucknow and Jaipur secondary metropolitan area. Similarly Mumbai has Nagpur, Pune and Ahmedabad, and Chennai has Bengaluru and Hyderabad secondary metropolitan areas (**Fig. 13.27**)

Urban Sprawl

Growth in population and areal expansion of a city in the countryside is known as ***urban sprawl.*** Almost all the cities of the world grow, both with respect to population and area with the passage of time making urban sprawl more or less a continuous process. Following three factors are responsible for urban sprawl.

1. Natural growth of population (difference between birth rates and death rates).
2. Large scale migration of the people from rural to urban areas.
3. Migration of the people from small towns to big cities.

The above mentioned three factors cause rapid increase in population and area of cities and often these factors work in combination. However, there are temporal and spatial variations in the relative importance of these factors. In certain cities, natural growth of population may be the dominating factor but in most of the cities it is the migration of the people from rural to urban areas which plays a significant role in the process of urban sprawl.

The first large flow of migration from rural to urban areas was during the "depression" of late 1930s when people migrated in search of jobs. Later, during the decade 1941-51, another one million persons moved to urban places in response to wartime industrialisation and partition of the country in 1947. During 1991-2001, well over 20 million people migrated to cities. The greatest pressure of the immigrating population has been felt in the central districts of the city (the "old city") where the immigrants flock to their relatives and friends before they search for housing. Population densities beyond the "old city" decline sharply. **Brush** (1968) has referred to this situation in the central parts of the cities as ***"urban impulsion"*** which results from concentration of people in the centre of the city close to their work and shopping. Incidentally many of the fastest growing urban centres are large cities. This is due to the fact that such large cities act as magnets and attract large number of immigrants by dint of their employment opportunities and modern way of life. Such ***hyperurbanisation*** leads to projected cities sizes of which defies imagination. Delhi, Mumbai, Kolkata, Chennai, Bengaluru, etc. are examples of urban sprawl due to large scale migration of people from the surrounding areas.

In several big cities wealthy people are constantly moving from the crowded centres of the cities to the more pleasant ***suburbs*** where they can build larger houses and enjoy the space and privacy of a garden around the house. In some cities, the outskirts are also occupied by squatters who build makeshift shacks on unused land although they have no legal right to the land. The difficulty of restricting town growth in either case is immense and most

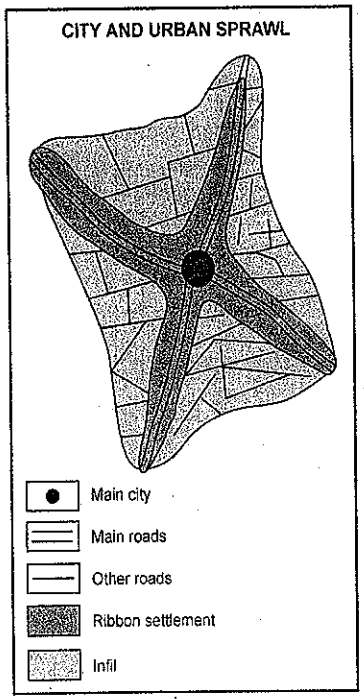


FIG. 13.28. Urban Sprawl

towns and cities are surrounded by wide rings of suburbs.

Historically suburbs have grown first along the major roads leading into the town. This type of growth is known as ***ribbon settlement.*** Such sites are first to be developed because of their location near the road gives them greater accessibility. But soon the demand for suburban homes causes the land between ribbon settlements to be built and made accessible by constructing new roads. This type of development is known as ***'infil'***. Simultaneously small towns and villages within the commuting distance of major cities are also developed for residential purposes. In this way towns are continuously growing and in some areas the suburbs of a number of neighbouring towns may be so close together as to form an almost continuous urban belt which is called ***conurbation.*** Urban sprawl is taking place at the cost of valuable agricultural land.

Urban sprawl has its own advantages and disadvantages. Whereas urban sprawl provides livelihood and shelter to lakhs of people, the problems created by urban sprawl are complicated and solving such problems is an uphill task. Some of the problems created by urban sprawl are briefly described below :

1. Urban sprawl is generally caused by large scale immigration which leads to steep rise in land prices. People with moderate income are unable to afford high land prices and their life becomes troublesome.
2. There is heavy pressure of population on the infrastructure facilities such as water, electricity, transport, sewerage, education and health services, etc. and people have to face multiple problems in their daily life.
3. Most immigrants come to big cities in search of jobs. They often fail to find suitable jobs and add to the problem of unemployment.
4. Slums and squatter settlements come up in different parts of cities. This leads to environmental degradation and lower standard of living.
5. Unemployment, particularly among the youngsters, leads to several social evils like thefts, decoities, kidnappings, murders, rapes, etc. which creates many problems for the common man.
6. Valuable fertile agricultural land is encroached upon by urban sprawl.
7. Increasing urbanisation is also associated with industrialisation and both of them lead to environmental degradation and environmental pollution.

Slums and Squatter Settlements

The natural sequel of unchecked, unplanned and haphazard growth of urban areas is the growth and spread of slums and squatter settlements which present a striking feature in the ecological structure of Indian cities, especially of metropolitan centres.

The rapid urbanisation in conjunction with industrialisation has resulted in the growth of slums. The proliferation of slums occurs due to many factors, such as, the shortage of developed land for housing, the high prices of land beyond the reach of urban poor, a large influx of rural migrants to the cities in search of jobs etc. In spite of several efforts by the Central and State Governments to contain the number of slum dwellers, their growth has been increasing sharply exerting tremendous pressure on the existing civic amenities and social infrastructure.

In India slums have been defined under section 3 of Slum Areas (Improvement and Clearance) Act 1956 as

(*i*) Area in which buildings are of poor quality.

(*ii*) Area in any respect unfit for human habitation.

(*iii*) Area by reason of dilapidation, overcrowding, faulty arrangement and design of such buildings, narrowness or faulty arrangement of streets, lack of ventilation, light, sanitation facilities or any combination of these factors, which are detrimental to safety, health and morals.

The following criteria characterises an area as slum :

(*i*) All areas notified "Slum" by state govt. under any Act.

(*ii*) All areas recognised as slum by state govt. which have not been formally notified as slum under any Act.

(*iii*) A compact area of at least 300 population or about 60-70 households of poorly built congested tenements in unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities.

Census of India defines a slum as "residential areas where dwellings are unfit for human habitation" because they are dilapidated, cramped, poorly ventilated unclean or "any combination of these factors which are detrimental to safety and health."

Socially, slums tend to be isolated from the rest of the urban society and exhibit pathological social symptoms (drug abuse, alcoholism, crime, vandalism and other deviant behaviour). The lack of integration of slum inhabitants into urban life reflects both, the lack of ability and cultural barriers. Thus the slums are not just huts and dilapidated buildings but are occupied by people with complexities of social-networks, sharp socio-economic stratification, dualistic group and segregated spatial structures.

In India, slums are one or two-room hutments mostly occupying government and public lands. The houses in slums are built in mud or brick walls, low roofs mostly covered with corrugated sheets, tins, bamboo mats, polythenes, gunny bags and thatches, devoid of windows and ventilators and public utility services. Slums have invariably extreme unhygienic conditions. They have impoverished lavatories made by digging shallow pit in between three or four huts and with sackcloth as a curtain, hanging in front. When the pit overflows excreta gets spread over the surrounding area and is rarely cleaned. The children cultivate the habit of defecating anywhere in the slum area. Slums have practically no drains and are marked by cesspools and puddles. Piped water is not available to slum dwellers and they mainly depend upon shallow handpumps for water supply. Such handpumps are generally dug in the middle of a stale dirty pool. People wash their clothes and utensils under the handpumps. The entire muck around the handpump percolates into the ground and contaminates the ground water. This contaminated ground water is taken out through the handpump which adversely affects the health of the slum dwellers. Consequently people suffer from water-borne diseases like blood dysentery, diarrhoea, malaria, typhoid, jaundice, etc. These diseases stalk the people all the year round. Children with bloated bellies or famished skeletons, many suffering from polio, are a common sight. Most of the slums are located near drains (*Nullahs*) which contain filthy stagnant water. Billions of flies and mosquitoes swarming over these drains cause infectious diseases. These drains are used as open lavatories by the inhabitants and are always choked. Such drains (*Nullahs*) pose serious threat to health of the people.

Slums are known by different names in different cities. They are called *bustees* in Kolkata, *jhuggi-jhoparies* in Delhi, *Jhoparpattis* or *Chawl* in Mumbai and *Cheri* in Chennai.

Squatter Settlements

No clear-cut distinction can be drawn between slums and squatter settlements in practice except that slums are relatively more stable and are located in older, inner parts of cities compared to squatter settlements which are relatively temporary and are often scattered in all parts of the city, especially outer zones where urban areas merge with their rural hinterland. Normally, squatter settlements contain makeshift dwellings constructed without official permission (*i.e.*, on unauthorised land). Such settlements are constructed by using any available material such as cardboards, tin, straw mats or sacks. Squatter settlements are constructed in an uncontrolled manner and badly lack essential public services such as water, light, sewage. Such an environment leads to several health problems. Determining size of squatter settlement is a difficult job. Some may occur singly or in small groups of 10-20 dwellings while others occur in huge agglomerations of thousands of houses. They can occur through organised rapid (almost overnight) invasions of an area by large number of people or by gradual accretion, family by family.

Squatter settlements have following three characteristics in common.

Physical Characteristics **:** Due to inherent 'non-legal' status, a squatter settlement has services and infrastructure below the adequate minimum levels. As such water supply, sanitation, electricity, roads, drainage, schools, health centres, and market places are either absent or arranged informally.

Social Characteristics **:** Most of the squatter households belong to lower income group. They are predominantly migrants, but many are also second or third generation squatters.

TABLE 13.9. Number of Town and Households–2011

State Code	India/State/ Union territory #	Number of towns			Urban households	Slum households	
		Total	Statutory	Slum reporting		Absolute	Percentage
1	2	3	4	5	6	7	8
	INDIA	**7,933**	**4,041**	**2,543**	**78,865,937**	**13,749,424**	**17.4**
01	Jammu & Kashmir	122	86	40	517,168	96,990	18.8
02	Himachal Pradesh	59	56	22	166,043	14,240	8.6
03	Punjab	217	143	71	2,094,067	296,482	14.2
04	Chandigarh #	6	1	1	228,276	22,080	9.7
05	Uttarakhand	115	74	31	592,223	89,398	15.1
06	Haryana	154	80	75	1,751,901	325,997	18.6
07	NCT of Delhi #*	113	3	22	3,261,423	383,609	11.8
08	Rajasthan	297	185	107	3,090,940	383,134	12.4
09	Uttar Pradesh*	915	648	260	7,449,195	992,728	13.3
10	Bihar	199	139	71	2,013,671	194,065	9.6
11	Sikkim	9	8	7	35,761	8,612	24.1
12	Arunachal Pradesh	27	26	5	65,891	4,005	6.1
13	Nagaland	26	19	7	115,054	15,268	13.3
14	Manipur	51	28	NS	171,400	NS	NS
15	Mizoram	23	23	1	116,203	16,240	14
16	Tripura	42	16	15	235,002	33,830	14.4
17	Meghalaya	22	10	6	116,102	10,936	9.4
18	Assam	214	88	31	992,742	48,122	4.8
19	West Bengal	909	129	122	6,350,113	1,393,319	21.9
20	Jharkhand	228	40	31	1,495,642	79,200	5.3
21	Odisha	223	107	76	1,517,073	350,306	23.1
22	Chhattisgarh	182	168	94	1,238,738	395,297	31.9
23	Madhya Pradesh	476	364	302	3,845,232	1,086,692	28.3
24	Gujarat	348	195	96	5,416,315	360,291	6.7
25	Daman & Diu #	8	2	NS	47,631	NS	NS
26	D & N Haveli #	6	1	NS	37,655	NS	NS
27	Maharashtra	534	256	187	10,813,928	2,449,530	22.7
28	Andhra Pradesh and Telangana	353	125	124	6,778,225	2,421,268	35.7
29	Karnataka	347	220	206	5,315,715	728,277	13.7
30	Goa	70	14	3	198,139	4,846	2.4
31	Lakshadweep #	6	0	NS	8,180	NS	NS
32	Kerala	520	59	19	3,620,696	54,849	1.5
33	Tamil Nadu	1,097	721	504	8,929,104	1,451,690	16.3
34	Puducherry #	10	6	6	206,143	35,070	17
35	A & N Islands #	5	1	1	34,346	3,053	8.9

Note : 'NS' indicates slum not reported.

***Delhi includes 19 Census towns and Uttar Pradesh includes 1 Census Town.**

Source : Census of India 2011, Housing Stock, Amenities and Assets in Slums, Series 1, p. ci.

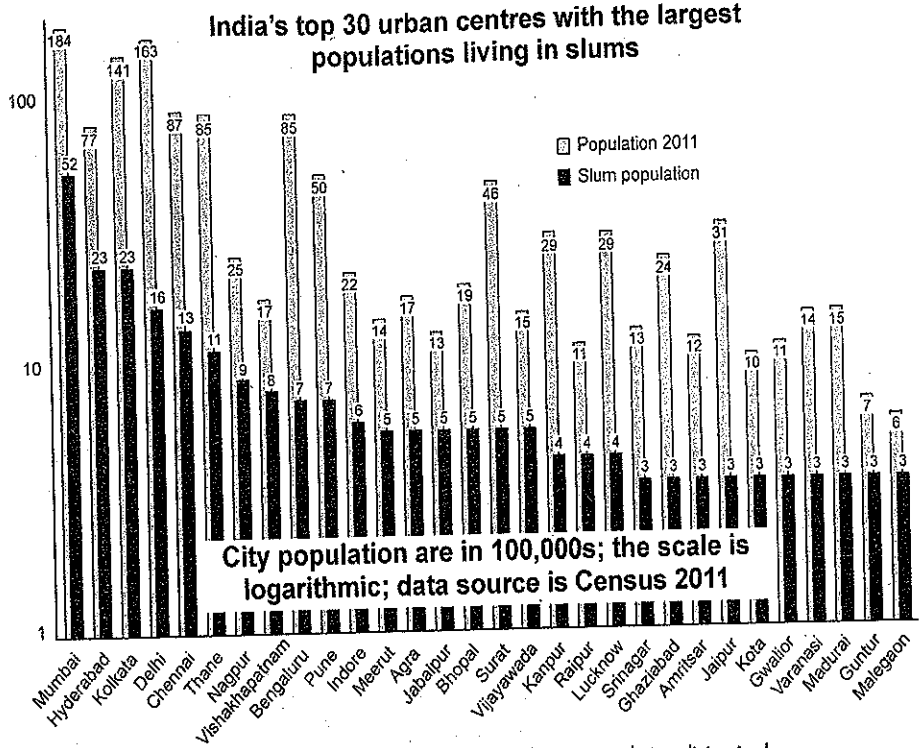


FIG. 13.29. India's to 30 urban centres with the largest populations living in slums

Legal Characteristics : Such settlements lack land ownership.

From the above discussion it is clear that *squatter* refers to legal position of the settlement and *slum* refers to the condition of a settlement.

A distinction has to be drawn between squatter settlements and *shanty towns*. Illegality of tenure is the hallmark of the squatter settlement but shanti huts or mean dwellings are defined by their fabric. *Shanty* towns result mainly from massive rural-urban migration and from the inability of city authorities to provide sufficient housing facilities and employment for the vast influx of people from rural to urban areas.

Indian cities abound with slums which have been termed as ***'eyesores'***, a ***'rash'*** on city landscape, 'a blot on civilization' etc. But actually they are much more health hazards for its unfortunate poverty stricken inhabitants and also for the city as a whole. The most shocking aspect is that slums are growing at an accelerated rate.

CAUSES OF SLUM GROWTH

- Rapid growth of urban population.
- Unemployment in rural areas.
- Mass migration of unskilled and semi-skilled workers from rural to urban areas.
- Limited employment opportunities to immigrant rural population in urban areas.
- Limited land and high land values in urban areas.
- Shortage of cheap residential accommodation in urban areas.

Census of India, for the first time in 2001, came out with detailed data on slum population in India. According to data released by Census of India 2011. types of households has been considered as an important criteria for evaluating the position of slum dwellers in 2011 census. Out of a total of 788.66 million households, as many as 13.75 million households or 17.4% of the total have been reported as slum households. Maharashtra had reported maximum of 2.45 million slum households followed

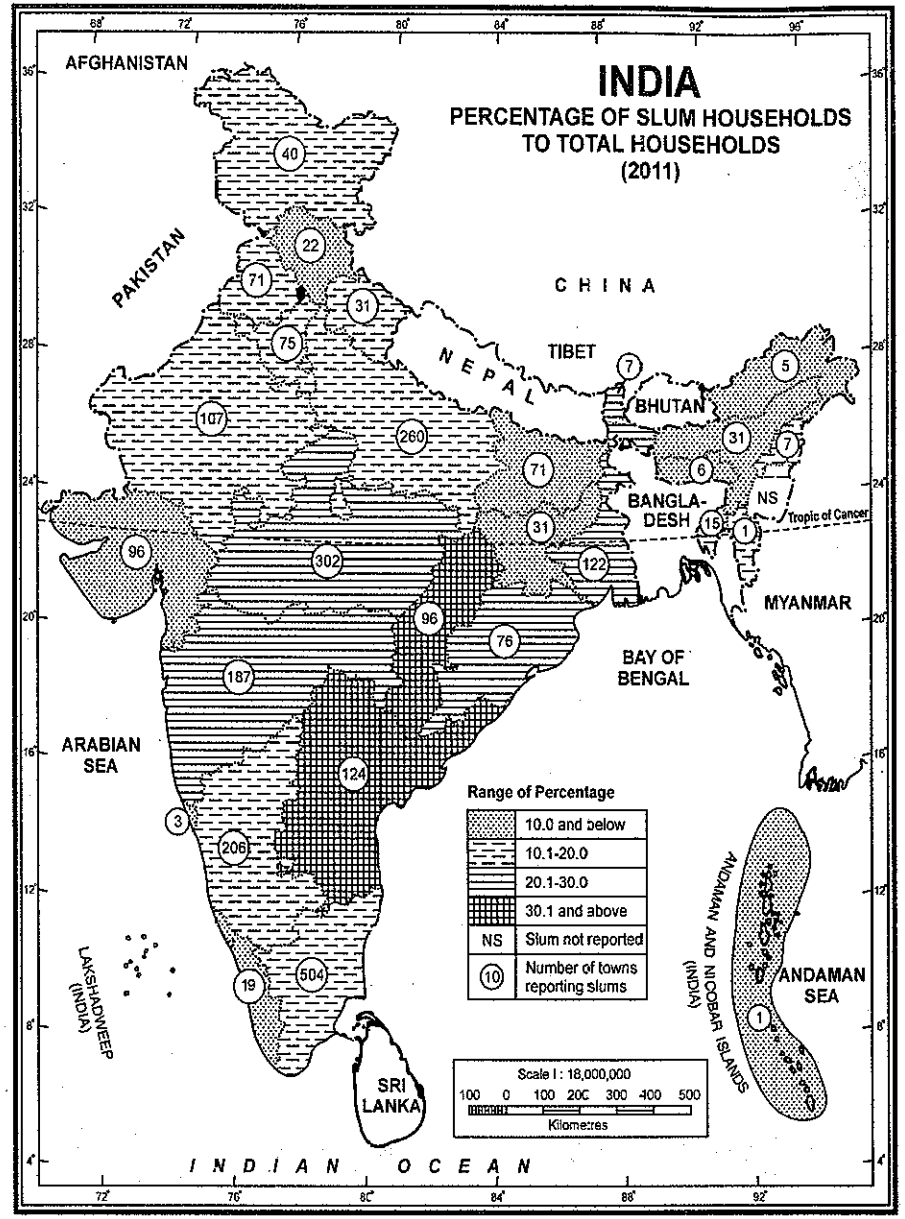


FIG. 13.30. Slum Population, 2001

by Andhra Pradesh and Telangana (2.42 million), Tamil Nadu (1.45 million) and West Bengal (1.39 lakh). State of Manipur and union territories of Daman and Diu, Dadra and Nagar Haveli and Lakshadweep have not reported any slum households (**Table 13.9 and Fig. 13.30**). Entirely different picture emerges if we consider the percentage of slum households to total households at the state/union territory level. The highest percentage (35.7%) of slum households are in Andhra Pradesh including Telangana. This is followed by Chhattisgarh (31.9%) and Madhya Pradesh (28.3%). The lowest percentage of 1.5% has been reported by Kerala.

Figure 13.29 shows that Mumbai has the largest number of 52 lakh slum dwellers which is 28.26 per cent of the total population of city's Municipal Corporation population. This is followed by Hyderabad (23 lakh), Kolkata (23 lakh), Delhi (16 lakh) and Chennai (13 lakh). If we consider the percentage of population living in slums to the total population of the concerned cities, then Hyderabad is at the top where 29.87 per cent population is living in slum areas. This is followed by Mumbai (28.26%), Kolkata (16.31%), Chennai (14.94%) and Delhi (9.8%). Slum population of the remaining big cities can be seen from **Fig. 13.29**. **Dharavi** slum in Central Mumbai is the second largest slum of Asia. Earlier Dharavi of Mumbai was the largest slum of Asia, but according to Human Development report released by the United Nations Development Programme (UNDP) in 2009, 'Orangi in Karachi' is the largest slum of Asia. Here some of the side allays and lanes are so narrow that not even a bicycle can pass. The whole neighbourhood consists of tenement buildings, two or three storey high with rusty iron stairways to the upper part, where a single room is rented by a whole family, sometimes twelve or more people. In this place of shadowless, treeless sunlight, uncontrolled garbage, stagnant pools of foul water, the only non-human creatures are the shining black crows and long gray rats. Dharavi was an arm of the sea, that was filled by waste, largely produced by the people who have come to live there.

CHIEF CHARACTERISTIC FEATURES OF SLUMS

- Slums grow illegally on government land.
- Slums are almost invariably occupied by poor people belonging to lower strata of society.
- Houses in slum areas are very small and most of them consist of one room without separate toilet and kitchen.
- Houses are constructed with poor materials consisting of mud or bricks with thatched roofs or roofs covered with corrugated sheets, tins, bamboo mats, polythenes, gummy bags etc.
- Houses badly lack in ventilation and sanitation.
- Public latrines are practically absent and people, especially children defecate anywhere in the slum area.
- Infrastructural facilities such as electricity, piped (running water), sewage, garbage removal and roads are almost completely absent.
- Hand-pumps are used for water supply.
- People take bath and wash their clothes and utensils with water obtained from the hand-pumps.
- Muck around hand pumps percolates into the ground and contaminates ground water. People fall ill after consuming this water.
- There is shortage of education and health facilities and most people are illiterate and have poor health.
- Sex ratio is low in slum areas.
- There is obnoxious smell in the surroundings.

SOME GLARING FACTS ABOUT SLUMS IN INDIA

- 17 per cent of India's urban population lives in slums.
- Maharashtra accounts for 23 per cent of total slum population followed by Andhra Pradesh and West Bengal.
- Half of slum population lives in 53 million plus cities.
- Maharashtra, Karnataka and Andhra Pradesh have largest number of slums.
- Slum population has risen from 52 million in 2001 to 65 million in 2011 and is expected to rise to 104 millions in 2017.

However the UN-HABITAT report entitled "*State of the World Cities 2010/2011, Bridging the Urban Divide*" released at the World Urban Forum in Rio de Janeiro in March, 2010 has shown a silver lining. According to this report, China and India have lifted at least 125 million people out of slum condition. Out this, 59.7 million people are in India and the rest are in China.

The Census of India 2011 report released on March 21, 2013, had pointed a very bright picture of living conditions in slum areas of some major cities. The report says that living conditions in slums are no different from that of non-slums. In fact there are great similarities as far as access to basic amenities like drinking water and electricity is concerned. India's first-ever census of household amenities and assets in slums has revealed that slum dwellers are also spending more on TV sets, computers and mobile phones rather than sanitation.

TABLE 13.10. Comparison of slums and non-slum households with respect to basic amenities in some selected cities of India (2011)

City (Figures in %)	Tap Water		Toilet		Electricity		Cell Phone	
	S	NS	S	NS	S	NS	S	NS
Delhi	86.7	89.9	50.6	95.8	97.8	99.6	66.1	63.4
Kolkata	90.8	87.0	92.0	96.2	95.5	96.5	70.1	63.5
Greater Mumbai	96.1	97.3	32.8	75.1	95.6	98.3	76.6	53.5
Bengaluru	84.3	80.2	86.8	97.8	96.6	98.4	71.0	66.5
Ahmedabad	88.2	86.6	61.3	94.6	91.5	98.9	48.8	63.1
Pune	98.8	98.4	35.8	90.6	96.2	98.9	73.4	62.0
Chennai	78.2	83.7	91.0	97.4	98.4	99.3	70.0	59.2

S = Slum house, NS = Non-slum household.
Source : Census of India 2011.

In 2011, of the 13.7 million slum households, 74% have access to tap water as against 70% in non-slums. As many as 90% have access to electricity as against 92% in non-slums. Also more slum dwellers—77% have access to permanent houses. The figures indicate the narrowing gaps between slums and non-slums.

In an indication of an increase in purchasing power, the report also reveals that 70.2% of slum families own their houses at compared to 69% in non-slum households. Further 70% of slum families have TV sets, 63% have mobile phones and 10.4% computers.

Overall there are 19 million plus cities where more than 25% households live in slums.

Highlights about slums according to provisional figures released by Census of India 2011 in 2013

- 13.71 million urban households live in slums which is 17.4 per cent of total households in the country.
- There are 19 million plus cities where more than 25 per cent households live in slums.
- 35 per cent of India's slum households are in Maharashtra and Andhra Pradesh.
- Maharashtra has 2.45 million slum households which is two times more than 1.19 million slum households in Uttar Pradesh and Bihar put together.
- 64 per cent of India's slum households live in five states *viz.* Maharashtra, Andhra Pradesh, Tamil Nadu, West Bengal and Madhya Pradesh.

TOWN PLANNING

Introduction and Necessity of Town Planning

Urbanisation has increased at rapid pace during the last few decades and size as well as number of cities have increased at an unprecedented rate. This phenomenon has resulted into a large number of complex problems in urban areas. Uncontrolled, unplanned and haphazard growth of cities has led to tremendous pressure of population on the basic infrastructural facilities such as housing, transport, sewer, education, health, water, electricity, etc. and the city dwellers have to face a lot of problems, some of which have really become very complicated. With the increasing number of vehicles, slums and squatter settlements, industries, urban environment has become polluted beyond the permissible limits which has made life of the urban people miserable. Keeping in view these problems, town planning has become of paramount importance. Its implies that new towns should be dwelled in a planned way and proper plans should be made to improve the condition of old cities. By town planning, we will not only make life of the present generation comfortable but will secure the life of the future generations also. From the historic point of view, it is very aptly said that town planning is as old at towns themselves. Romans planned city of Rome more than two thousand years ago and this city has the pride privilege of being the first planned the city of the world. The present day problems of towns have made town planning as the foundation of towns on which the infrastructure rests and the future prospects of towns depend.

Definition of Town Planning

Town planning is a multi-disciplinary subject and specialises from different fields make their respective contribution to the process of town planning. For example sociologists, economists, geographers, artists, politicians, engineers, demographers, etc. view town planning from their respective angles. The role of geographers in town planning has become very important during the last few decades and many geographers have become professional town planners in India. In fact, *town planning is an art of which geography is a science*. Several geographers have defined town planning in their own way (see box).

1. "The underlying idea of Town Planning is the welfare of the citizens and raise the standard of living of the people." —**L.D. Stamp**
2. "Town and country planing is concerned with the use and development of land." —**Jackson**
3. "The touchstone of planning is the accommodation of several units to make a complete and harmonious whole." —**H.M. Mayer**
4. "City planing is simply the exercise of such foresight as will promote the orderly and sightly development of a city and its environs along rational lines with due regards for health, amenity and convenience and commercial and industrial advancement." —**Nelson, P. Lewis**

Aims and Objectives of Town Planning

There can be several aims and objectives of town planning but for the sake of convenience, three objectives are considered important : (1) beauty, (2) health, and (3) convenience.

1. ***Beauty*** of a town implies that the town should look beautiful and attractive and its beauty should not fade away with the passage of time. To maintain the beauty of a town, there should be proper provision for cleanliness, drainage, light, roads, buildings, etc. The initial beauty of a town quickly fades away if proper arrangements for maintaining this beauty are not made.

2. ***Health*** of the inhabitants of a town is the main pillar on which the town's progress depends. People need pollution free environment and nutritious food to maintain good health. Industries and other polluting establishments should be placed in such a corner of the city that they cause least harm to the people living the town. Wind rose diagrams can be great help in this regard.

3. ***Convenience*** is an important need of man and all activities are performed according to man's convenience. If a town looks beautiful and proper provision for the people's health is also taken care of the town cannot be termed as planned town if convenience of the people is ignored. For example, if an industrial worker has to spend 1-2 hours to reach his place of work from his place of residence, it will be very inconvenient for him. Things can become very convenient for him, if arrangement for his residence is made near the factory or if proper arrangements for cheap and efficient transport are made.

Thus beauty, health and convenience are three basic components of a planned town. Chief aims and objectives of town planning can be summed up as follows :

1. Proper plan should be made for the chronological growth of the town so that there is no obstacle in the future urban sprawl.
2. Land surrounding the town should be included in the plan of the town so that town can spread depending upon the nature of land.
3. Buildings should be planned according to convenience of the people and there should be no scope for unplanned buildings.
4. Growth of town should be planned according to civilizations, culture, rituals or social structure of its inhabitants.
5. There should be proper provision for trade, commerce and other economic activities so that town could be provided with a socio-economic base.
6. Requirements for the coming at lest fifty years should be considered while preparing a plan for a town.
7. Roads and buildings should be specious and there should be open space at the corners.

8. The buildings should be designed in such a way that fresh air and sufficient light can enter in the building. These things are essential for maintaining good health.
9. Due consideration must be given to convenience, comfort and health of the people while preparing plan for a town.

Subject and Scope of Town Planning

Number of size of towns is fast increasing all over the world including India which has increased the importance of town planning considerably. Therefore, it is necessary to know the subject matter of town planning. The subject and scope of town planning has become very vast with the increasing trend in urbanisation. A Augiston of France has mentioned four main elements of town planning. (1) trade, (2) industry, (3) administration and (4) residence. Thus, according to him, a town should be planned in such a way that it is capable of providing scope for growth in trade and industries, its administration base is solid and it provides sufficient scope for residential areas. This plan has not mentioned anything about facilities of health and education which are essential parts of urban life. Arthur B. Galion has divided the subject matter of town planning into two broad classes. (1) *Planning for land-use* which is concerned with the use of land for residence, trade, industry open spaces, etc. Density of land use is determined according to houses and population. (2) *Planning for transport and communication* which requires proper plans for highways and other roads, railways, airports, water-ways and communication network.

Special attention is to be paid to the convenience of the inhabitants and possibilities of future growth of the town. Department of Town and Country Planning has prepared master plans for several towns in India. According to the views expressed by Indian town planners, land use map must be prepared to begin with and then the town plan should be proposed according to the problems of the concerned town. Following are the special features of town planning :

1. Special attention is to be paid to the physical growth of the town.
2. Town plan should have proper consideration for future growth.
3. It should have a broad base.
4. The present population should find it convenient and comfortable to live in the town.

Principles of Urban Planning

Town planning is always bound by certain principles, some of them are briefly described below :

1. Provision for separate area for industries. There is a close relationship between industrialisation and urbanisation and both go hand-in-hand with each other. In some of the towns, industries are set-up in residential areas which is against the principle of town planning. Industries should be located in such an area which is accessible from other parts of the town and at the same time it has least effect of air, water, land and sound pollution.

2. Division of town into functional zones. The whole town is divided into functional zones and each zone is meant for a particular function. Thus there are residential zones, industrial zones, trade and commerce zones, medical zones, educational zones, etc. They are located in such a way that they are complimentary to rather than competitive against each other.

3. Planning for transport. Transport is the main artery and forms the life-line of a town which facilitate the movement of people and goods from one part of the town to another. Therefore, meticulous planing of transport system of a town is of paramount importance. Roads should be broad and clean and there should be separate lanes for separate modes of transportation. Pedestrians need special attention because they are the first victims in any road accident. The road network should be planned in such a way that people do not find much difficulty in travelling from one part of the town to another. Roads coming in and going out of the town are to be properly planned so that greatest accessibility is achieved. Removal of unwanted speed breakers, provision of traffic signals, fly-overs, under-passes, etc. can go a long way in the smooth flow of traffic in big cities.

Local railways also play a significant role in big cities like Mumbai, Delhi, Kolkata, Chennai etc. Mumbai has the best network of local railways in India, but even there, one finds that local trains are unable to meet the increased pressure of traffic and

are almost invariably over-crowded. Delhi metro rail has brought much needed relief to commuters and the success of this railway has encouraged many of the million cities to develop their metro rail system.

4. Slums and Squatter Settlements. Slums and squatter settlements grow in towns and cities when unskilled and semi-skilled workers migrate from rural to urban areas and do not find a suitable job there. Under the plan, the slum dwellers are provided with free or heavily subsidised alternate residential accommodation. In certain cases where it is not possible to remove slums and squatter settlements, basic facilities like water, electricity, roads, sewer, garbage disposal etc. should be proved so as to enable the slum dwellers to lead a reasonably good life.

5. Provision for Public Places. Any good town plan is expected to make provision for public places like parks, play grounds, clubs, community centres, religious places so that people, particularly children and senior citizens can walk, play and spend their free time.

6. Stratified Residential Areas. Normally three types of people live in towns which are labelled as upper class, middle class and lower class according to their financial status. Each class should be allotted separate residential area so that people belonging to one class are able to mix with one another and enjoy the community life.

7. Green Belt. Green belt is usually provided to check the uncontrolled and irregular growth of a town. Usually it is circular area which surrounds the town from all sides and acts as a buffer area between urban and rural land use. In addition to check the uncontrolled, unplanned and irregular growth of the town, green belt also helps in providing pleasant and healthy environment to the people. Scope for future planned growth of the town is also there in the green belt **(Fig. 13.31)**.

8. Land Use. In a planned town, specific piece of land is earmarked for a specific purpose and it is assured that the land is actually used for the purpose for which it is allotted. Height, spacing and design of buildings is also fixed and is strictly adhered to.

9. Open Spaces. Open spaces are needed by all sections of society. Therefore, distribution of parks and playgrounds is planned in such a way that everyone is able to lead the life of virtue.

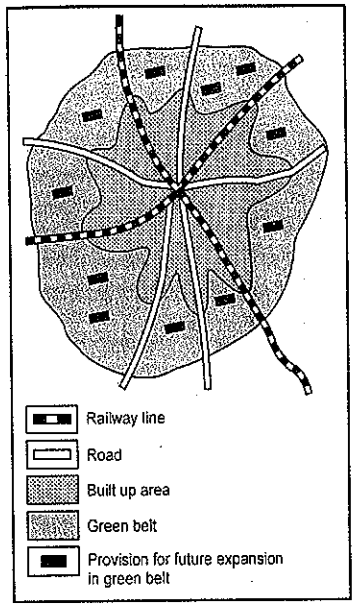


FIG. 13.31. Green Belt

10. Urban Decentralisation. Satellite towns are developed around big cities to decentralise urban population so that high concentration and overcrowding in the city centre is reduced. Satellite towns are new, open and cheaper and act as great mechanism for decentralisation.

11. Renewal of Cities. This is a very important aspect of town planning according to which master plan for 10-20 years is prepared and old land use is improved upon. Currently work is going on Delhi Master Plan 2021.

12. Rehabilitation and re-development. This principle is used for improving old towns. Under this principle, old buildings are improved. Critically old buildings, which are dangerous, are demolished and new buildings are constructed in their place.

13. Development of City Centre. City centre which is usually located at the centre of the city is called the Central Business District (CBD). This area is characterised by tall buildings, high density of land use, convergence of transport routes, high concentration trade and overcrowding. Such a situation leads to a large number of problems. Under the planned development, ways means are devised to solve these problems.

14. Provision for future growth of towns. Plan for future growth and sprawl of urban areas is prepared under this principle. While preparing the plan for future growth of the city, direction and limit of growth are fixed for residential, industrial and commercial areas and priorities for different varieties of land use are also fixed. For metropolitan cities like Delhi, Mumbai, Kolkata, Chennai etc. plans for future development of satellite towns, linear towns, dispersed towns and radial towns are prepared.

TOWN PLANNING IN INDIA

India has a long tradition of town planning. Our old scriptures have many references of planned towns wherein markets, roads, streets, temples, public buildings, residential places, secretarial centres, parks etc. have been mentioned as parts of planned towns. Excavations of Harapa and Mahenjodaro in the Indus Valley are solid proofs of town planning of higher level in India. Four main roads and several other roads and streets of Mohenjodaro meet at right angles giving a typical rectangular shape to the town. The width of main road and the other roads was 10 and 7 metres respectively.

Several towns were developed during the *Vedic* period. Some of the important town built during this period are Kannauj, Ayodhya, Mathura, Janakpuri, Hastinapur, Vaishali, Patliputra, Madurai, Sanchi, Kanchipuram, etc. Majority of these towns were the capitals of their respective kingdoms and were built very meticulously in a planned way. Different parts of the towns were used for different purposes and division of land use pattern was planned in a scientific way. The length and breadth of Ayodhya at that time was 600 and 1500 yards respectively. The town contained beautiful roads and houses and provision for drinking water was made throughout the town.

Patliputra (present Patna) is another example of town planning in ancient time. It was 12 miles (20 km) long and 2 miles (3.2 km) wide and had one fort with 60 doors. The King's palace was in the centre of the city and this palace was surrounded by parks, fountains, ponds, etc. which gave esthetic look to the place. The whole city was encircled by a water channel from security point of view.

Delhi had been the target of invaders throughout its history and had the privilege of being the capital of the country a number of times. Its beginning was made at Indra Prastha which had several palaces, parks, gardens, tanks and beautiful buildings. The Mughal emperor Shahjahan built the city of Shahjahanabad on the bank of the river Yamuna which is now known as Old Delhi. Chandni Chowk was at the heart of the city. The town was spread over 1240 acres of land meant for about 60,000 inhabitants. It had a protection wall on all the sides which had four gates. Currently they are known as Delhi Gate, Kashmiri Gate, Ajmiri Gate and Lahori Gate. It had broad roads which were meeting each other at right angles. A large number of mosques, parks, gardens and fountains enhanced the beauty of the city. Other towns built by the Mughal emperors include Srinagar, Agra and Fatehpur Sikri.

Jaipur, the present capital of Rajasthan, built by the Rajput king Maharaja Jai Singh in 1727 is an outstanding example of planned city. Its broad and beautiful roads and beautiful buildings add to the beauty of the city. All buildings of the original city were painted in pink colour and the city has the distinction of being a **Pink City.**

In the 19th century, the British rulers prepared development plans for cities like Mysore, Vadodara, Kolkata, Delhi etc. for their administrative convenience. Most of the plans were prepared by the army engineers and special attention was paid to the convenience of army personnels while preparing the development plans. In 1915 the then governor of Madras invited a great town planner Patreck Geddes to help the Britishers in town planning. He made an indepth study of the Indian towns and gave valuable suggestions for preparing plans for various towns. It gave a new direction to the process of town planning in India. The British rulers could not afford to ignore the strategic importance of Delhi and decided to shift the capital of India from Kolkata (Calcutta) to Delhi in 1916. Plan for developing New Delhi on a piece of land about 5 miles long and 4 miles broad between the Delhi Ridge and the Yamuna river was prepared by Delhi Town Planning Committee in 1912. Lutyans was the chief architect of this plan and New Delhi is still known as Lutyen's Delhi. Delhi has been one of the fastest growing urban areas in the country. From a little over 2 lakhs in 1901 and 4.5 lakh in 1931 the city took a leep to 7 lakh in 1941. In the first four years after partition, it is estimated that about

1,00,000 left for Pakistan but thrice that number came in and by 1951, Delhi's population had doubled. By 1961, the urban area recorded a population of 2.3 million which rose to 16.75 million in 2011. At the initial stage, New Delhi and Old Delhi were separate urban identities and there was a vast open area between the two. Both the areas have widened with the passage of time and at present there is no open space between the two.

In the year 1907 Jamshedji Tata established Tata Iron and Steel Company (TISCO) at Sanchi in Saghbum district of Jharkhand and prepared development plan for the industrial town of Jamshedpur in 1911 which was revised in 1920, 1936 and 1943. According to the plan, the whole town is divided into two parts and 12 zones. One part is industrial area and the other is residential area. According to the plan, houses are not close to each other, rather they are wide apart, separated by sufficient open space. Due provision for entertainment, market, education and medical facilities has been made.

Town Planning in the Post-Independence Period

India witnessed rapid growth of urbanisation after Independence in 1947. Several new towns came up and many old towns were remodeled. New towns

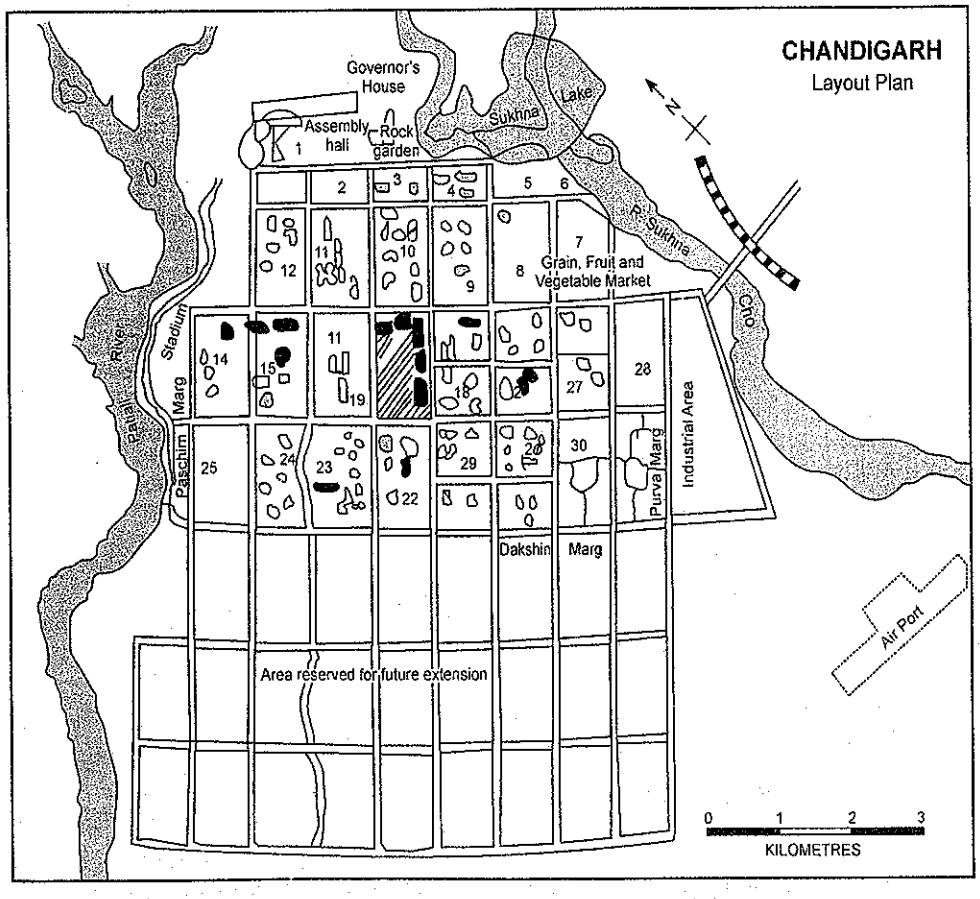


FIG. 13.32. Layout Plan of Chandigarh

were direly needed for immediate settlement of migrants from Pakistan as a result of partition of the country. New colonies named as '*model towns*' were establishes in old towns to provide shelter to the immigrants. A number of industrial towns was also set up to boost the industrial growth. Durgapur, Rourkela, Bhilai, Bokaro, Chittaranjan etc. are examples of such towns. Many new capital towns like Chandigarh, Bhubaneshwar, Gandhinagar, Itanagar were also established for administrative purpose. All these towns have been constructed according to pre-determined plans and they are examples of planned towns in India.

Chandigarh. Chandigarh is the proud city of Independent India and is considered to be one of the most beautiful cities of the world. Need for the new capital of Punjab was felt immediately after partition of the country and its plan was prepared at the initiative of the then chief minister of Punjab, Sardar Partap Singh Kairon. Its construction started in 1952 and it became a union territory and capital of Punjab and Haryana on 1st November 1966 when the erstwhile Punjab was divided into present Punjab and Haryana. It was designed to accommodate 1,50,000 inhabitants but is remained a great attraction for people of the neaghouring states and it is one of the million plus cities of India according to 2011 census.

The city has a rectangular plan in which the roads are designed according to gridiron or chequerboard pattern and they meet each other at right angles (**Fig. 13.32**). According to the original plan, the city is spread on an area of 3642 hectares between Patiali river in the west and Sukhna Cho in the north-east and has 30 sectors, out of which 24 are residential sectors and the remaining six are meant for other purposes. Sector 17 is meant for trade and commerce and may be termed as Central Business District (CBD) of the city. Sector 14 has the campus of Punjab University and sector 11 and 12 host other educational institutes. Important buildings like assembly hall, secretariat, and governor's house are in the northern part of the city. Adjacent to the Sukhna Cho are grain, fruit and vegetable markets while industrial area is in the extreme east corner of the city. Sukhna Lake, Rock Garden, Rose Garden etc. are the main tourist attractions of the city. The southern part of the city has been keep vacant for future expansion of the city.

PROBLEMS OF URBANISATION IN INDIA

Although India is one of the less urbanized countries of the world with only 31.16 per cent of her population living in urban agglomerations/towns, this country is facing a serious crisis of urban growth at the present time. Whereas urbanisation has been an instrument of economic, social and political progress, it has led to serious socio-economic problems. The sheer magnitude of the urban population, haphazard and unplanned growth of urban areas, and a desperate lack of infrastructure are the main causes of such a situation. The rapid growth of urban population both natural and through migration, has put heavy pressure on public utilities like housing, sanitation, transport, water, electricity, health, education and so on. Poverty, unemployment and under employment among the rural immigrants, beggary, thefts, dacoities, burglaries and other social evils are on rampage. Urban sprawl is rapidly encroaching the precious agricultural land. The urban population of India had already crossed the 377 million mark by 2011 which is more than the total population of U.S.A., third most populous country of the world after China and India. By 2030, more than 50 per cent of India's population is expected to live in urban areas. Following problems need to be highlighted.

1. Urban Sprawl

Most cities of India are growing at a rapid pace, both with respect to population and area. This is known as urban sprawl which creates a large number of problems. These problems have already been discussed in this chapter and need not be repeated.

2. Overcrowding

Overcrowding is a situation in which too many people live in too little space. Overcrowding is a logical consequence of over-population in urban areas. It is naturally expected that cities having a large size of population squeezed in a small space must suffer from overcrowding. This is well exhibited by almost all the big cities of India. For example, Mumbai has one-sixth of an acre open space per thousand population though four acres is the suggested standard by the Master Plan of Greater Mumbai. Metropolitan cities of India are overcrowded both in 'absolute' and 'relative' terms.

Absolute in the sense that these cities have a real high density of population; relative in the sense that even if the densities are not very high the problem of providing services and other facilities to the city dwellers makes it so. Delhi has a population density of 11,297 persons per sq km (Census 2011) which is the highest in India. This is the overall population density for the National Capital Territory of Delhi. Population density in central part of Delhi could be much higher. This leads to tremendous pressure on infrastructural facilities like housing, electricity, water, transport, employment, etc. Efforts to decongest Delhi by developing ring towns has not met with the required success.

3. Housing

Overcrowding leads to a chronic problem of shortage of houses in urban areas. This problem is specifically more acute in those urban areas where there is large influx of unemployed or underemployed immigrants who have no place to live in when they enter cities/towns from the surrounding areas. An Indian Sample Survey in 1959 indicated that 44 per cent of urban households (as compared to 34 per cent of rural families) occupied one room or less. In larger cities the proportion of families occupying one room or less was as high as 67 per cent. (Roy Turner, 1962). Moreover, the current rate of housing construction is very slow which makes the problem further complicated. Indian cities require annually about 2.5 million new devellings but less than 15 per cent of the requirement is being constructed.

As per 2011 Census figures, there are 110.1 million houses for a total urban population of over 377 million which means that nearly four persons live in one house. Only 68.5 per cent of the total houses are in good condition and remaining are just livable or dilapidated. **Table 13.11** shows that about two-thirds of the houses are just one room or two room dwellings, many of them without a kitchen or a bathroom. The table also shows that the percentage of houses decreases with the increase in number of rooms.

Several factors are responsible for the above mentioned sad state of affairs with respect to housing problems faced by the urban people. The major factors are shortage of land, building materials and financial resources, inadequate expansion of pubic utilities into sub-urban areas, poverty and unemployment of urban immigrants, strong caste and family ties and lack of adequate transportation to sub-urban areas where most of the vacant land for new construction is located.

TABLE 13.11. Households by Number of Dwelling Rooms

Size of houses	Percentage of the total houses
1. No exclusive room	3.1
2. One room	32.1
3. Two rooms	30.6
4. Three rooms	18.4
5. Four rooms	9.3
6. Five room	3.2
7. Six rooms and above	3.3
Total	100.0

Source : Census of India 2011. Tables on Houses, Household Amenities and Asses, Series 1, p. XIV.

4. Unemployment

The problem of unemployment is no less serious than the problem of housing mentioned above. Urban unemployment in India is estimated at 15 to 25 per cent of the labour force. This percentage is even higher among the educated people. It is estimated that about half of all educated urban unemployed are concentrated in four metropolitan cities (Delhi, Mumbai, Kolkata, Chennai). Furthermore, although urban incomes are higher than the rural incomes, they are appallingly low in view of high cost of living in urban areas.

One of the major causes of urban unemployment is the large scale influx of people from rural to urban areas. Rural-urban migration has been continuing for a pretty long time but it has not always been as great a problem as it is today. The general poverty among the rural people pushes them out to urban areas to migrate in search of livelihood and in the hope of a better living. But the growth of economic opportunities fail to keep pace with the quantum of immigration. The limited capacity of urban areas could not create enough employment opportunities and absorb the rapid growth of the urban labour force. Efforts made by the central and the state governments to create

employment opportunities in rural areas and to check the large scale rural-urban migration have not met with much success.

5. Slums and Squatters

Slums and squatter settlements grow due to unchecked, unplanned and haphazard growth of city and also due to low income levels of the city dwellers. This creates many problems which have already discussed in this chapter.

6. Transport

With traffic bottlenecks and traffic congestion, almost all cities and towns of India are suffering from acute form of transport problem. Transport problems increase and become more complex as the town grows in size. With its growth, the town performs varied and complex functions and more people travel to work or shop. As the town becomes larger, even people living within the built-up area have to travel by car or bus to cross the town and outsiders naturally bring their cars or travel by public transport. Wherever trade is important, commercial vehicles such as vans and trucks will make problem of traffic more complicated.

Since most of the commercial activities of the towns are concentrated in the Central Business District (C.B.D.), the centres are areas of greatest congestion. However, other parts of the town are not free from traffic congestion. Such areas include the roads leading to factories, offices, schools, etc., which will be thronged with people in morning and evening; minor shopping centres which grow up in the suburbs; sporting arenas, entertainment districts which will be busy at night, roads leading to residential and dormitory towns which will be busy when commuters flock to the cities in the morning to work and return home in the evenings. Such congestion becomes greater when the centre is built up in tall skyscraper blocks whose offices sometimes employ thousands of workers, because at the end of the office hours everyone leaves the building within a short span of time to make his way home. This puts tremendous pressure on public transport and causes journeys to take much longer period than they normally would. In most cities the rush hour or peak traffic hour lasts for about two hours and during that period buses and trains are crammed to capacity, roads are overcrowded with vehicles and the movement of traffic becomes very slow.

In other towns, the narrowness of the streets, which were built long before the motorised transport and lack of parking facilities are the main cause of congestion. Cars may be parked along the edges of the roads restricting movement to a narrow lane and the multiplicity of narrow streets, sharp corners and waits to turn into lanes of traffic may slow down the movement and thus create even greater congestion.

The traffic scenario in almost all the Indian cities presents a pathetic picture with Mumbai still having the best city transport system and Chennai, Ahmedabad and Pune being reasonably well served by local transport system. In all other cities, if one does not own a personal vehicle, great hardship is experienced in moving about in the city. Apart from that, the level of incomes and affordability of Indian masses is very low and the citizens are not able to pay an economic fare for use of public transport system. Therefore, all city bus services sustain such heavy losses that they cannot really expand or even maintain a fleet adequately to meet the city needs. Moreover, mixture of vehicles causes uncontrollable chaos on the roads. Free movement of stray cattle and domestic animals on the roads adds to traffic problems and often cause accidents. Heavy traffic and congestion leads to slow movement of traffic, fuel wastage environmental pollution and loss of precious time.

A study of traffic problem in Delhi will aquant us to traffic scenario in the rest of urban India. Already there are more than 82 lakh vehicles on Delhi road (2014). The road length, however has not increased proportionately. The road length per vehicle was 3 km in 1971 which reduced to less than 0.2 km in 2014. Introduction of metro rail eased traffic congestion to begin with but the number of metro rail users is far out pacing the facilities which this mode of transportation is able to provide.

Urban planners say that by 2021, going in a car will take longer time than walking. The guidelines for Delhi Master Plan 2021, allowing mixed land use, multi-storeyed structures and regularisation of 24 industrial estates will add to the city's already congested roads. Disturbing trends have also been indicated in the Status Report for Delhi, 2021 prepared by the Union Ministry of Environment and Forests. Planning Department of Delhi Government also States that despite roads occupying 21 per cent of the total area of the city, the increase of traffic on arterial roads is resulting in lower speeds, congestion, intersection delays and higher pollution level during peak hours.

Similar conditions prevail in most of the Indian cities. In Kolkata, metro rail and Vivekanand Setu were constructed to ease traffic flow. But traffic congestion in several old localities and near Haora bridge is almost a daily routine. In Ahmedabad, the speed of vehicles comes down to 5 km/hr on Gandhi Marg and several other roads due to congestion and overcrowding.

7. Water

Water is one of the most essential elements of nature to sustain life and right from the beginning of urban civilisation, sites for settlements have always been chosen keeping in view the availability of water to the inhabitants of the settlement. However, supply of water started falling short of demand as the cities grew in size and number. Today we have reached a stage where practically no city in India gets sufficient water to meet the needs of city dwellers. In many cities people get water from the municipal sources for less than half an hour every alternate day. In dry summer season, taps remain dry for days together and people are denied water supply at a time when they need it the most. The individual towns require water in larger quantities. Many small towns have no main water supply at all and depend on such sources as individual tubewells, household open wells or even rivers. Accelerated Urban Water Supply Programme (AUWSP) was launched to provide water to towns with population of less than 20,000. Keeping in view the increased demands for water by the urban population, Central Public Health and Environmental Engineering Organisation (CPHEEO) fixed 125-200 litres of water per head per day for cities with a population of more than 50,000, 100-125 litres for population between 10,000 and 50,000 and 70-100 litres for towns with a population below 10,000. The Zakaria Committee recommended the water requirement per head per day 204 litres for cities with population between 5 lakh and 2 million and 272 litres for cities with population more than 2 million. This amount of water is supposed to be used for drinking, kitchen, bathing, cloth washing, floor and vehicle washing and gardening. Sadly majority of the cities and towns do not get the recommended quantity of water. Gap in demand and supply of water in four metro cities, *viz.*, Mumbai, Kolkata, Delhi and Chennai varies from 10 to 20 per cent. The condition is still worse in small cities and towns. To meet the growing demand for water, many cities are trying to tap external sources of water supply. Mumbai draws water from neighbouring areas and from sources located as far as 125 km in the Western Ghats. Chennai uses water express trains to meet its growing demand for water. Bengaluru is located on the plateau and draws water from Cauvery river at a distance of 100 km. Water for Bengaluru has to be lifted about 700 metres with help of lifting pumps. Hyderabad depends on Nagarjuna Sagar located 137 km away. Delhi meets large part of its water requirements from Tajewala in Haryana. Water is also drawn from Ramganga as far as 180 km. Under the proposed scheme it will meet its growing requirements of water from Tehri, Renuka, and Kishau barrages.

8. Sewerage Problems

Urban areas in India are almost invariably plagued with insufficient and inefficient sewage facilities. **Not a single city in India is fully sewered.** Resource crunch faced by the municipalities and unauthorised growth of the cities are two major causes of this pathetic state of affairs. According to latest estimates, only 35-40 per cent of the urban population has the privilege of sewage system. Most of the cities have old sewerage lines which are not looked after properly. Often sewerage lines break down or they are overflowing. Most cities do not have proper arrangements for treating the sewerage waste and it is drained into a nearby river (as in Delhi) or in sea (as in Mumbai, Kolkata and Chennai), thereby polluting the water bodies.

In most Indian cities, water pipes run in close proximity to sewer lines. Any leakage leads to contamination of water which results in the spread of several water borne diseases.

9. Trash Disposal

As Indian cities grow in number and size the problem of trash disposal is assuming alarming proportions. Huge quantities of garbage produced by

our cities pose a serious health hazard. Most cites do not have proper arrangements for garbage disposal and the existing landfills are full to the brim. These landfills are hotbeds of diseases and innumerable poisons leaking into their surroundings. Wastes putrefy in the open inviting disease carrying flies and rats and a filthy, poisonous liquid, called leachate, which leaks out from below and contaminates ground water. People who live near the rotting garbage and raw sewage fall easy victims to several diseases like dysentery, malaria, plague, jaundice, diarrhoea, typhoid, etc.

10. Urban Crimes

Modern cities present a meeting point of people from different walks of life having no affinity with one another. Like other problems, the problem of crimes increases with the increase in urbanisation. In fact the increasing trend in urban crimes tends to disturb peace and tranquility of the cities and make them unsafe to live in, particularly for the women. Growing materialism, consumerism, competition in everyday life, selfishness, lavishness, appalling socio-economic disparities and rising unemployment and feeling of loneliness in the crowd are some of the primary causes responsible for alarming trends in urban crime. Not only the poor, deprived and slum dwellers take to crime; youngsters from well-to-do families also resort to crime in order to make a fast buck and for meeting requirements of a lavish life. Occasional failures in life also drag youngsters to crime. The problem of urban crime is becoming more complicated in the present day world because criminals often get protection from politicians, bureaucrats and elite class of the urban society. Some of the criminals reach high political positions by using their money and muscle power.

According to study made by Dutt and Venugopal (1983), violent urban crimes like rape, murder, kidnapping, dacoity, robbery, etc. are more pronounced in the northern-central parts of the country. Even economic crimes (like theft, cheating, breach of trust, etc.) are concentrated in the north-central region. Poverty related crimes are widespread with main concentration in the cities of Patna, Darbhanga, Gaya and Munger.

However, the latest surveys show that Mumbai and Delhi figure in 35 cities that have high crime rate. As much as 31.8 per cent of citizens in Mumbai and 30.5 per cent in Delhi have been victims of crime. Sexual assault was higher in Mumbai (3.5 per cent) as compared to Delhi (1.7 per cent). Both cities score poorly on corruption, with 22.9% in Mumbai being exposed to bribery as compared to 21% in Delhi.

11. Problem of Urban Pollution

With rapid pace of urbanisation, industries and transport systems grow rather out of proportion. These developments are primarily responsible for pollution of environment, particularly the urban environment. The problem of environmental pollution has already been discussed in details in Chapter 9 and need not be repeated here.

We cannot think of strong India, economically, socially and culturally, when our cities remain squalor, quality of urban life declines and the urban environment is damaged beyond repair. As a matter of fact, cities comprise the backbone of economic expansion and urbanization is being seen in a positive light as an engine of economic growth and agent of socio-political transformation. The share of urban areas in the total national economic income had been estimated at 60 per cent and the per capita income was about three times higher than rural per capita income. But this is not sufficient partly, due to high cost of living and partly, because of growing economic disparity in urban areas. Rich are becoming richer and poor are becoming poorer. Several steps have been initiated to meet the challenges posed by urban crisis but with little or no success. National Commission on Urbanization (NCU) has, in its policy proposal of 1988, stressed the need for (*a*) the evolution of a spatial pattern of economic development and hierarchies of human settlements, (*b*) an optimum distribution of population between rural and urban settlements, and among towns and cities of various sizes, (*c*) distribution of economic activities in small and medium-sized growth centres, (*d*) dispersal of economic activities through the establishment of counter-magnets in the region, and (*e*) provision of minimum levels of services in urban and rural areas. The other major development programmes include (*i*) Urban Basic Services for the Poor (UBSP) programme, (*ii*) the Environmental Improvement of Urban Slums (EIUS) programme, (*iii*) the Integrated Development of Small and Medium Towns (IDSMT), (*iv*) various housing and infrastructure financing schemes of Housing and Urban Development Corporation (HUDCO), (*v*) the Mega Cities Project, and (*vi*) the Integrated Urban Poverty Eradication Programme (IUPEP). Almost all the major programmes of urban development suffer from the chronic disease of resource crunch. Right from the beginning of the planning period, urban development has been low on the development agenda with only 3-4 per cent of the total plan outlay being allocated to the urban sector. The National Commission on Urbanization recommended in 1988 that at least 8 per cent of the Plan outlay should be dedicated to urban sector.

The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was launched by the Ministry of Urban Development in 2005 for a seven year period upto March 2012 which was extended to 31st March, 2014. The components under the sub-mission Urban Infrastructure and Governance (UIG) include urban renewal, water supply (including desalination plants), sanitation, sewage and solid waste management, urban transport, development of heritage areas and preservation of water bodies. All the selected 65 cities under the UIG component of JNNURM have prepared comprehensive city development plans (CDPs). The Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT) is a subcomponent of the JNNURM for development of infrastructure facilities in all towns and cities other than the 65 Million cities under UIG. Proposals for bus rapid transit system (BRTS) were approved for Ahmedabad, Bhopal, Indore, Jaipur, Pune-Pimpri, Chhindwara, Rajkot, Surat, Vijayawada, Visakhapatnam, Kolkata, Naya Raipur and Hubli-Dharwar. Metro-rail has been approved for a number of large cities and the work of the metro rail projects in such cities are at various stages of construction.

REFERENCES

Adams R, Mc. C., (1968), *The Evolution of Urban Society,* Chicago University, Chicago.

Ahmed, E. (1952) : "Rural Settlement Types in Uttar Pradesh", Annals. Assoc. of American Geographers, Vol. 42, pp. 223-246.

Ahmed E. (1954), *Geographical Essays in India,* Patna.

Alam, S.M. (1966), *Hyderabad-Secundarabad (Twin Cities)* : A Study in Urban Geography, Allied Publishers, Bombay.

Bala, Raj (1986) : *Trends in Urbanization in India,* Rawat Publications, Jaipur.

Berry, B.J.L. (1970) : *Geographical Perspective on Urban Systems,* U.S.A.

Berry, B.J.L. and Spodek, H. : "Comparative Ecologies of Large Indian cities", *Economic Geography,* Vol. 47 (suppl.), pp. 266-285.

Bose, A. (1973) : *Studies in India's Urbanization,* Tata McGraw Hill Publishing Co. Bombay.

Bose, Ashish (1980) : *India's Urbanisation 1901-2001,* Tata McGraw Hill, New Delhi.

Bose, N.K. (1965) : Calcutta : A premature Metropolis, *Scientific American,* Sept., 1965.

Breese, G. (1966) : *Urbanization in Newly Developing Countries,* Prentice Hall.

Brush, J.E. : "The Spatial Patterns of Population in Indian Cities "*Geographical Review*", Vol. 587, 1968, pp. 362-391.

Carter, Harold (1975) : *The Study of Urban Geography,* Edward Arnold, London.

Census of India 2011, *Housing Stock, Amenities and Assets in Slums,* Tables Based on Housing and Housing Census Series 1.

Census of India 2011, *Provisional Population Totals,* Paper 1, of 2011 India, Series 1.

Census of India 2011, *Provisional Population Totals,* Paper 2, Volume 1 of 2011, Rural-Urban Distribution, India Series 1.

Census of India 2011, *Tables on Houses, Household Amenities and Assets,* India Series 2.

Doxiadis, C.A. (1968) : *Ekistics, An Introduction to Science of Human Settlements,* Oxford University Press, New York.

Dube, K.K. and A.K. Singh (ed.) (1988) : *Urban Environment in India,* Inter India Publications, New Delhi.

Economic Survey 2013-14, Govt. of India, Ministry of Finance.

Faweett, C.B. (1932) : "*Distribution of Urban Population in Great Britain, 1931*", Geographical Journal, 79,100-116.

Finch, V.C. *et al.* (1977) : *Elements of Geography, Physical and Cultural,* McGraw Hill, New Delhi.

Fukutake, T. (1967) : *Asian Rural Society,* Seattle.

Geddes, P. (1957), *City in Evolution,* London.

Gibson, M.S. and Langstaff, M.J. (1982) : *An Introduction to Urban Renewal,* Hutchinson, London.

Gosal, Gurdev Singh (1999) (ed) : *4th Survey of Research in Geography,* ICSSR, New Delhi.

Gottmann, J. (1964) : *Megalopolis : The Urbanized North-eastern Seaboard of United States,* The MIT Press, Cambridge.

Harris, C.D. (1943) : "*A Functional Classification of Cities in the United States*", Geographical Review, 33, 86-99.

India 2014 : *A Reference Annual,* Publications Division, Ministry of Information and Broadcasting, Government of India, New Delhi.

India : Town and Country Planning Organisation, "Land Use Pattern of India's Cities and Towns", *Urban and Rural Thought,* Vol. II, 1965, pp. 188-190.

James, H.E. (1930) : *Urban Geography of India,* Bulletin of Geographical Society of Philadelphia, 28, 101-122.

Janki, V.A., Sayed, Z.A. (1962) : *The Geography of Padra Town,* Baroda University.

Jonston, R.J. (1985) : *Urban Geography, City Structure in Progress in Human Geography.*

Kaushik, S.D. (1959) : "*Types of Human Settlements in Jaunsar Himalaya*", Geographical Review of India, 21, 1-18.

Kohn, C.F. (1954) : "Settlement Geography" In: Jones, P.E. and Jones, C.F. (eds.) : *American Geography—Inventory and Prospectus,* Syracuse University Press.

Krishan, Gopal and Singh, Nina (1996) : *Urbanization—Emerging Scenario and New Challenges,* In: Kulwant Singh and Florian Steinberg (ed.), *Urban India in Crisis,* New Age International Ltd., New Delhi.

Kundu, A. (1992) : *Urban Development and Urban Research in India,* Khanna Publishers, New Delhi.

Lakshman, T.K. and Narayan, B.K. (1984) (eds) : *Rural Development in India,* Himalayan Publishing House, Mumbai.

Lewis, J.P. (1969) : *Quiet Crisis in India,* Washington, D.C.

Manzoor Alam, S. and Fatima Ali (ed) (1987) : *Poverty in Metropolitan Cities,* Concept Publishing Co., New Delhi.

Maurya S.D. (1989) : *Urbanization and Environmental Problems,* Chugh Publications, Allahabad.

Maurya, S.D. (2012) : *Human Geography,* Prayag Pustak Bhawan, Allahabad.

Mayer, Harold M and Kohn Clyde, F. (1967) : *Readings in Urban Geography,* University of Chicago, Chicago.

Mill, E.S. (1980) : *Three Essays on Urbanization in India,* Princeton University (Mimeo).

Misra, R.P. (1978) : *Million Cities of India,* Vikas Publishing House, Pvt. Ltd. New Delhi.

Mitra, A. (1973) : *Functional Classification of Towns,* Institute of Economic Growth.

Mookherjee, D. *et al.* (1973) : *Urbanization in Developing Economy, Indian Perspectives and Patterns,* Berkelay.

Mukherji, Shekhar, (2000) : Distress Migration and Urban Decay in India : Phenomena, Process and Planning Strategies, paper presented in International conference on Land-use change, Environment and Sustainable Development, Dept. of Geography, Banaras Hindu University, Varanasi.

Muttiah, S. *et al.* (eds.) (1987) : *A Social and Economic Atlas of India,* Oxford University Press, New Delhi.

Nagpaul, Hans (1996) : *Modernization and Urbanization in India—Problems and Issues,* Rawat Publications, Jaipur.

Nangia, S. (1976) : *Delhi Metropolitan Regions,* K.B. Publications, New Delhi.

National Institute of Urban Affairs (1988) : *State of India's Urbanization,* New Delhi.

Neale, C. (1986) : *Developing Rural India,* Riverdale, AM.

Negi, B.S. : *Rural Geography,* Kedar Nath Ram Nath, Meerut.

Nelson, H.J. (1955) : "*A Service Classification of American Cities*", Economic Geography, 3, 189-210.

Piggo, S. (1950) : *Pre-Historic India,* Penguin Books.

Pownall, L.L. (1953) : "*Functions of New Zealand Towns*", A.A.A.G. 43/4, 332-350.

Prakasa Rao, V.L.S. (1964) : *Towns of Mysore State,* Asia Publishing House, Delhi.

Prakasa Rao, V.L.S. (1983) : *Urbanization in India : Spatial Dimensions,* Concept Publishing Co., New Delhi.

Premi, M.K. (1986) : *India's Urban Scene and its Future Implications.* Demography India, 20.

Rafiullah, S.M. (1965) : '*A New Approach to the Functional Classification of Towns*'. The Geographer, Vol. XII.

Raza, M,. *et al.* (1979) : *Spatial Organization and Land Utilization.* In: India in R.P. Misra and K.V. Sundaram (eds.) Rural Area Development, Perspective and Approaches, Sterling New Delhi.

Rees, H. (1942-44) : *A Functional Classification of Towns,* Journal of Manchester Geographical Society, 52, 26-32.

Ramachandran, R. (1995) : *Urbanization and Urban Systems in India,* Oxford University Press, New Delhi.

Sharma, R.C. (1975) : *Settlement Geography of Indian Desert,* Kumar Brothers, New Delhi.

Siddhartha, K. and Mukherjee, S. (2001) : *Cities, Urbanization and Urban Systems,* Kisalaya Publications, New Delhi.

Singer, M. (ed.) (1969) : *Traditional India : Structure and Change,* Philadelphia.

Singh, K.N. (1972) : *An Approach to the Study of the Morphology of the Indian Village in Rural Settlements in Monsoon Asia,* NGSI, Varanasi, pp. 204-14.

Singh, Kulwant and Steinberg Florian (ed) (1996) : *Urban India in Crisis,* New Age International Limited Publishers, New Delhi.

Singh L.R. (2003) : *Fundamentals of Human Geography,* Sharda Pustak Bhawan, Allahabad.

Singh, O.P. (1969) : *A Study of Central Places in Uttar Pradesh,* Varanasi.

Singh, R.B. (1975) : *Rajput Clan Settlements in Varanasi Distt.* N.G.S.I. Varanasi Pub. No. 12.

Singh R.L. (1955) : *Banaras* : A Study in Urban Geography, Nand Kishore Brothers, Banaras.

Singh R.L. (1961) : *Meaning, Objectives and Scope of Settlement Geography,* National Geographical Journal of India, 7, 12.

Singh, R.L. *et al.* (1975) : *Readings in Rural Settlement Geography,* National Geog. Society of India, Varanasi.

Singh, R.L. (1985) : Slums of Allahabad : A Socio-Economic Profile, *National Geographer,* Vol. 20, No. 2, pp. 97-98.

Singh, R.Y. (1994) : *Geography of Settlements,* Rawat Publications, Jaipur.

Sinha, V.N.P. (1976) : *Chotanagpur Plateau—A Study in Settlement Geography.*

Sivaramakrishnan, K.C. (1978) : '*Indian Urban Scene*', Indian Institute of Advanced Study, Shimla.

Smailies, A.E. (1962) : *The Geography of Towns,* Hutchinson University Library, London.

Smailies, A.E. (1973) : *Indian City Structure, Urban Geography Proceedings,* Varanasi Symposium, pp. 50-59.

Smith, A.E. (1965) : *Methods and Purpose in Functional Town Classification,* A.A.A.G. 55/3, 39-48.

Sovani, N.V. (1966) : *Urbanization and Urban India,* Asia Publishing House, Mumbai.

Spate, O.H.K and Ahmad, E., "Five Cities of the Gangetic Plain" *Geographical Review,* Vol. 40, 1950, pp. 260-278.

Srinivas, M.N. (ed.) (1955) : *India's Villages,* Bombay.

Sunderam, V.K. (1977) : *Urban and Regional Planning in India,* Vikas Publication, New Delhi.

Taylor, G. (1949) : *Urban Geography,* Methuen, London

Tewari, Vinod K., Weinstein Jay A. and Prakasa Rao V.L.S. (1986) : *Indian Cities : Ecological Perspective,* Concept Publishing Co., New Delhi.

Thakur, V.K. (1981) : *Urbanization in Ancient India,* Abhinav Prakashan, New Delhi.

Tirtha Ranjit and Krishan Gopal (2001) : *Geography of India,* Rawat Publications, Jaipur, Ch. 7.

Turner, Roy (ed.) (1962) : *India's Urban Future,* University of California Press, Berkeley/Los Angles.

Regional Development and Planning

DEVELOPMENT

Development implies overall improvement in economic, social and political conditions of a society. Recently one more dimension of conservation and improvement of environment has been added to the overall gamut of development. The quest for development and strategies for development could be related to :

(*i*) Rapidly increasing population and pressure on physical resources.

(*ii*) Growing demand for food and other necessities of life.

(*iii*) Quest for improving the general standards of living of the people specifically in the less developed parts of the world.

(*iv*) Decolonisation of large number of countries and their consequent emergence as independent countries. For example, India become an independent country in 1947, after which a lot of development has taken place.

(*v*) Reconstruction of former colonies that have become now independent sovereign states.

(*vi*) Regional disparities at the national and international levels.

The concept of development is not only area specific but also time specific. It means that concept of development changes from place to place and from time to time. Thus development process belies any permanent conceptualization. Different disciplines like economics, sociology, political science, history, geography, etc. often deal with development from their own point of view.

The largest contribution to the study of development has been made by economists. An economist looks at development in terms of economic progress. Economic progress is expressed in terms of enhancement in general productivity level, per capita income, efficiency of a worker, overall improvement in quality of life in general and elimination of poverty in particular. As such the economists have met with greater success in the formulation of theories and models and have earned greater acceptability in policy formulation.

Sociologists, on the other hand, believe that economic development was of little relevance in the absence of social development and social development must precede economic development. The main focus of social development is the development of people in terms of their mental relations and the institutional and structural changes in the society. The two most significant parameters of measuring social development are quality of life (*i.e.* social harmony and social cohesion) and social justice.

Political scientist's, conceptualization of development has its focus on political context. This is justified in view of the increasing role of government not only as promoter but also as the principal planner. Thus, power structure holds the pivotal position in political scientists conceptualization of development.

A historian's concept of development lies in the formulation of theories and models that may explain economic, social and political history. Thus, a historian's focus is upon temporal changes in economic, social and political institutes and models, if any, would be temporal models.

Geography is an integrating discipline and offers a unique synthesis of development of natural and human resources. As such a geographer's conceptualization of development is much more comprehensive. It considers economic progress, social advancement, political development and environmental preservation.

Figure 14.1 gives an idea of geographer's conceptualization of the process of development. The

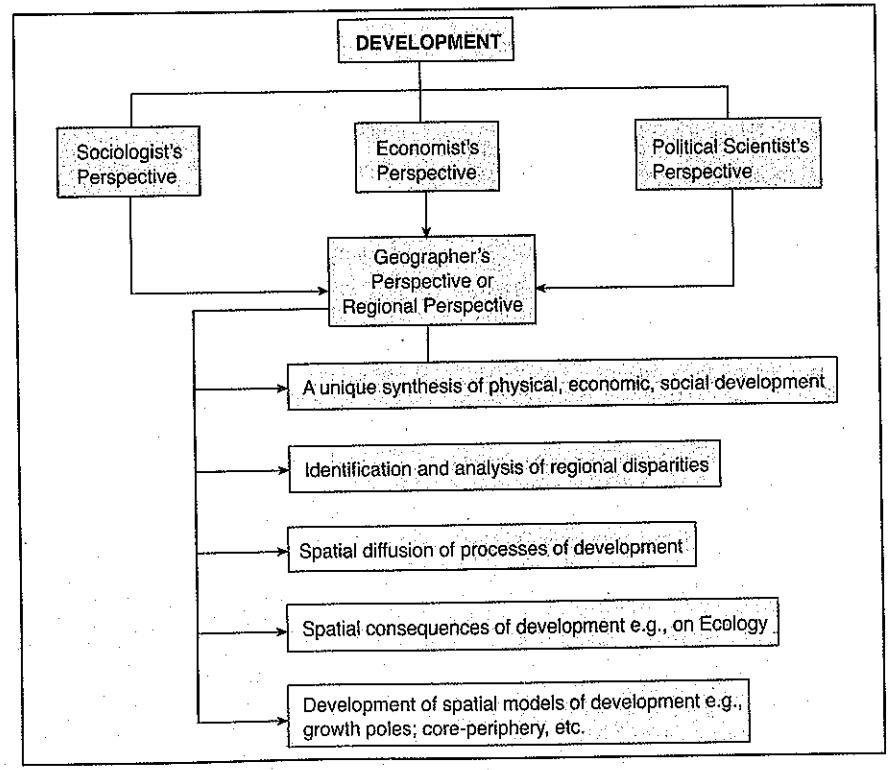


FIG. 14.1. Development

figure shows that each social science such as sociology, economics political science, geography, etc. has its own perception of the process of development. However, geographer's concept offers a unique synthesis of physical, social and economic development. The figure also shows four basic steps in geographic analysis of regional development. These are (*i*) identification and analysis of regional disparities, (*ii*) spatial diffusion of process of development, (*iii*) spatial consequences of development *e.g.* on ecology and (*iv*) development of spatial models of development *e.g.* growth poles, core-periphery, etc.

In the last quarter of 20th century, a growing focus on the behavioural aspect of development has been observed. This is in tune with the behavioural revolution in geography. This thrust was the outcome of geographer's quest for role of human factor in development, more specifically human behaviour.

What is Planning ?

Planning has been defined as "the process of thinking through and implementing a set of appropriate actions to achieve some goals." Generally the goals are economic prosperity and social development. Thus planning is a device with the help of which we can achieve socio-economic prosperity by making optimum use of natural and human resources available to us. In other words, it a process of socio-economic development which can make a place for good living and can help in keeping the ecology and environment in a healthy condition. According to the Planning Commission of India, "Planning involves the acceptance of a clearly defined system of objectives in terms of which to frame overall policies. It also involves the formation of a strategy for promoting the realisation of ends defined. Planing is essentially an attempt at working out a rational solution of problems, an attempt to coordinate means and ends; it is then different from traditional hit and miss methods by which reforms and reconstruction are often undertaken." (First Year Plan, p. 7). In fact, planning is a *process of human thought and action based upon that thought.*

Planning India

The foundation of planning in India was laid much before Independence during the heat of India's freedom struggle by the stalwards of Indian thought and freedom movement like Mahatma Gandhi, Subhash Chandra Bose and Jawaharlal Nehru. The setting up of National Planning Committee in 1938 by the then Indian National Congress marks the beginning of thought for planning in pre-Independence era. As a consequences of this initiative, regular planning was started immediately after Independence.

The Planning Commission was set up by a Resolution of the Government of India in March 1951 in pursuance of declared objectives of the Government to promote a rapid rise in the standard of living of the people by efficient exploitation of the resources of the country, increasing production and offering opportunities to all for employment in the services of the community.

The First Five Year Plan was launched in 1951, *i.e.* within 4 years of Independence. Three basic principles of planning policy of India as enshrined in the country's constitution are as follows :

(*a*) that the citizens, men and women, equally, have the right to adequate means of livelihood.

(*b*) that the ownership and control of material resources of community are so distributed as best to serve the common good; and

(*c*) that the operation of economic system does not result in the concentration of wealth and means of production in a few hands to the detriment of the common man.

First Five Year Plan (1950-51 to 1960-61). Regional and national problems became glaring during the initial phase of planning in India. This plan set out following five objectives for accomplishment :

(*a*) increasing the national income and improving the average standard of living of the people;

(*b*) increasing the pace of industrialisation of both the basic and heavy industry sector;

(*c*) increasing employment potential of various sectors;

(*d*) narrowing down both vertical and horizontal inequalities; and

(*e*) achieving self-reliance so as minimise dependence on foreign aid.

Since the First Five Year Plan was initiated immediately after Independence and partition of the Indian subcontinent, India faced the following serious problems in the beginning of this plan :

(*i*) resettlement of immigrants from Pakistan due to partition of the country in 1947.

(*ii*) acute shortage of food resulting in large scale import of foodgrains.

(*iii*) Checking the increasing rate of inflation.

Also there was immediate need to reduce the regional imbalances in economy caused by World War II and partition of the country.

Keeping in view above scenario, new towns were planned and old towns were expanded to rehabilitate immigrants from Pakistan. Top priority was given to irrigation and agriculture and establishment of power projects in the form of multi-purpose projects. About 44.6 per cent of the total outlay of ₹ 2,069 crore in the public sector (later raised to ₹ 2,378 crore) was allocated for this purpose. The Plan aimed at increasing the rate of investment form 5 to about 7 per cent of the national income.

The national level problems were very serious and not much attention was paid to regional planning. But all the states were divided into five broad divisions which is considered to be the first step towards regional planning. Although regions were ignored in broad outlines of planning, yet problem areas like Damodar Valley were identified and importance of resource planning at the regional level was recognised.

Second Five Year Plan (1956-57 to 1960-61). The efforts made during the First Five Year Plan helped the country to tide over the economic crisis and increase agricultural production to some extent. Inflation rate was also controlled partially. Therefore, it was felt that industries should be given priority over agriculture. The plan aimed at promoting a pattern of development which would lead to the establishment of a socialistic pattern of society. It aimed at :

(*i*) an increase of 25 per cent in the national income;

(*ii*) rapid industrialization with particular emphasis on the development of basic and heavy industries;

(*iii*) large expansion of employment opportunities;

(*iv*) reduction of inequalities in income and wealth and a more even distribution of economic power.

The Plan aimed at increasing the rate of investment from about 7 per cent of the national income to 11 per cent by 1960-61. It laid emphasis on increasing the production of iron and steel, heavy chemicals including nitrogenous fertilizers and development of heavy engineering and machine building industry.

Third Five Year Plan (1960-61 to 1965-66). The first two Five Year Plans helped in generating the required infrastructure and Indian economy entered the "*take off stage*" at the beginning of Third Five Year Plan. Therefore this Plan aimed at securing self-reliance, self-generating economy and self-sustained growth. Its immediate objectives were to :

(*i*) secure over five per cent per annum increase in national income and at a same time ensure a pattern of investment that could sustain this rate of growth in the subsequent plan periods;

(*ii*) achieve sell sufficiency in food grains and also increase production of other crops to meet requirements of industry and export;

(*iii*) expand basic industries like steel, chemicals, fuel and power and establish machine building capacity so that requirements of further industrialization could be met within a period of about 10 years mainly from the country's own resources;

(*iv*) fully utilize the manpower resources and increase substantially the employment opportunities;

(*v*) establish progressively greater quality of opportunity and bring about reduction in disparities of income and wealth and more even distribution of economic power.

The Third Five Year Plan was *shifted from development to defence at a later stage due to invasion of India by China in 1962 and India's war with Pakistan in 1965.*

Annual Plans (1966-67 to 67 to 1968-69). Many problems cropped up by the end of the Third Five Year Plan which delayed the finalization of the Fourth Five Year Plan. These problems were : (*i*)

Indo-Pakistan conflict in 1965; (*ii*) two successive years of severe drought (1965-66 and 1966-67); (*iii*) devaluation of the currency; (*iv*) general rise in prices; and (*v*) erosion of resources available for plan purposes. Consequently, three annual plans from 1966-67 to 1968-69 were prepared. Although annual plans were prepared, there was no overall five-year framework and the period of 1966-67 to 1968-69 between the Third and the Fourth Five Year Plans is termed as ***"Plan Holiday."***

Fourth Five Year Plan (1969-74). The primary aim of this plan was to accelerate the tempo of development and reduce the fluctuations in agricultural production as well as the impact of uncertainties of foreign aid. It sought to raise the standards of living through programmes designed to promote equality and social justice. The Plan laid particular emphasis on improving the conditions of the less privileged and weaker sections by providing facilities of employment and education. Provision was also made for reducing concentration of wealth, income and economic power to promote equity. The average annual growth rate was 3.4 per cent against the target of 5.7 per cent.

Fifth Five Year Plan (1974-79). This plan was prepared against the backdrop of severe inflationary pressure. Its two primary aims were (*i*) removal of poverty and (*ii*) attainment of self-reliance through promotion of higher rate of growth, better distribution of income and very significant set up in domestic rate of saving. Efforts were mode to develop backward areas through the cooperation of the centre and state governments. The backward areas were divided into two classes *viz.* (*a*) areas where conditions of physical geography such as relief, climate etc. were not much suited for human habitation and where people of typical culture were living and (*b*) economically backward areas where land man ratio was low, infrastructure was poor or resources for development ever scarce. Separate plans were prepared for both types of areas. This led to the development of concept of area specific planning and special programmes were chalked out for drought affected hilly areas and for areas inhabited by the tribal people. Medium and minor irrigation projects were launched to meet the requirements of drought affect areas. Special plan was also prepared for afforestation, soil conservation, orchards, livestock diary farming, road construction and drinking water. The plan targeted an annual growth rate of 5.5 per cent but actual growth rate was 5.0 per cent.

Four Annual Plans pertaining to this plan were completed. Then there was change of guards and Government headed by Janata Party replaced the Congress led Government at the centre. The new Government at the centre decided to end the Fifth Plan period with the close the Annual Plan 1978-79.

Sixth Five Year Plan. There are two different types of Sixth Plan in the planning history of India. One of the Sixth Five Year (1978-83) Plans was prepared by the Government led by Janata Party which sought to reconcile the objectives of higher production with greater opportunity for employment. Provision was made for increasing employment opportunities in agriculture and allied activities, incentives for small scale and cottage industries and increasing income of low income groups.

As a result of 1980 general election, Janata Party was defeated and Congress (I) came back to power. The new government led by Congress (I) presented its own Sixth Five Year Plan (1980-85). The thrust of this plan was to expand the economic base and to reduce poverty. This was to be achieved by strengthening the agricultural and industrial base. Stress was laid on tackling inter-related problems through a systematic approach with greater management, efficiency and intensive monitoring in all sectors and active involvement of people in formulating specific schemes of development at local level and securing their speedy and effective implementation.

The actual expenditure in this plan stood at ₹ 1,09,291.7 crore (current price) at against the envisaged total public sector outlay of ₹ 97,500 crore (1979-80 prices) accounting for a 12 per cent increase in nominal terms. The achieved annual growth rate of 5.4 per cent was higher than the targeted annual growth rate of 5.2 per cent.

Seventh Five Year Plan (1985-90). This plan emphasized on policies and programmes, which aimed at rapid growth in food grains production, increase in employment opportunities and productivity within the framework of basic tenents of planning, namely growth, modernization, self-reliance and social justice. Production of food grains increased by 3.23 per cent compared to a long-term growth rate of 2.68 per cent between 1967-68 and 1988-89. To reduce unemployment and poverty, special programmes like ***Jawahar Rozgar Yojna*** were launched in addition to the existing programmes. Special attention was paid to small scale and food processing industries. The Gross Domestic Product (GDP) grew at an average rate of 5.8 per cent exceeding the targetted growth rate of by 0.8 per cent.

Annual Plans. The Eighth Five Year Plan could not take-off due to fast changing political situation at the centre. The new Government at the centre decided that the Eighth Five Year Plan would commence on 1st April, 1992 and that 1990-91 and 1991-92 would be treated and separate Annual Plans. The basic of the Annual Plans was on maximization of employment and social transformation.

Eighth Five Year Plan (1992-97). This plan was prepared in the backdrop of worsening inflation and Balance of Payments position. The Plan aimed at an average annual growth rate of 5.6 per cent and an average industrial growth rate of about 7.5 per cent. The salient features of this plan were (*a*) a faster economic growth, (*b*) a faster growth of manufacturing, agriculture and allied sectors, and (*c*) significant growth in exports and imports. Following programmes were initiated to achieve these goals :

(*i*) increase employment opportunities and achieve full employment by the end of 20th century;

(*ii*) control population growth with the cooperation of the people;

(*iii*) universalization of primary education and spread literacy among the people in age group 15-35 years;

(*iv*) providing drinking water and primary health services;

(*v*) development and diversification of agriculture for self-reliance in food grains and for export of agricultural commodities;

(*vi*) strengthen the infrastructure (power, transport, communication, irrigation), to sustain the tempo of growth.

The actual average annual growth rate was 6.8 per cent against the envisaged growth rate of 5.6 per cent.

Ninth Five Year Plan (1997-2002). The aim of this plan was to achieve the targeted GDP growth rate of seven per cent per annum and there was emphasis on seven identified **Basic Minimum Services (BMS).** These include (*i*) provision of safe drinking water; (*ii*) primary health services, (*iii*) universalization of primary education, (*iv*) public housing assistance to shelterless poor families, (*v*) nutritional support to children, (*vi*) connectivity of all villages and habitations, and (*vii*) streamlining the public distribution system with a focus on the poor. The plan also aimed at reduction in revenue deficit through a combination of improved revenue collections and control of inessential expenditures. Following steps were proposed to achieve the targets set in this plan :

(*i*) priority to agriculture and rural development for eradication of poverty and generating adequate employment;

(*ii*) accelerating the growth rate of economy with stable price;

(*iii*) ensuring food and nutrition security for all; particularly the vulnerable sections of society;

(*iv*) providing basic minimum services of safe drinking water, primary health care, universal primary education, shelter and road conductivity to all in a time bound manner;

(*v*) containing growth rate of population;

(*vi*) ensuring environmental stability;

(*vii*) empowering women, backward classes (scheduled castes, scheduled tribes, etc.) people belonging to minority communities as agents of economic and social change;

(*viii*) promoting and developing people's institutions like Panchayati Raj Institution, Cooperatives and self-help groups;

(*ix*) strengthening efforts to build self-reliance;

(*x*) strengthening foreign exchange.

Tenth Five Year Plan (2002-2007). This plan was approved by the National Development Council (NDC) which envisaged to double the per capita income in ten years and achieve a growth rate of eight per cent of GDP per annum. The plan also aimed at harnessing the benefits of growth to improve the quality of life by setting the following targets :

(*i*) Reduction in poverty rates from 26 per cent to 21 per cent by 2007.

(*ii*) Reduction in decadal population growth from 21.3 per cent in 1991-2001 to 16.2 per cent in 2001-11.

(*iii*) Growth in gainful employment, at least, to keep pace with addition to the labour force.

(*iv*) All children to be in school by 2003 and all children to complete five years of schooling by 2007.

(*v*) Reduce gender gaps in literacy and wage rates by 50 per cent.

(*vi*) Increase literacy rate from 65 per cent in 1999-2000, to 75 per cent in 2007.

(*vii*) Provide potable drinking water to all villages.

(*viii*) Reduction in infant mortality rate from 72 in 1999 to 45 in 2007.

(*ix*) Reduction in mortality ratio from 4 in 1979-2000 to 2 in 2007.

(*x*) Increase in Forest/Tree cover from 19 per cent in 1999-2000 to 25 per cent in 2007.

(*xi*) Cleaning the major polluted rivers.

The growth rate during this plan was 7.7 per cent against the target of 8 per cent.

Eleventh Five Year Plan (2007-2012). This plan provided a comprehensive strategy for inclusive development, building on growing strength of economy, while also addressing the weaknesses that have surfaced. It set a target for 9 per cent growth in five year period with acceleration during the period to reach 10 per cent by the end of the plan. It also covered 26 major indices of performance relating to poverty, health, education, women and children, infrastructure and environment.

The new priorities outlined in the plan relate to reviving dynamism in agriculture and building the necessary supportive infrastructure in rural areas, expanding access to health and education, especially in rural areas, undertaking programs for improving living conditions for the weaker sections and for improving their access to economic opportunity. Major thrust for infrastructure development was also included.

The plan provided a major expansion in irrigation and water management for increasing agricultural production. The National Food Security Mission aimed at increasing cereal and pulses production by 20 million tons over a period of five years.

In education, it was proposed to spend more than double the amount what was spent in the tenth plan. The plan aimed at providing improved broad based health care in rural areas through the National Rural Health Mission. The *Rashtriya Swasthya Bima Yojna* provided insurance cover against illness to the population below poverty line.

The Plan improved the need for energy conservation, increasing energy efficiency, and development of renewable sources of energy.

Achievements of Five Year Plans. Although Five Year Plans have failed to achieve the fixed targets, yet the constructive role played by these plans in the socio-economic development of the country cannot be under estimated. Some of the major achievement of these plans are listed below :

1. During the period from 1950-51 to 2002-03, the national income—Net National Product (NNP) has increased 8.7 times from ₹ 1,32,367 crore to ₹ 11,56,714 crore (at 1993-94 prices) implying a compound growth rate of 4.2 per cent per annum.
2. The per capital income had increased three times from ₹ 3,687 to 10,964 (at 1993-94 prices) registering a compound growth rate of ₹ 2.1 per cent.

Table 14.1 gives the targets and actual achievements right from the First Five Year Plan to the Eleventh Five Year Plan. This table shows that the economy has performed better than the target in five of the first nine plans and even in the Second Five Year the gap was not very large. In the Third and the Fourth Five Years Plans shortfalls were due to severe drought conditions in 1965 and 1966 and the Indo-Pakistan war of 1965. The Fourth Five Year Plan experienced three consecutive years of drought (1971-73) and increase in oil prices in the international market in 1970. After the Fourth Plan, there had been a steady improvement in the growth rate of economy until the Ninth Five Year Plan when it received setback.

TABLE 14.1. Growth Performance in the Five Year Plans

(Per cent per annum)

Sl. No.	Plan	Target	Actual
1.	First Plan (1951-56)	2.1	3.60
2.	Second Plan (1956-61)	4.5	4.21
3.	Third Plan (1961-66)	5.6	2.72
4.	Fourth Plan (1969-74)	5.7	2.05
5.	Fifth Plan (1974-79)	4.4	4.83
6.	Sixth Plan (1980-85)	5.2	5.54
7.	Seventh Plan (1985-90)	5.0	6.02
8.	Eighth Plan (1992-97)	5.6	6.68
9.	Ninth Plan (1997-2002)	6.5	5.5
10.	Tenth Plan (2002-2007)	8.0	7.7
11.	Eleventh Plan (2007-2012)	9.0	—

Note : The growth targets for the first three plans were set with respect to National Income. In the Fourth Plan, it was the Net Domestic Products. In all plans thereafter, it has been the Gross Domestic Product at factor cost.

Source **:** India 2014 : A Reference Annual, p. 671.

3. Impressive industrialisation in capital goods sector through public sector.
4. Development of economic infrastructure including improvement in energy, irrigation, transport and communication.
5. Large scale diversification in international trade (both exports and imports).
6. Rise in the life expectancy from 37 years in 1951 to over 66 years in 2010.
7. Literacy rate increased from 18.33 per cent in 1951 to 74.04 per cent in 2011.
8. Development of science and technology and nuclear power for peaceful purposes.
9. Achievement of self-sufficiency in foodgrains and full food security. Per capita cereal consumption increased from 417.6 grams per day in 1971 to 468.9 grams per day in 2013. (Economic Survey 2013-14, Statistical Appendix, p. 21).

Failures of Five Year Plans. Although Five Year Plans have succeeded on many fronts and have contributed a lot to improve the living a conditions of the masses, yet these plans have failed miserably to achieve some important objectives as described briefly below :

1. Plans failed to evolve a society free from exploitation.
2. India has still not been able to evolve a society based on equity and social justice.
3. India has failed miserably to eradicate poverty. Even as late as 2011-12 as much as 21.9 per cent of the total population of India was living below poverty line. In rural areas, it was still higher at 25.7 per cent (Economic Survey 2013-14, p. 233).
4. Plans could not succeed in reducing hunger, malnutrition, unemployment, child labour and social injustice as targetted in the plans.
5. Gender discrimination still prevails and women are deprived of their fundamental rights. Sex ratio has fallen from 946 in 1951 to 940 in 2011.
6. A lot of black money has been generated and this black money is running a parallel economy in the country.
7. Not much success has been achieved to control the population growth through Five Year Plans. The benefit of economic growth is not available to the common man and big industrialists, traders and politicians are the main beneficiaries.
8. The pace of land redistribution and land reforms has been tardy which has adversely affected agricultural growth.
9. Planing has not been able to remove or even reduce—economic, social and regional inequalities.
10. Plans have failed to achieve the target of balanced regional development.

Regional Planning

As national planning is concerned with the development of the entire country, regional planning is concerned with the development of a particular

region. It is neither economic planning alone, nor physical planing alone. Instead, it is such a planning whose core area of interest lies in the synthesis of physical, social, economic, political *et al.* interests of the concerned region. Thus regional planning is a specific type of planing, based on a specific planning structure (regional system), for inducting pubic action aimed at social well being. It implies that regional planing is concerned fundamentally with the society in the context of space (Chandna, 2008 : 33). Regional planning is concerned both with space and society as both are intimately interwoven with each other and form the basis of regional planning. Regional planning is, thus, a specific type of planning, based on a specific planning structure, the primary aim of which is the well being of the society and improvement in living standard. A regional planner is supposed to reorganise or reshape the regional system in such a way that the regional plan is able to serve the society to the best. Regional planning while confining to the planning of regional space can hardly afford to overlook the economic, socio-cultural and political dimensions of the ever evolving regional organism. Right location of each of the economic activities is the main concern of a regional planner.

Principles of Regional Planning

Regional planning is guided by the following seven principles :

1. The principle of vertical unity of phenomena
2. The principle of horizontal spatial unity
3. The principle of space-time continuum
4. The principle of comprehensive development
5. The principle of community development
6. The principle of equilibrium between social desirability and economic viability
7. The principle of ecological equilibrium.

1. The Principle of Vertical Unity of Phenomena. The principle of vertical unity of phenomena means that are phenomena in a region are inter-related and no single phenomena can change independently without influencing the other phenomena. **Figure 14.2** shows that vertical phenomena consists of four different spaces. On the base is the *real physical* space relating to lithosphere, hydrosphere and atmosphere (both known and unknown). On the real physical space, lies perceived physical space, as perceived by the regional planner. It may consist of all known physical phenomena concerning lithosphere, hydrosphere and atmosphere. Above the perceived physical space lies the human space consisting of all sorts of human phenomena enamating from the demographic structure. The interaction between the physical space and the human space gives rise to economic space. **Figure 14.2** shows the economic space, the human space and the physical space get integrated with each other. It implies that we have to realize the vertical unity of all phenomena and planning for any single phenomenon independent of other phenomena will not be in the real spirit of regional planning.

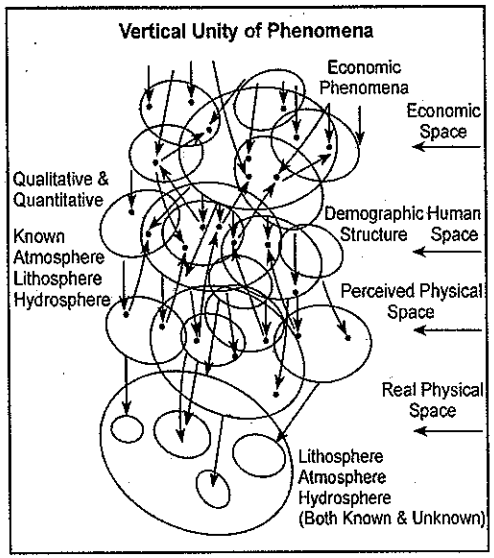


FIG. 14.2. Vertical unity of Phenomena

2. The Principle of Horizontal Spatial Unity. According to this principle, each region is a sub-system of the regional system whole. This means that different regions constituting the regional space do not exist in isolation, rather they co-exist in integration with each other as a part of the regional system whole.

The human body provides the best illustration of such an integration between sub-systems and the system. The entire human body as a whole functions

as a system, which consists of a number of sub-systems like digestive system, renal system, respiratory system, nervous system etc. Each one of them constitutes a complete system in itself and yet is a sub-system of the body whole. If something goes wrong with any of these sub-systems say the digestive system, it will affect the functioning of the entire human body, as the person may fall sick and may not be able to perform even day to day functions. (Chandna, 2008 : 50)

Similarly a region may be a complete system in itself and yet may constitute a sub-system in the regional system whole. One thing happening in a region affects the regional system whole because all the regions are integrated with the whole just as different parts of the human body are integrated with the whole body. **Figure 14.3** shows how a single regional unit gets integrated with other regional units of a nation—state and the nation-states getting integrated with the international space.

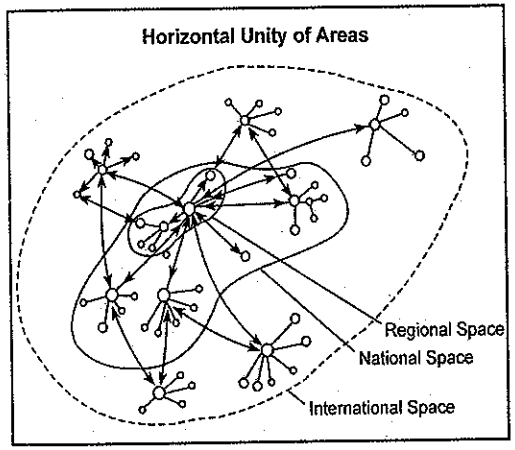


FIG. 14.3. Horizontal Unity of Areas

Thus the principle of horizontal spatial unity implies that planning for any region cannot be done in isolation from the adjoining regions within the same nation. Similarly, the planning within the national space cannot be done in isolation from planning in international space. Therefore regional planning amounts to planning in universalism.

3. The Principle of Space-time Continuum. According to this principle, spatial reality has four dimensions of which three dimensions (length, breadth and thickness) are of space and the fourth dimension is that of time. Also space and time cannot be separated from each other and time is considered as an integral part of space. A region is a living dynamic identity which operates simultaneously in the past, present and future like the human body's DNA. It uses the past experience for the present and preserves energy for the future. Therefore, the regional planner has to realise the fact that regional space is a continuously growing organic whole and the region changes through time not only in terms of space-content but also in terms of space relationships. Thus, the regional planner should be conscious of the fact that while he is planning in space, be is planning in time also.

4. The Principle of Comprehensive Development. This principle means that regional planning seeks to achieve the comprehensive development of the entire region, the regional system in its entirely. In other words, the regional planner seeks comprehensive development of all sectors of economy along with all segments of society.

5. The Principle of Community Development. This is the principle of equal opportunities to all for self development. The entire community is considered as an organic whole in which each individual is a sub-system of this whole. It is only through equal opportunities (like education, health, employment, etc.) to each individual that the whole society can be developed into community with the sense of belonging to each other.

6. The Principle of Equilibrium between Social Desirability and Economic Viability. According to this principle, the regional planner is supposed to maintain a balance between what is socially desirable and economically viable while planning for comprehensive development of all regions. This means that the regional planner has to consider the potentialities of the regional economy and society while creating hospitality in the regions of human occupance.

7. The Principle of Ecological Equilibrium. This principle seeks adherence to the maintenance of ecological balance. The regional planner has to assure the sustainability of ecology and environment. It means that he has to develop the regional space at his disposal only within the framework of ecological

equilibrium. In simple words all the development plans in the region should be carried out in harmony with nature and without disturbing the ecological balance.

REGIONAL PLANNING IN INDIA

As mentioned earlier, the basic postulates of planning in India were conceived and formulated during the heat of India's freedom struggle and the First Five Year Plan was launched in 1951 *i.e.* within four years of India's Independence. The primary objectives of the plan were accelerating the pace of economic and social development, elevating poverty and unemployment and improving the standard of living. However, planning process in India remained highly centralised for most of the plan period barring a few exceptions here and there. The chief components of planning machinery in India include :

(*a*) Planning Commission of India handed by the Prime Minister of India as its Chairman and having a full time Deputy Chairman. It was constituted in 1950 as an advisory as well as executive body. The main functions of the Planning Commission are :

(*i*) to formulate five year annual plans;

(*ii*) to supervise the work of national planning;

(*iii*) to consider the national plans formulated by the Planning Commission;

(*iv*) to recommend measures for achieving the targets set out by the plans;

(*v*) to review the working and to monitor the plans from time to time.

(*vi*) to encourage people's participation in the planning process.

(*b*) The National Development Council, and

(*c*) State Level Planning Boards for each state.

Unfortunately no recognition worth the name was given to regional planning in the first two Five Year Plans (from 1950-51 to 1960-61). Following could be the probable reasons for this complete negligence of Regional Planning in the early phase of planning period :

(*i*) There was no serious attempt to identify a regional scheme or a set of regions, which could form the basis of the planning activity in the country.

(*ii*) The leaders who took the reigns of the country immediately after Independence were perhaps too enthusiastic and too keen to initiate the process of planned development that could not wait for discovering the existing regional system/real region nature.

(*iii*) Perhaps the leaders of that time could not appreciate the utility of planning process based on regional system.

(*iv*) The leadership of the early plan period probably believed that as the developmental process starts, the new regional system may emerge in the country which could form the basis of future regional planning process.

The regional or spatial planning process in the country was most probably incorporated in the Third Five Year Plan when the philosophy of balanced regional development got appended to the era of Five Year Plans. Even during and after the Third Five Year Plan, the concept of Regional Planning could not much influences our planners because our plans are still conceived and termed as Five Year or Annual Plans rather than Regional Plans devised for different regions. Our planners have probably failed to realise the fact that identification of a regional scheme is fundamental to any regional planning. After the identification of a regional scheme, preparation of plans for each region has to be made. Care has to be taken that plan for any region is not to be prepared in isolation, rather in integration with other regions so as to achieve a comprehensive plan for the entire country.

The Planning Commission should supervise the process of regional planning at the regional level. Establishment of State Planing Boards at the state level is a step towards decentralisation of the country's planning and also to incorporate the spatial dimension to the planning process. In some of the states like Punjab, the State Planing Boards have taken a step forward to formulate the district level plans and even the block level plans.

Most of the Regional Plans are prepared according to the political boundaries of the states because official data are available according to the political divisions only. But political boundaries do not always coincide with the geographical boundaries

and a planning process based on such political boundaries rarely succeeds. The Damodar Valley Corporation (DVC) and the National Capital Region (NCR) are two such examples which do not follow political boundaries. The Damodar Valley spreads over Jharkhand and West Bengal whereas the National Capital Region coves large areas of Union Territory of Delhi, Haryana, Uttar Pradesh and Rajasthan. Development plan for DVC has met with partial success while NCR plan has almost completely failed to achieve the target and serve the planned purpose.

The 73rd and 74th amendments in the Indian Constitution have given a new direction to the planning process in India. The primary aim of these amendments is to introduce the planning process at the grass-root level by involving Panchayats for identifying the problems at the grass-root level and initiate decentralisation of the entire planning process. Till now, not much success has been achieved as many states have shown likewarm interest in involving the village Panchayats in the planning process.

The 73rd and 74th constitutional amendments have provided for fund collection by the Panchayats at the local level for local development for which state governments are supposed to provide matching giant. Till now, not even a single state government has taken any initiate to generate resources at the Panchayat level. At the maximum the Panchayats can identify the problems at the local level which can provide guidelines to our planning process.

Unfortunately, no one at the administrative level is willing to share any power which creates great practical hindrances in decentralisation of the planning process and give much needed thrust to regional planning. The success of regional planning primarily depends upon :

(*i*) quality of planing education

(*ii*) degree of public awareness about the rationale for a planned effort

(*iii*) efficiency of planning institutions, and

(*iv*) proper comprehension and appreciation of the basic issues involved in regional planning by society itself.

In India, regional planning is still at its nascent stage and is not very popular with our planners. It has a long way to go in terms of its content and implementation before it is able to show its utility and be of some use to people at the regional level.

Integrated Rural Development Programmes

The integrated rural development programme was launch in 1977 when Janta Party formed the government at the centre after defeat of the Congress Party. This programme was initially implemented in 2000 blocks out of a total of 5004 blocks at that time. Its broader version was presented in 1978-79 through which 2300 blocks were benefitted. Another 300 blocks were brought under this programme in 1979-80.

The main objective of this programme was to provide employment opportunities to the poor rural people and to increase their assets for which provision for financial assistance was made. This programme covered poor people living below poverty line, which included small and marginal farmers, agricultural labourers, scheduled castes and scheduled tribes and economically backward people having an annual income of less than ₹ 11,000 at the time of the Eighth Five Year Plan. With a view to give maximum benefit to the most vulnerable families, it was decided that at least 50 per cent of the families should be from the scheduled castes and scheduled tribes. Besides, reserved benefit was 40 per cent for women and 3 per cent for handicapped people. Families rather than persons were selected and among families too, women were given priority.

The Integrated Rural Development Programme was implemented at the grassroot level through District Rural Development Agencies (DRDA) and Block Level Agencies (BLA). DRDA was established in April 1, 1999 with the objective of strengthening the programme. The funding pattern of the DRDA administration is in the ratio of 75 : 25 between the Centre and the States for non-NE States and 90 : 10 for NE-States. In the case Union Territories, it is hundred per cent under the scheme. The governing body DRDAs include local MPs, MLAs, Chairman of Zila Parishad, Heads of District Development Departments, representatives of Scheduled Castes and Schedule Tribes, and women. Staff of blocks is responsible for implementing the programme on the grassroot level. At the state level, this programme is implemented by the State Level Coordination

Committee. Ministry of Rural Areas and Employment is responsible for providing financial assistance, framing policies, guiding the implementation of policies, and evaluating the programme at the central level. Some of the important programmes are National Rural Employment Programme (NREP), Training of Rural Youth for Self-Employment (TRYSEM), Development of Women and Children in Rural Areas (DWCRA), *Indira Awas Yojna* (IAY), Council for Advancement of People Action and Rural Technology (CAPART), *Jawahar Rojgar Yojna*, the *Ganga Kalyan Yojna*, etc.

Some of the important projects initiated under Integrated Rural Development Programmes are briefly describe as under :

1. Training of Rural Youth for Self-Employment (TRYSEM). Initiated on 15th August, 1979, this is an integral part of IRDP. Young people in the age group of 18-35 years are selected to become skilled workers and they are imparted technical training also. They are trained in such a way that they become capable of starting their own work for self employment. Young people are selected form families having income less than ₹ 3,500 per annum and poorest of the poor are given priority. Only one member is selected from each family. Preferential treatment is given to people belonging to Scheduled Castes, Scheduled Tribes, Ex-Army men and also those people who have participated in the National Adult Education for nine months.

2. Supply of Tools Kits in Rural Areas (SITRA). This scheme aims at providing quality implements to rural artisans so that they are able to improve quality and increase quantity of their products. As many as 7.46 lakh kits of implements costing ₹ 14.8 million were distributed among the rural artisans during 1992-93 to 1997-98.

3. Development of Women and Children in Rural Areas (DWCRA). This programme aimed at improving the income levels of women belonging to poor families. Groups of 5 to 10 women are constituted so that they can help each other in work and increase their income. The programme is based on equal contribution by the central and state governments as well as by UNICEF. Basic facilities like womens' health, education, children care and nutritional food are also provided.

4. Council for Advancement/Peoples Action and Rural Technology (CAPART). Set-up on 1st September, 1986, it is an autonomous organisation under the Ministry of Rural Development and acts as a funding agency for voluntary organisations. Its primary objective is to promote voluntary action through community participation and to propagate rural technologies for the benefit of downtrodden people (SC/ST/OBC and others) living in rural areas.

5. Jawahar Rojgar Yojna. This scheme came into being by the merger of National Rural Employment Programme (NREP) and Rural Landless Employment Guarantee Programme (RLEG) in April, 1989. The primary object of this scheme is to provide additional employment opportunities to unemployed and under-employed men and women and to increase their assets. Besides, this scheme aims at improving the living conditions of the villagers and to provide sustainable employment. The funding by the centre and the state governments for this scheme are in the ratio of 80 : 20. For schedule caste and schedule tribes, 22.5 per cent of the allocation is reserved. The other components of this scheme are assistance to wards of child labourers living below poverty line, disabled and food for work. This scheme was further strengthened in the Ninth Five Year Plan so that it could work more effectively.

6. Indira Aawas Yojna (IAY). This scheme was started as a sub-scheme of Jawahar Rojgar Yojna in May, 1985. It aims at providing financial assistance to extremely poor people belonging to SCs/STs, for constructing their houses and for repairing the dilapidated *kutcha* houses. Since 1995-96, this benefit has been extended to war windows and retired workers of military and para-military forces, subject to their qualifying the laid conditions. About 3 per cent of the allocated funds has been reserved for disabled people living below poverty line. People living below poverty line and belonging to minority communities have also been included among the beneficiaries from this scheme.

IAY is being implemented across the country (except Delhi and Chandigarh) and funding for this scheme is shared between the centre and the states in the ratio of 75 : 25. In case of union territories, the entire fund is provided by the centre. In case of north-eastern states the funding ratio between the centre and states is 90 : 10. With effect from April 1, 2010, the

ceiling on construction assistance under IAY scheme is ₹ 45,000 per unit in the plain areas and ₹ 48,500 in the hilly/difficult areas. For upgrading *kutcha* house, the financial assistance to ₹ 15,000 per unit.

During 2010-11, as against the target of constructing 29.69 lakh houses, only 14.57 lakh houses were constructed. Since its inception, about 286.88 lakh houses have been constructed with an expenditure of ₹ 85141.13 crore.

7. Swarnajayanti Gram Swarojgar Yojna/ National Rural Livelihood Mission (NRLM). This scheme was launched on 1st April, 1999 and is designed as a holistic self employment scheme aimed at providing sustainable income to rural BPL (below poverty line) families through income generating assets/economic activities so as to bring them above the poverty line. Thrust is on empowerment of the vulnerable sections of the society, is 50% for SC/STs, 40% for women, 15% for minorities and 3% for disabled persons.

Assistance under Swarnajayanti Gram Swarojgar Yojna to individuals or Self Help Groups (SHGs) is given in the form of Revolving Funds Assistance and Capital Subsidy by the government linked credit by the banks. Since its inception upto March, 2012, 43.34 lakh SHGs have been formed and 14.46 lakh SHGs have taken up economic activities.

8. Employment/Assurance Scheme. Poor labourers do not get any employment during the lean season in agricultural operations. The Government of India launched scheme for employment assurance on 2nd October, 1993 in some selected blocks. National Rural Employment Guarantee Act was passed which was implemented for 200 most backward districts of the country in its first phase. In the second phase, it was implemented for 130 districts in 2007-08 and for 274 districts in the third phase after 1st April, 2008.

This is the first law which guarantees employment opportunities to the poor people on such a large scale. Its other aims are to provide safety against droughts, deforestation, soil erosion etc. for sustainable growth. These are some of the factors responsible for poverty.

9. Million Wells Scheme. This programme was started in 1988-89 as a sub-programme of National Rural Employment Programme (NREP) and Rural Landless Employment Guarantee (RLGP). It continued to work as a sub-programme of Jawahar Rojgar Yoja from 1st April 1989 to 31st December 1995 and became a full-fledged independent programme on 1st January, 1996. The main purpose of this scheme is to provide irrigation facilities to small and marginal farmers living below poverty line and to bonded labourers who have been freed from the clutches of their masters. This scheme was basically meant for people belonging to SCs and BCs but poor people belonging to other castes were also included in 1993-94. There is provision for 3% reservation for physically handicapped persons. Panchayati Raj organisations are doing a wonderful job preparing the list of beneficiaries from this scheme.

10. Ganga Kalyan Yojna (GKY). This programme was initiated by the Central Government on 1st February 1997 to provide irrigation facilities to small and marginal farmers or groups of such farmers living below poverty line by utilising ground water through wells and tube-wells. The finances for this programme are provided by government subsidy or financial organisations. The funding ratio between the Centre and the States is 80 : 20. Priority is given to SCs and BCs.

11. National Social Assistance Programme (NSAP). Started on 15th August, 1995, this programme has the following three components :

(*i*) old age pension of ₹ 75 per month to people of age 65 years and above.

(*ii*) one time financial assistance to those families which have lost their only earning member; ₹ 5,000 in case of natural death and ₹ 10,000 in case of accidental death.

(*iii*) financial assistance to pregnant women living below poverty line for the birth of first two children under National Maternity Benefit Scheme (NMBS), provided the women is above 19 years of age.

12. Total Sanitation Campaign (TSC). Rural sanitation came into focus of the Government of India during the World Water Decade of 1980s. The Central Rural Sanitation Programme (CRSP) was started in 1986 for providing sanitation facilities in rural areas. Following are the main objectives of this campaign :

(*i*) Bring about an improvement in the general quality of life in the rural areas.

(*ii*) Accelerate sanitation coverage in rural areas.

(*iii*) Generate felt demand for sanitation facilities through awareness creation and health education.

(*iv*) Cover schools/anganwadis in rural areas with sanitation facilities and promote hygiene education and sanitary habits among students.

(*v*) Encourage cost effective and appropriate technologies in sanitation.

(*vi*) Eliminate open defection to minimise risk of contamination of drinking water sources and food.

(*vii*) Convert dry latrines to pour flush latrines, and eliminate manual scavenging practice, wherever it is in existence in rural areas.

Panchayati Raj and Decentralised Planning

It is a strongly believed that Panchayati Raj is a very powerful weapon for rural economic, social and cultural development and also for decentralisation of rights and taking the process of democracy to the common and most humble mean of the rural community. This enables people to become a part of the development process and increases the possibility of decentralised planning. Panchayati Raj is an important medium of politics, administration and planning.

India has a very old tradition of forming panchayats. Panchayats were recognised as the local unit of administration right from the beginning of the British rule in India. Later on, the Britishers tried to strengthen the institution of Panchayati Raj to divert the attention of our national leaders from the demand of complete Independences.

Mahatma Gandhi often used to say that real India lives in villages and the country cannot grow as a nation until the life style of the villagers is not improved. About one-third of our villages had Panchayats when India got freedom in 1947. The Congress Government at the centre took immediate steps to strengthen village Panchayats after Independence. The 40th amendment in the constitution in 1950 stated that "The state shall take steps to organise village panchayats and to endow them with such powers and authority as may be necessary to enable them to function as units of self-government."

Programme of Community Development was started in the year 1952 which aimed at infusing awakening among the rural folks about economic planning and social reconstruction. But this programmer could not yield the desired results. Consequently Block Advisory Committees were constituted which were renamed as Block Development Committees. This step also did not get much success. Then it was realised that the rural masses will not take interest in any scheme unless they are directly involved in framing and implementing any development programmes. Balwant Rai Mehta Committee was constituted to remove the shortcomings in the Panchayati Raj (See box).

A Committee to study the Panchayati Raj was constituted in 1957 under the chairmanship of Sh. Balwant Rai Mehta and it is known as Balwant Rai Mehta Committee. This committee submitted the report by the end of 1957. The report said that such programmes can succeed only if the local people at the village level are involved in it. It was recommended the Panchayati Raj institutions should be constituted immediately for decentralisation of democracy and development of the community.

Following were the main recommendations of this committee :

1. There should be three tier Panchayati Raj from village to district level. Gram Panchayat at the village level, Block Samiti at the Block level and Zila Parishad at the district level, they should be inter-related to each other.
2. Their rights and duties should be well defined.
3. They should have sufficient resources to discharge their duties in the desired manner.
4. Programmes regarding social and economic planning should be executed through these institutions.
5. In future all the facilities, rights, responsibilities and resources should be transferred under the Panchayati Raj system.

The National Development Council accepted the recommendations of the Mehta Committee report in 1958 and different states started implementing the Panchayati Raj scheme.

Various Patterns of Panchayati Raj Institutes

Different states have different patterns of Panchayati Raj institutions. Some states have three tier panchayats at the village, block and district level while some states have two tier panchayat at the village and block levels and still some other states have only one tier Panchayati Raj.

Panchayati Raj was formally inaugurated by Pandit Jawaharlal Nehru on 2nd October, 1959 in Nagaur district of Rajasthan. It had three constitutional parts *viz.* Gram Panchayat, (*ii*) Panchayati Samiti and (*iii*) Zila Parishad. This system worked for about three decades after which Maharashtra and Gujarat also constituted three tier Panchayati Raj.

Karnataka introduced a system of Panchayati Raj under 1985 Ordinance which was different from the recommendations of Mehta Committee. The three tier system accepted by this state consisted of Zila Parishad at the district level, Taluka Panchayat Samiti at block/taluka level and Mandal Panchayat at mandal level.

Achievements of Panchayati Raj Institutions. Spatial and temporal changes keep on occurring in the structure of Panchayati Raj. For example, there are changes from time to time in tiers and duties of Panchayati Raj institutions. In Andhra Pradesh, Panchayati Raj institutions have done a wonderful job in the basic fields like education and health. In Rajasthan, these institutions play a major role with respect to development at the initial stage. Panchayati Raj institutions in Tamil Nadu did a commendable job in the fields of education, water supply, roads and nourishment. In Maharashtra and Gujarat, these organisations worked very hard for decentralisation of planning.

The greatest achievement of Panchayati Raj institutions is that villages have got rid of fear psyche and are no longer affairs of government officers. They can easily and directly talk to the concerned Block Development Officer (BDO) and get solution to their problems. The main purpose of constituting panchayat was to develop self confidence among the villagers, provide them with basic facilities of life and persuade them to come forward for planning and development. Panchayati Raj has infused awareness about development, planning and democracy and now they can take their own decisions and prepare programmes which are beneficial for them.

The Features of Panchayati Raj

Many weaknesses have been observed in Panchayati Raj during the last few decades as a result of which many failures of this system have come to light. Some of the major failures are listed below.

1. Lack of Conceptual Charity. The greatest drawback of Panchayati Raj system is the lack of conceptual clarity. Some scholars recognise it just an administrative agency while others treat it as spread of democracy at the grass root level. Still some others see it as government at the rural level. All these concepts work simultaneously which creates hinderance in the developing of a clear and universally accepted concept.

2. Lack of Political Will. Critical analysis of the working of Panchayati Raj has revealed that these organisations do not have sufficient resources, their activities are insufficient and not upto the mark and proper attention is not paid to them. Because of these factors the achievements of Panchayati Raj institutions are not upto the desired level. Such a situation is largely attributed to lack of will power. In certain states, the Panchayat elections are not held at the scheduled time and often the elected panches are ignored. Normally, MPs and MLAs work against the elected members of the gram panchayats and the grassroot problems are often ignored. Generally the political leaders cultivate a feeling that the panchayat members are working against their interests. In such a scenario, the panchayat members are not able to receive political support and proper action is not taken on their plans.

3. Role of Bureaucracy. Bureaucracy in India enjoys immense powers and bureaucrats often deprive panchayat members of their role in the development process. Most of the government officers do not like to work under panchayat members and consider themselves as representatives of the government, rather than as part of the development mechanism.

4. Disillusionment about structural functioning. In most panchayats, only the wealthy and influential people get elected and those people do not bother much about the interests of the poor and

downtrodden. Due to panchayat elections, the villagers are often divided into political and social groups which leads to frequent and sometimes serious disputes. Such a situation creates great obstacle in the path to progress and the primary aim of Panchayati Raj is ignored.

In addition to the above mentioned factors it is felt that planning is priority the job the planner and interference by panchayats causes shortcomings in planning and retards the pace of progress.

Ashok Mehta Committee

As a result of 1977 general elections, Congress Party was defeated and Janata Party come to power at the centre. In December 1977, the Janata Party Government at the centre constituted a 14 member Committee with Ashok Mehta its chairman. The report submitted by this Committee in August, 1978 said that it was wrong to think that Panchayati Raj does not cooperate in the process of development. Panchayati Raj has achieved many successes but they are not given much opportunities to be a great instrument of development. Panchayati Raj institution should be constituted in such a way that it becomes a strong medium of economic, social and political development through peoples' participation.

RECOMMENDATIONS OF ASHOK MEHTA COMMITTEE

Report submitted by Ashok Mehta Committee made about 132 recommendations. The main recommendations pertained to (*a*) functional necessity for decentralization of administration through under democratic supervision; (*b*) two-tier system of Panchayati Raj *viz.* the revenue District assuring the technical expertise of high order required for rural development and the Mandal Panchayat to be constituted by grouping a number of villages; (*c*) the Panchayati Raj Institutions to have compulsory powers of taxation and mobilize their own resources, thus reducing their dependence on diversion of funds from the state government. Certain taxes collected from the area such as provision tax, entertainment tax and special tax on land and building be transferred to Panchayati Raj Institutions; (*d*) open participation of political parties in Panchayati Raj affairs; (*e*) the creation of certain economic groups in the villages; (*f*) a regular social audit by a district level agency as well as a committee of legislators to check whether funds earmarked for these social and economic groups are actually spent on them; (*g*) the State legislators will have a committee on Panchayati Raj with adequate representation for schedule castes and tribes to cater to their needs and mitigate grievances of the weaker sections; (*h*) the State Government must not supersede the Panchayati Raj Institutions on partisan grounds. In case of an imperative suppression, election must take place within six months; (*i*) provision of urban amenities such as roads, potable water, medical care, employment and education in rural areas to neutralise pull for immigration to urban centres.

50 PER CENT RESERVATION FOR WOMEN

The central cabinet passed a resolution on 27th August, 2009 according to which 50 per cent seats in panchayats are reserved for women. According to data released in 2009, there were 28.18 lakh elected representative in Indian panchayats out of which 36.87 per cent were women. After this resolution, more than 14 lakh women are supposed to the members of panchayats.

Command Area Development

An area reserved by canals, wells, tube wells, tanks etc. for irrigation is known as command area. The irrigation potential created is not used to its optimum due to the following reasons :

1. Proper basic structure for carrying water from its source so the agricultural fields—like channel, drainage etc. is lacking.
4. There is lack of proper agricultural system according to the ecological conditions.
3. There is lack of awareness on the part of farmers.
4. Lack of proper maintenance of canals results in loss of water.
5. There is over irrigation in areas near the source of canals which leads to water logging, salinity and alkalinity of vast area on one hand and shortage of water at the tail of the canals and agricultural fields do not get sufficient water.

Keeping in view the above problems, the Central Government started Command Area Development (CAD) programme in 1974-75 with the objective to bridge the gap between irrigation potential created and utilized through micro level infrastructure development for efficient water management and enhancement of agricultural production and productivity so as to improve socio-economic

conditions of the farmers. This programme is implemented by Area Development Authority. Specialists from different departments work under this authority which makes it easy to achieve the fixed targets.

This programme was initially applied to Indira Gandhi Canal Command Area in 1974. In the Fifth Five Year Plan, 38 Area Development Authorities were constituted for 50 irrigation projects. These authorities provided irrigation facilities to 12.4 million hectares spread over 108 districts in 13 states. So far it has covered 332 irrigation projects with a Cultivable Command Area of nearly 29 million hectares.

Following are the main objectives of this programme :

1. Influential farmers with large expanses of land at their disposal get the maximum benefit of irrigation facilities and a small and marginal farmers are often deprived of irrigation facilities which they rightly deserve. ***Warabandi*** was introduced to solve this problem. It is a rotational system which assures equitable and timely supply of water to all farmers irrespective of the size of their holdings. This programme is implemented with the help of Panchayat Samities.
2. Construction of field channels and field-drains to reduce the pilferages and mis-use of water and making sure of effective use of water for irrigation. Central assistance up to 50 per cent (limited to the prescribed cost norms) is provided for irrigation and field-development activities.
3. Land has to be levelled so that water is spread uniformly in the agricultural fields.
4. Giving proper shape to fields and their boundaries through consolidation of holdings so that the objective of optimum utilisation of water is achieved. Simultaneously provision of **chak roads** is also essential.
5. Educating farmers through demonstrations and imparting technical training for adopting new agricultural innovations and adopting cropping patterns according to natural environment as well as improving farming practices and maintaining fertility of soil.
6. Preparing plan for supply of inputs, credit, seeds, fertilisers, insecticides and pesticides to the farmers.
7. Promoting ancillary activities such as animal husbandry, forestry, poultry, marketing and processing facilities.
8. Updating land records.
9. Diversifying agriculture to make it more profitable.
10. To lay more emphasis on the cultivation of more remunerative crops like oil-seeds, pulses, green-manure crops.
11. To use ground water for compensating the shortage of su face water.
12. Reclamation of the water-logged, saline and alkaline areas rendered uncultivable due to over irrigation by canals.
13. To introduce participatory management of irrigation.

The Command Area Development programme was restructured and renewed as Command Area Development and Water Management (CAD&WM) with effect from 1st April, 2004. During the mid-term appraisal, the Planing Commission has emphasised the need for implementing CAD and WM programme *paripassu* with creation of infrastructure. Under this programme, financial assistance is being provided to the State governments on 50 : 50 basis for construction activities and on 75 : 25 basis to carry out training programmes for field functionaries/ farmers, monitoring, evaluating, adaptive trials and demonstration.

At the initial stage, 60 major and medium irrigation projects were taken up under the CAD programme, covering a Culturable Command Area (CCA) of about 15.0 million hectares. At present there are 145 projects covering a CCA of 16.02 million hectares. The scheme had been implemented as a State Sector Scheme during the Eleventh Five Year Plan (2008-09 to 2011-12).

An area of about 18.06 million hectares was covered under the programme, upto the end of March, 2007 and another 1.62 million hectares have been covered between March 2007 and March 2011.

The National Water Policy, 2002, stresses on participatory approach in water resources management. There is a great realisation of the fact that participation of beneficiaries greatly enhances the optimal use of the irrigation facilities and proper use of irrigation water. The participation of farmers in the management of irrigation would give responsibility for operation and maintenance, collection of water charges from the areas under the jurisdiction of Water Users Associations (WUAs) and redressal of petty grievances.

Reports from various states reveal that the CAD programme has made positive impact on some important indicators, like increase in irrigated area, productivity and production, irrigation efficiency etc. In spite of all these efforts, the problem of water logging has been reported in many irrigated commands. For reclaiming the water logged areas, 579 schemes in 9 states *viz.* Bihar, Gujarat, Madhya Pradesh, Jammu and Kashmir, Karnataka, Kerala, Odisha, Maharashtra and Uttar Pradesh have been approved for reclaiming 78.81 thousand hectares of water logged area; of which about 52.11 thousand hectares of water logged area has already been reclaimed.

Indira Gandhi Canal Command Area Development Programme

Indira Gandhi Canal Project is a living example of man's effort to transform a desert land into a green

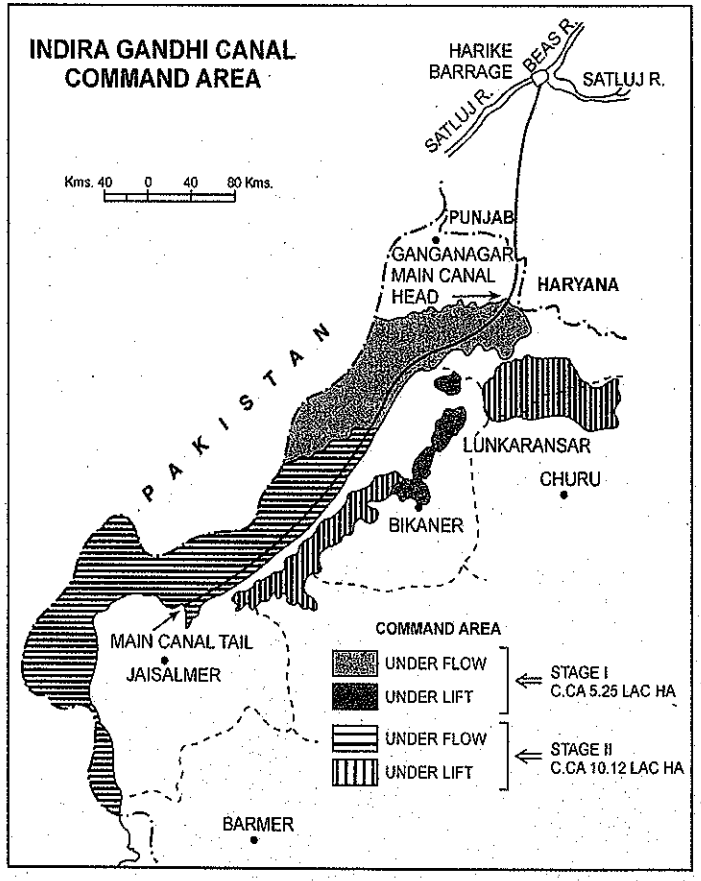


FIG. 14.4. Indira Gandhi Canal Command Area

land of prosperity and plenty. It is one of the largest canal systems of the world. The command area of this canal is located in dry desert lands of Ganganagar, Bikaner, Jaisalmer, Barmer, Jodhpur and Churu districts in Rajasthan. It stretches over 23,725 sq km having 525 kms length and 45 kms breadth along the international boundary between India and Pakistan. The Indira Gandhi Main Canal runs parallel to the Pakistan border for an approximate distance of 38 kms from north-east to south-west.

The Canal originates from Harike Barrage near the confluence of Satluj and Beas rivers in Ferozepur district of Punjab. The plan for this canal was prepared in 1957-58 and the work on this project started on 31st March 1958. The canal does not do any irrigation in Punjab and is known as Rajasthan Feeder. The total length of Rajasthan Feeder is 204 kms. The main canal is 40 metres wide at bottom and 6.4 metres deep. The carrying capacity of canal is 18,500 cusecs of water at its head. According to a proposal in 1981, Rajasthan was allocated 8.6 million acre feet of Ravi-Beas surplus water. The Indira Gandhi Canal envisages the utilisation of 7.6 million acre feet of water allocated to Rajasthan.

The head of the main canal is located near Masitanwali in Hanumangarh district. The tail of the 445 km long main canal is located near Mohangarh in Jaisalmer district. The command area of the canal is further extended till Gadra Road in Barmer district, through Sagarmal Gopa branch.

Construction work of the project has been carried out in two stages. Water was released in the main canal on 11 October 1967 and reached its tail on 1 January 1987. The main canal has two kinds of branches and distributaries. The right bank branches of the canal are flow channels as the land west of the main channels slopes down gently towards Pakistan border. The left bank branches except Rawatsar Branch which takes off from the head of the main canal, are lift channels. This is because of the fact that area towards the south-east of the main canal slopes towards the canal and water is to be lifted against the slope of the land.

Stage I. Construction work of Stage I has been completed at a cost of ₹ 246 crore. It included the construction of 204 kms long feeder, 189 kms of the main canal and 2,960 kms long distribution system. Stage I has five flow branches and one lift canal covering south and south-western part of Ganganagar district and north and northwestern parts of Bikaner district. Nearly 4.79 lakh hectares of land is provided with flow irrigation and 0.46 lakh hectares get lift irrigation. The irrigation potential on full development has been estimated to be 5.78 lakh hectares. The project plan of Stage I envisages intensive irrigation with an irrigation intensity of 110%. *Irrigation intensity is expressed as percentage ratio between gross irrigated area and culturable command area of the project.*

The above facilities results in annual food production of 14.50 lakh tonnes [*See* **Table 14.2**].

Stage II. Stage II of the project includes the construction of 256 kms long main canal and 4,800 kms long distributaries. According to the revised plan, this stage provides extensive irrigation. Extensive irrigation means reducing per acre allowance of water and providing irrigation to maximum cultivated area. Irrigation intensity of this region is *80%* that amounts to provide irrigation to 80% of culturable command area. This will prevent water-logging and soil-salinity and help in growing light irrigated crops. Stage II proposes to develop irrigated pastures on an area of about 3.66 lakh hectares. This would help in providing benefits of irrigation to aboriginal nomadic communities, develop animal husbandry and arrest desertification. This stage of the project envisages to provide flow irrigation to 7 lakh hectares and lift irrigation to 3.12 lakh hectares of land. This will lead to annual food production of 22.50 lakh tonnes (*See* **Table 14.2**).

Command Area Development Programme. The Command Area Development Programme is an integrated area development approach towards the command area of major and medium irrigation projects in the country. This programme is aimed at bridging the gap between created irrigation potential and its utilisation in the command areas of major and medium irrigation projects. The Fifth Five-Year Plan document emphasized the need of implementing this programme in all the command areas of major and medium projects in the country. The importance of Command Area Development (CAD) is all the more important in a desert areas because it requires proper use of water and ecological development for the following reasons :

TABLE 14.2. Salient Features of Indira Gandhi Canal Project

Particulars	Unit	Stage I	Stage II	Total
1. Length of the Main Canal :				
(*i*) Indira Gandhi Feeder	kilometres	204	—	204
(*ii*) Indira Gandhi Main Canal	kilometres	189	256	445
Total		**393**	**256**	**649**
2. Length of Distribution System	kilometres	2,960	4,800	7,760
3. Culturable Command Area :				
(*i*) Under flow irrigation	Lakh hectares	4.79	7.00	11.79
(*ii*) Under lift irrigation	Lakh hectares	0.46	3.12	3.58
Total		**5.25**	**10.12**	**15.37**
4. Irrigation Potential on Full Development	Lakh hectares	5.78	8.10	13.88
5. Irrigation Intensity	Per cent	110	80	90
6. Water Requirement	Million acre feet	3.59	4	7.59
7. Drinking and Industrial Use of Water	Cusecs	300	900	1200
8. Cost	Crore ₹	246	1,420	1,666
9. Annual Food Production	Lakh tonnes	14.50	22.50	37.00

(*i*) Conveyance loss of water is 30 to 50% below outlet level in sandy soils. This results in under-utilisation of water and leads to water-logging and soil-salinity. Consequently, it adversely affects agricultural production.

(*ii*) This is a newly settled area and requires civic amenities as well as modern agricultural inputs.

(*iii*) There is large-scale siltation in the main canal and its distributaries by wind. In addition, cultivable land is also eroded.

The Command Area Development Programme was introduced in the Indira Gandhi Canal Command Area in 1974 and it was entrusted with following tasks :

(*a*) On-farm development which includes surveying and planning water course lining, land levelling, shaping and reclamation of degraded lands.

(*b*) Afforestation and pasture development which includes canal side and roadside plantation, block plantation near new settlements, sand dune stabilisation and pasture development on culturable waste land.

(*c*) Providing communication and civic amenities which includes construction of roads, connecting the settlements with markets, construction of new markets and supplying drinking water.

(*d*) Availability of modern agricultural inputs including ensuring supply of HYV seeds, chemical fertilizers, insecticides and pesticides and providing agricultural extension and training facilities to the farmers.

Agricultural Development. Crops could be grown only in the *kharif* season in this dry area and a large tract of cultivable land was left as culturable waste and fallow land. Introduction of irrigation has dramatically increased the net sown area (NSA) and area sown more than once, *i.e.*, double cropped area. Drought-resistant crops like *bajra, guar, moong, moth* and *gram* used to occupy about 95% of the gross cropped area of this region before the introduction of irrigation. Cropping pattern has undergone drastic changes as a result of irrigation. Commercial crops, such as cotton, groundnut, wheat and mustard have become very important occupying nearly two-thirds of the gross cropped area in Stage I. Wheat alone occupies about one-fourth of the gross cropped area. The yield of cotton, groundnut, paddy and wheat is increasing consistently, while yield of *guar*, gram and mustard is fluctuating. The main reason for the fluctuations of yield level of these crops is that they are not fully irrigated.

The production of cotton, groundnut, wheat and mustard has increased considerably. This is due to increase in area under these crops as well as their increase in yield per hectare as a result of irrigation and use of better seeds.

Impact of Irrigation on Environment. Whereas irrigation has increased the agricultural production tremendously, it has resulted in environment degradation in the form of water logging and soil-salinity. The ground-water table is rising at an alarming rate of 0.8 metre per year in most parts of Stage I. About 25% of land under the command area near Ghaggar basin is critical area as the ground water level in this area is less than 6 metres below surface level. In a large part of the command area in Stage I, soil-salinity has arisen because of water-logging and the presence of salt in the soils. This has adversely affected the soil-fertility and agricultural productivity. This problem is more serious in the command area of Stage II where irrigation was introduced in mid-eighties. This part of the command area is underlain by hard pan of calcium carbonate and clay at a depth of few metres which causes parched water table : water-logging.

Watershed Management

Water is one of the most important natural resources and no life is possible without water. For sustainance of life and for better standards of living, optimum development and efficient utilisation of water resources is of paramount importance. According to the Ministry of Water Resources, the average annual water availability of the country is assessed as 1862 billion cubic metres (BCM). Of this, total utilizable water resource is assessed as 1123 BCM out of which 690 BCM is surface water and 433 BCM replenishable ground water resources. Since the total availability of water is fixed and our population is increasing at an accelerated rate, the per capita availability of water has reduced drastically from 6008 cubic metres a year in 1947 to less than 1800 cubic metres a year in 2014. Keeping in view this critical trend in falling per capita availability of water, the Ministry of Water Resources has come out with certain policies and programmes for development and regulation of the water resources of the country. It covers sectoral planning, coordination, policy guidelines, technical examination and techno-economic appraisal of projects.

Watershed management is a very important component of water policy and planning. *Watershed is the line separating headstreams which flow in different river systems. It may be sharply defined such as crest of a ridge or it may be indetermined as is the case in a low undulating area.* The water divide determines the boundary of the watershed. Watershed becomes a practical agricultural unit in two different situations (*i*) when it is used as drainage line or flood control and (*ii*) when it is accepted as a unit planning for hydro-electric production, irrigation, drinking water, etc.

The All India Soil and Land use Survey Organisation of the Department of Agriculture, Government of India, has finalised a nationwide system of delineation and codification of watersheds. According to this system, watersheds have been divided into the following four categories depending upon their size :

(*i*) basins, (*ii*) catchments, (*iii*) subcatchments, and (*iv*) watersheds.

As per computation made by this organisation, India has 35 river basins, 12 catchments, 500 sub-catchments, and 320 watersheds. Depending upon their area, watersheds are divided into following four categories :

(*i*) Sub-watersheds (10,000 to 20,000 hectares)

(*ii*) Milli-watersheds (1,000 to 10,000 hectares)

(*iii*) Micro-watersheds (100 to 1,000 hectares)

(*iv*) Mini-watersheds (1 to 100 hectares)

The watershed management is a multi-departmental and comprehensive programme which aims at the optimum utilisation of the available water and other resources to achieve the following goals :

(*i*) increasing agriculture productivity

(*ii*) promoting allied activities

(*iii*) generating additional income from social forestry

(*iv*) checking soil erosion

(*v*) developing cottage industries

(*vi*) maintaining ecological balance.

Integrated Watershed Management Programmes (IWMP). It has been estimated that about 60 per cent of cultivated area in India is rainfed which suffers from cronic problem of water shortage, low agricultural productivity, land degeneration, poverty, malnutrition, etc. Watershed development programme is considered to be an effective tool to solve these problems.

Under the aegies of the Planning Commission, National Rainfed Area Authority (NRAA), farmed Common Guidelines for watershed programmes based on Parthasarathy Committee Report. Accordingly, a single modified programme called Integrated Watershed Management Programme (IWMP) was launched in 2009-10 which is being implemented as per Common Guidelines for Watershed Development Projects, 2008.

Impact Assessment Studies of Watershed Projects. A study entitled "Comprehensive Assessment of Watershed Programmes in India" has been assigned to International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad to assess the impact of various watershed development programmes in India, which among other things, gave the following report :

- Soil loss of 1.1 tonne/hectare/year was prevented
- Additional water storage capacity of about 38 hectare metre was created in 9500 hectare watershed.
- The area under irrigation increased by 52 per cent and the cropping intensity increased by 35.5 per cent.
- Low income regions were more benefited than high income regions.
- Benefits were more in areas receiving between 700 mm and 1000 mm of annual rainfall with the available technologies.
- Peoples' participation produced better results.
- The macro, watershed (area more than 1000 hectares) performs better than micro watersheds (area below 500 hectares).

PLANNING FOR BACKWARD AREA

It is difficult to define and identify backward areas because several parameters are used for this purpose. Generally areas with low per capita income are treated as backward areas. But this is not a very reliable measure. Various other measures have to be applied for proper identification of backward areas. Some such measures can be (*i*) the percentage of the scheduled caste and schedule tribe population to the total population of the area, (*ii*) the ratio of population to the cultivated land, (*iii*) the percentage of the working force engaged in agriculture, (*iv*) the ratio of urban to rural population, (*v*) availability of transport, communications, and other services, (*vi*) availability of water, electricity, and other facilities, (*vii*) level of literacy, etc. During the first decade of planning no attempt was made to specify the backward areas and pockets of underdevelopment taking into account these various indicators. Perhaps the Committee on the Dispersal of Industries, set up by the Small Scale Industries Board in 1960, was the first to identify the backward areas for purposes of rural industrialisation. The criteria for backwardness suggested by this Committed were as follows :

1. Poverty of the people as indicated by
   (*a*) Low per capita income; and
   (*b*) Low per capita consumption.
2. High density of population in relation to development of productive resources and employment opportunities as indicated by the following factors :
   (*a*) High ratio of population to cultivable land (50% above the national average should be considered as backward);
   (*b*) Low percentage of population engaged in output (50% or more below the national average should be considered as backward);
   (*c*) Absence or under-exploitation of other natural resources, *viz.*, minerals, forest and animals;
   (*d*) Low percentage of population engaged in secondary and tertiary activities (25% below the national average should be considered as backward);
   (*e*) Low ratio of urban to rural population (districts where the ratio was less than 50% of the national average might be considered as backward);
   (*f*) Low percentage of factory employment (50% below the national average might be considered as backward).
3. Poverty of communications as indicated by small lengths of railways and metalled roads per square mile (districts where the railway and road mileage fall below 50% of the national average might be considered as backward).
4. High incidence of unemployment or gross underemployment.
5. Consumption of electric power.

At the time of formulating the Fourth Plan (1966-1971) the Planning Commission appointed a Study Group to suggest the criteria for identifying the backward areas. The Group suggested the following indicators :

1. Total population and density of population;
2. Number of workers engaged in agriculture including agricultural labourers as percentage of total workers;
3. Total area per agricultural worker;
4. Cultivable area per agricultural worker;
5. Net area sown per agricultural worker;
6. Percentage of gross irrigated area to net sown area;
7. Percentage of area sown more than once to net sown area;
8. Per capita (rural population) gross value of agricultural output;
9. Establishments (manufacturing and repair) using electricity :
   (*a*) Total
   (*b*) Household
   (*c*) Non-household
10. Number of workers per lakh of population employed in registered factories;
11. Mileage of surfaced roads :
    (*a*) Per 100 sq miles
    (*b*) Per lakh of population
12. Number of commercial vehicles registered in a district;
13. Percentage of literate population :
    (*a*) Men
    (*b*) Women
14. Percentage of school going children :
    (*a*) Boys
    (*b*) Girls in age groups of
    (*i*) 6-11 years, and (*ii*) 11-14 years.
15. Number of seats per million population for technical training :
    (*a*) Craftsmen
    (*b*) Diploma level
16. Hospital beds per lakh of population.
17. Per capital income.

In the year 1968, the Planning Commission set up two Working Groups for studying the regional imbalances. One group was for recommending the criteria for the identification of backward area and the other for recommending the fiscal and financial incentives for starting industries in the backward areas. The committee for specifying the criteria for identification of backward areas was set up under the chairmanship of B.D. Pande (and is popularly known as the Pande Committee) and the committee for recommending the fiscal and financial incentives in the backward areas was set up under the chairmanship of N.N. Wanchoo (and is popularly known as the Wanchoo Committee).

The criteria for the identification of industrially backward States and Union territories adopted by the Pande Committee were as follows :

1. Total per capital income.
2. Per capita income from industry and mining.
3. Number of workers in registered factories.
4. Per capita annual consumption of electricity.
5. Length of surfaced roads in relation to :
   (*a*) the population, and
   (*b*) the area of the State.
6. Railway mileage in relation to :
   (*a*) the population, and
   (*b*) the area of the State.

Based on the above described criteria, the Pande Committee classified ten backward states. These

states are Andhra Pradesh, Assam, Bihar, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Nagaland, Odisha, Rajasthan and Uttar Pradesh. All Union territories except Chandigarh, Delhi and Puducherry were also classified as industrially backward.

This committee identified 238 districts all over India comprising 60% of the country's area and an equal proportion of its population as industrially backward.

The Wanchoo Committee recommended following incentives to develop industries in backward areas :

(*a*) Grant of higher development rebate to industries located in backward areas.

(*b*) Grant of exemption from income-tax, including corporate tax, for 5 years after providing for the development rebate.

(*c*) Exemption from the payment of import duties on plant and machinery, components, etc., imported by units set up in backward areas.

(*d*) Exemption from excise duties for a period of 5 years.

(*e*) Exemption from sales tax, both on raw materials and finished products, to units set up in specified backward areas for a period of 5 years, from the date of their going into production.

(*f*) Transport subsidy for taking out the finished products for as a period of 5 years. Upto 400 miles (650 km) the distance should be considered as normal and beyond that the transportation cost for finished products should be subsidized for such backward areas as may be selected in the States of Assam, Nagaland, Manipur, Tripura, NEFA (present Arunachal Pradesh) and Andamans. The transport subsidy should be equivalent to 50% of the cost of transportation in case of the backward areas specified in J&K State.

The National Development Council (NDC), decided in September, 1969 that the recommendations of the Pande Committee should be applied not only to backward districts in backward states only, rather such concessions should be made available to selected backward area in all the States and Union Territories. The criteria for the selection of the industrially backward districts in the States sand Union territories were to be decided by the Planning Commission in consultation with the financial institutions and the State governments, in the light of the two sets of criteria recommended by the Pande Committee. The following set of criteria was evolved by the Planning Commission for the purpose of identification of the industrially backward districts to qualify for concessional finance :

1. Per capita foodgrains/commercial crops production depending on whether the district is predominantly a producer of foodgrains/cash crops. (For inter-district comparisons, conversion rates between foodgrains and commercial crops may be determined by the State government on a pre-determined basis where necessary.)
2. Ratio of agricultural workers to population.
3. Per capita industrial output (gross).
4. Number of factory employees per lakh of population or alternatively number of persons engaged in the secondary and tertiary activities per lakh of population.
5. Length of surfaced roads in relation to population or railway mileage in relation to population.

On the basis of these criteria, 241 districts (later raised to 247) all over the country were classified as industrially backward.

Location of Large Public Sector Projects. Several public sector projects were located in the backward areas for their economic development. Such projects included steel plants, fertilizer plants, heavy electrical plants in states like Odisha, Chhattisgarh, Jharkhand and Madhya Pradesh. Though economic and technical considerations cannot be ignored while deciding the location of these projects, the Third Plan felt that "the disadvantages which particular areas may have for the location of the larger projects are not always basic or irremediable, for at times they may reflect only the lack of basic facilities and services."

Industrial Estates Programme. This programme was initiated in 1955 when 12 estates were

sanctioned. The construction, organization, and management of ten estates was entrusted to the State governments while the development of two estates (one situated in Naini at Allahabad and the other in Okhla at Delhi) was the responsibility of the National Small Scale Industries Corporation. The ten estates entrusted to the respective State governments were situated at Rajkot in Gujarat, Guindy and Virudhunagar in Tamil Nadu, Kanpur and Agra in Uttar Pradesh and Palghat, Trivandrum (Thiruvananthapuram), Kottayam, Quilon and Trichur in Kerala. The State governments were sanctioned a loan of ₹ 57.89 lakhs and a grant of ₹ 0.495 lakhs each for the purpose.

The principal objectives of the programme, varying to some degree with time and place, have been :

(*i*) to encourage the growth of small scale industries;

(*ii*) to shift small scale industries from congested areas to estate premises with a view to increasing their productivity;

(*iii*) to achieve decentralised industrial development in small towns and large villages; and

(*iv*) to encourage the growth of ancillary industries in the townships, surrounding major industrial undertakings, both in public and private sectors.

Desert Development Programme

The Desert Development Programme (DDP) was launched 1977-78 to reduce the adverse effects of the natural conditions prevailing in the desert areas. It is applied to 235 blocks of 40 districts in seven states. As many as 15,746 plans had been sanctioned between 1995-96 and 2007-08, which benefited 78.73 lakh hectares of land. A sum of ₹ 2103.29 crore was spent on these plans. The seven states which are benefited from this programe are Rajasthan, Haryana, Gujarat, Himachal Pradesh, Jammu and Kashmir, Andhra Pradesh and Karnataka. These states have hot sandy or cold deserts. The funding programme between centre and states is in the ratio of 75 : 25 for hot sandy deserts but the Central Government bears the entire cost in case of cold deserts. The primary aim of this project is to encourage proper use of natural resources, increase employment opportunities, remove poverty and illiteracy and raise the living standard of the common man.

Problems of Desert Area

1. Most of the desert areas receive scanty rainfall and enough water is not available for crops. Vast areas of Rajasthan and the adjoining parts of Haryana and Gujarat receive less than 40 cm annual rainfall. The amount of annual rainfall is less than 20 cm in Barmer and Jaisalmer districts in the western part of Rajasthan. Leh-Ladakh region of Jammu and Kashmir also receive less than 20 cm annual rainfall. Most parts of Andhra Pradesh, Telangana and Karnataka are located in the rain shadow area of the Western Ghats where the amount of annual rainfall is less than 60 cm. Lesser amount of rainfall is not the only problem, rainfall variability is also very high. Rainfall variability is as high as 50 per cent in Rajasthan and its neighbouring areas and 40 per cent in the Leh-Ladakh. Under such conditions, it is not an easy task to depend on natural amount of rainfall and people have to face famine conditions whenever the actual rainfall is below average.
2. In most parts of Rajasthan and its neighbouring areas, the soils are sandy which are easily blown away by winds. This leads to soil erosion and low agricultural productivity.
3. Only those crops can be grown which need lesser amount of water for their proper growth. These include coarse grains such as *jowar, bajra,* barley and pulses. They have lesser market value and their yields are also very low. With the construction of the Indira Gandhi Canal in the western part of Rajasthan, the cropping pattern has changed and wheat and at certain places rice cultivation has become possible.
4. Most of the farmers in the desert areas are poor and cannot afford modern inputs like high yielding varieties of seeds, fertilizers, pesticides and new implements.

5. In the event of a drought condition, there is acute shortage of food and fodder and people are force to migrate to other places in search of food, fodder and livelihood.
6. The infrastructural facilities like market, storage, transport etc. are badly lacking.

Main Objectives

1. To check the spread of desert and increase productivity.
2. To promote dry farming and increase productivity.
3. To make optimum use of natural resources of the desert areas and raise the living standard of the common man.
4. To generate more employment and enhance per capita income so that people can lead a comfortable life.

Strategies for Development

1. The most important strategy is to check the spatial growth of desert through shelter belt and to stabilize sand dunes by intensive plantation.
2. The Desert Development Programme has been made an integral part of the 20-point Programme of the government so that maximum benefit reaches the maximum number of people.
3. Under the dry farming programme, crops needing lesser amount of water have been promoted. Course grains (*jowar, bajra,* barley), pulses, oil-seeds etc. are such crops.
4. New technologies are promoted to increase the production of fodder.
5. Proper use of resources has been encouraged to maintain ecological balance.
6. Much emphasis has been laid on the use of eco-friendly pesticides and wedicides.
7. Irrigated agriculture and animal husbandry has been given priority in the cold deserts of Ladakh and Spiti.
8. Various devices for water harvesting have been used to meet the water shortages.
9. In addition to growing crops, allied activities like milk production, poultry, horticulture, selviculture, sheep rearing, bee-keeping etc. have been suggested to help farmers, especially small and marginal farmers.
10. Emphasis has been laid on agro-forestry, social-forestry etc. to check soil erosion and to maintain ecological balance.
11. Plan has been prepared to reclaim water logged areas in the Indira Gandhi Canal Command Area.
12. Programme to involve Non-Government Organisations (NGOs) in desert development programmes.

Drought Prone Area Development Programme

On an average, about 12 per cent of population and 16 per cent of the total area of India is affected by droughts and a severe drought occurs after every 4-5 years. At the micro level, one part of the country or another is affected by a drought almost every year. Drought causes shortage of food and fodder and lakhs of people and animals become victims of hunger and malnutrition. Hence solid steps are required to be taken to solve the problem of droughts. Drought Prone Area Programme ((DPAP) was initiated in 1973-74. Currently 972 blocks in 193 districts of 16 states are being benefited by this programme. Between 1995-96 and 2007-08, as many as 27439 schemes covering a vast area of 130.2 lakh sq km were prepared at the cost of ₹ 2837.81 crores. The primary aim of this programme is to make provisions for optimum use of land, water and animals resources, maintain ecological balance and to raise the income level of the poor section of society. Following are the salient features of this programme :

1. Management and conservation of water resources.
2. Land reforms.
3. Conservation of soil and soil moisture.
4. Special emphasis on forestation and social forestry.
5. Development of pasture lands and sheep rearing.
6. Development of livestock and dairy.
7. Restructuring the cropping pattern and changes in the farming process.

8. Cleaning of ponds, canals, rivers and other water reservoirs.
9. Special assistance to small and marginal farmers as well as to agricultural labourers.
10. Availability of infrastructural fund and development of citizens' conveniences.
11. Development of allied activities, in addition to the main agricultural activity.

Since 1995-96, this programme is being carried on for watershed administration based on new guidelines in which local people are also involved. The primary object of this programme is to minimise the problems of areas prone to low rainfall and drought conditions for which coordinated programme involving local people and based on new techniques is adopted. The main emphasis is laid on irrigation, forestation, development of pasture lands, rural electrification, rural road connectivity, markets for agricultural products, loans to farmers and services. These factors help in strengthening infrastructure and reducing the impact of drought.

Different systems for implementing this programme prevail in different states. For example, this work is done by the District Planing Board in Maharashtra. In Karnataka this work is done at the district level under the chairmanship of the Divisional Commissioner while in Tamil Nadu, it is implemented by the District Development Corporation.

Shortcomings of the Drought Prone Area Development Programme

1. The process of fixing the targets is faulty. In many areas small and marginal farmers as well as agricultural labourers do not get benefit from the programme; and this section of society is in dire need of assistance in such a situation.
2. Programmes are often delayed due to shortage of working force with the requisite skill.
3. There is a general lack of experience to run such a programme.
4. The expected results are not obtained due to lack of information.
5. Dualism and dichotomy in efforts results in lower capabilities.

Hill Area Development Programme

According to 1951 Census data, about 18.6 per cent of India's total area is termed as hilly area (305-2135 metres) and as per 2001 census, these hilly areas are divided into following two broad categories :

(*i*) The Hilly Areas that are along the boundaries of the States and Union Territories. This category includes Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Darjeeling hills areas of West Bengal, and north-eastern states (Assam, Arunachal Pradesh, Nagaland, Mizoram, Manipur, Tripura, Meghalaya and Sikkim). These are termed as ***Special Category States*** and most part of the outlay for development of these areas is provided in the shape of Central Assistance.

(*ii*) Hilly Areas which are parts of States. These hilly areas form part of one or more than one states. The main examples of this category of hilly areas are the Aravalli, the Vindhyas, the Satpura, the Mahadev, the Maikala, the Ajanta, the Western Ghats and the Eastern Ghats. All these hilly areas are situated in the peninsular plateau area and they spread in different directions. The development plans for these areas are prepared and executed by the concerned state governments.

For the integrated development of the North-eastern region, the Central Government set up the North-Eastern Council by an Act of Parliament. This council prepares development plans for one or two states or for the whole of North-eastern region. The North-eastern council has played a significant role in the development of inter-regional programmes of power generation and its transmission, construction of roads, agriculture, animal husbandry, fisheries, forestry, etc. This council is also engaged in research, experiment and human development as well as in educating the people.

Some of the typical hilly areas from the development planning point of view are Karbi Anglong and Cachar in Assam (area 15,200 sq km) Darjeeling in West Bengal (area 2,400 sq km), Dehra Dun, Pauri Garhwal, Chamoli, Uttarkashi, Almora, Pithoragarh, Tehri Garhwal, and Nainital (area 51,100 sq km) in Uttarakhand. Although the concerned state governments are responsible for the development of these areas, yet need for central assistance was felt during the Fifth Five Year Plan, which was granted

keeping in view the area and population of the concerned regions. The concept of sub-plans was also encouraged so that they are made complementary to each other. Another major hilly area is the Western Ghats which spreads over 132 talukas (area 1,37,000 sq km) in Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu. The Central Government provides financial assistance for the development of the Western Ghats.

The problems of hilly areas are quite different from those of the plain areas. The rugged topography and different climate of hilly areas gives rise to a different set of economic, social and cultural conditions. These conditions required special planning for the hilly areas for which detailed information regarding economic, social, cultural, and political conditions as well as that of natural and human resources is very essential. Special attention is paid to the optimum utilisation of land, mineral, water, and biotic resources.

Active participation of the people, particularly of the women, is essential for the successful implementation of the plan. Peoples' involvement can be ensured by encouraging the concept of ***social fencing***, which implies a voluntary and self imposed discipline in managing resources of society at a local level. Under the development plan subsistence agriculture, plantation, agriculture, food grains culture, animal husbandry, poultry, bee-keeping, pig farming, forestry, etc. can be developed by using the local resources. Cooperative societies and Farmers' Service Societies are strengthened. Plantation Agriculture (tea, coffee, spices, etc.), agricultural forestry and social forestry are given priority under the forestry programme. Linkages are established between fruit producing and fruit consuming areas.

In some of the areas of the north-east region, the tribal people are practicing shifting agriculture locally known as ***Jhuming***. This type of agriculture causes heavy damage to forest and soil resources and disturb the ecological balance of the concerned area. Under the Hill Area Development Programme, the practice of shifting agriculture is discouraged and in its place, plantation crops such as tea, coffee, rubber etc. are encouraged. This change from shifting to plantation agriculture saves soil and forest resources and help the tribal people in leading a settled life. These tribal people become owners of plantations in due course of time.

Planning is also done for animal husbandry depending upon the number of animals and extent of pasture lands. Provisions are made for improving the breeds, health and productivity of the animals and plans are also prepared for processing and marketing animal products.

Major thrust of the Hill Area Development Programme is to promote the following :

- Agriculture-sedentary, plantation (tea, coffee, species, rubber, coconut, etc.)
- Horticulture, especially banana, apple, grapes, and citrus fruits.
- Animal husbandry, poultry, bee-keeping and piggery.
- Conservation of soil and forest resources.
- Cottage and village industries.
- Employment to the rural youth.
- Strengthen co-operatives and farmers' service societies.
- Discourage Jhuming.

The hilly areas are more suitable for industries that require pollution free atmosphere, relatively cool and comfortable climate, are based on high skill and are capable of high value addition. Electronics, watch-making, optical glasses, medicines, fold furniture are some of such industries which flourish in these areas. Cottage industries like handloom and carpet-making are also carried on. Besides, tourist industry is a very important economic activity. The natural beauty of the hilly areas attracts tourists in large numbers from far and wide places and tourism has great potential in these areas. Solid planning is required to harness this potential.

Vast hilly areas, particularly in the Himalayan region, provide ideal conditions for the growth of pharmaceutical herbs, fruits, flowers and other useful plants. Thus, pharmaceutical industry has a huge potential in these areas. In fact many such industries have already been developed in the Shiwalik and the Lesser Himalayan region. The wild life of this area is an added attraction as it adds to the bio-diversity of the hilly areas. Therefore, integrated planning for conserving botanical and zoological wealth of these areas is very essential, under which there should be provision for national parks, wild life sanctuaries and biosphere reserves.

For any successful planning for the hilly areas, extensive field survey is of utmost importance because we get a wealth of information from such surveys. These surveys need to be updated periodically so that latest ground realities are made available to the planner. For such survey, modern techniques like remote sensing, air photographs, Global Positioning System (GPS) etc. are very useful. Planning can be at the regional, sub-regional, taluka, block or even at settlement level. Peoples participation is very essential for the success of such plans. The plan should be eco-friendly and peoples' awareness is also important. There should be provision for compensating the loss of natural resources. For example reforestation should be made mandatory for compensating the loss of forests if a paper mill is set up in any one of these areas. Wastage of water can be avoided by constructing small dams and storing water in tanks, lakes and other reservoirs. Hilly areas are basically more suitable for perennial commercial crops like tea, coffee and fruits and are deficient in the production of food grains. Thus, there should be sufficient arrangement for storing food grains so that common man, along with those who are willing to stop the practice of shifting agriculture may get the right quantity of food at the right time.

There are regional disparities of development between the hilly areas and plain areas which has led to separatist sentiments in the peripheral hilly areas and there is lot of insurgency particularly in the north-eastern region. Most of these areas are inhabited by the scheduled tribes and their development is necessary. The only way to bring them in the main stream of the century is to improve their economic social and cultural condition. Thus there is dire necessity to prepare and implement solid development plans to bring about positive change in their life style.

Tribal Area Development

Defining a tribe is a difficult task, and no definition in India has proved satisfactory and precise. In general, the tribes are expected to possess some, if not all, of the following characteristics :

(*i*) their roots in the soil date back to a very early period.

(*ii*) they live in relative isolation of hills and forests.

(*iii*) their sense of history is shallow in the sense that after some generations, the remembered history tends to shade off into mythology because they usually do not keep a written record of their history.

(*iv*) they have a low level techno-economic development.

(*v*) in terms of their cultural ethos (language, institutions belief and customs), they stand out from other sections of society.

(*vi*) even if they are not egalitarian, they are at least non-hierarchic and undifferentiated.

As noted by **S.C. Dube**, the above mentioned characteristics are only rough indicators and cannot withstand a critical scrutiny. Thus neither all tribals are 'original' inhabitants of the soil nor all of them live in isolation. In fact, three-biggest tribes in India *viz*. Gonds, Bhils and Santhals, live in close proximity of non-tribals. The third, fourth and fifth characteristics are not the legacy of the tribals alone. They are to be found among non-tribals as well. The sixth characteristic is also not universally applicable to all tribes. There are many tribes which are divided into a number of endogamous sub-divisions which behave like castes.

However, in the absence of any other convincing criteria, the above characteristics are usually accepted to identify the tribals. Thus on the basis of these characteristic features, the Government of India has included 427 communities in the Scheduled Tribes, given in he Eighth Schedule of the Constitution of India. Numerically, the Bhils and Santhals are the most important tribal groups of India, each with a population of more than 35 lakh. Next to them are Minas, the Mundas and the Oraons, each having a population of over ten lakh. The Hos, the Khonds and the Kols are next to them, each with a population of over five lakhs. After that, there are 42 tribes, each having a population varying from one to five lakhs.

Economy. Economy is the basic parameter for identifying and classifying the Tribal people. They are mainly involved in hunting, fishing, gathering, animal husbandry and agriculture (mainly shifting and sedentary cultivation). Tribes of Andaman and Nicobar Islands depend on gathering and hunting. On the mainland of India, almost all the tribal people living in forests also depend on gathering and

hunting. Birhor, Kharia, Kadar, Chenchu etc. are some of the tribes living in the forests of Central India and mainly depend on gathering various roots and tubers, fruits, honey, etc. They collect these items for their personal use or for exchange with agricultural products. The Todas of the Nilgiri Hills are pastoral tribes. They rear buffaloes and live on buffalo products. However most of the tribal people are engaged in agriculture although their method of cultivation is primitive and their agricultural productivity is low. It may be mentioned that about 90 per cent Bhils, Gonds, Santhals, Mundas, Oraons, Nagas, Khasi, Mizo, etc. are engaged in agriculture.

Most of the economic activities of the tribal people are low grade primary activities which do not provide enough means for their survival. Thus majority of the tribal people are not able to enjoy the basic facilities of good health, education and are still at lower level of economic development.

Tribal Development through Planning. The policy of the Central Government immediately after Independence was to focus on improving the economic condition of the Schedule Tribes and provide security to their interests. For the first time in 1954, about 43 special multi-purpose development schemes ever implemented. In the year 1957 the tribal block development plan was initiated, which aimed at improving the economy, education and communication for the tribal people. One development block consisted of 150-250 sq miles of area and 25,000 population. The Shibu Ao Committee constituted in 1969 recommended improvements in land tenure, loans, and economic conditions with respect to Scheduled Tribes.

Programmed initiated by the Central and State Governments

The Central Government and the State Governments have initiated a large number of programmes for improving the lot of the tribal people and for bringing them in the mainstream of the country. Some of the important programmes are named as under :

Centrally Sponsored Programmes

1. Scholarship to all the students (both males and females) after matric.
2. Special provision of hostels for girl students.
3. Pre-examination training.
4. Establishment of Tribal Development Blocks (TDBs).
5. Encouragement to cooperation.
6. Research, Training and Special Projects.
7. Improvement of working and living condition of those tribals who are working in unhygeinic occupations.
8. Setting up centres of Coaching-cum-Guidance.
9. Grants for All-India non-official organisations doing welfare work among the Scheduled Tribes and Schedules Castes.

Programmes Sponsored by the State Governments

1. Grant of pre-matric scholarship and stipends
2. Exemption from tuition and examination fee
3. Mid-day-meal
4. Provision for educational equipments
5. Setting up of Ashram Schools
6. Grants for the construction and maintenance of hostel and school buildings
7. Providing land and irrigation facilities
8. Provision for better seeds, fertilizers and agricultural implements
9. Bullock carts for transportation
10. Development of cottage industries in addition to agriculture for supplementing the income
11. Encouragement to cooperation
12. Development and improvement of communication system
13. Control on spread of shifting agriculture
14. Encouragement to animal husbandry and supply of poultry, sheep, pigs, goats, etc.
15. Health services at the village level.
16. Programme for providing drinking water.
17. Provision for house sites and houses.
18. Legal aid to resolve disputes.
19. Grants-in-aid to non-official organisations working at the State level.

Areas of Development

1. Agriculture. About 90 per cent of the tribal people are cultivators but majority of them are engaged shifting and/or sedentary or rudimentary cultivation. Their fields are of small size and their implements are old traditional and inefficient. The irrigation facilities are badly lacking. Consequently, their agricultural productivity is very low and many of them are not able to produce which may be considered sufficient even for their own family members. Economic gains from agriculture are simply out of question in such circumstances. Keeping these facts in view, the Central and the State Governments have prepared many plans for providing better seeds, fertilizers, implements, credit and irrigation facilities and making arrangements for land reforms, soil conservation, land reclamation, etc.

2. Land Distribution and Land Alienation. Land distribution is very uneven and irrational among the Scheduled Tribes and whatever little land they own, that is grabbed by the moneylenders, *Sahukars* and other non-tribal people. They lend money to the tribal people at very high rate of interest and when they are not able to pay back the loan, their land is transferred to the moneylenders. This transfer of land from the tribal to non-tribal people on the basis of non-payment of loan is known as ***land alienation.*** This process has been operating in the tribal belts of India for a pretty long time and many tribals have little assets they had inherited from their fore-fathers. To safeguard against this trend many State governments have adopted several measures. Some of the remedial measures are as follows :

(*i*) In Gujarat, Odisha and Rajasthan, there is restriction on transfer of land from tribals to non-tribals by sale.

(*ii*) In West Bengal, there is restriction on transfer of tribal land to any person (whether tribal or non-tribal).

(*iii*) Tribal land cannot be transferred to any one by any means.

In spite of all the above mentioned legal safeguards, the government agencies have failed to check land alienation which is going on rampantly.

3. Industrialisation. Tribal people are generally engaged in cottage industries and subsidiary occupation. The activities of their cottage industry include making conventional and crude implements, weaving, bee-keeping, oil extracting, sericulture, *palm-gurs,* etc.

After Independence, some integrated iron and steel plants were set up in tribal areas. These include iron and steel plants at Durgapur, Rourkela, Bhilai, Bokaro, etc. Many illiterate, unskilled and semi-skilled workers find jobs in these iron and steel plants. Technical training is also being provided to tribals to enable them to work as skilled labour in these and other projects.

4. Education. The Central and State Governments are spending huge amounts of money to educate the tribal people and to bridge the gap between the tribals and the non-tribals. There is provision for scholarships, stipends, hostels, free stationary and books, free boarding, mid-day meal etc. Coaching and guidance facilities are available even to those candidates who are preparing for competitive examinations. Scholarships are also granted for higher studies abroad.

5. Employment. There is 7.5 per cent reservation for candidates belonging to Scheduled Tribes in all the vacancies created by the Central and the State Governments. The reservation in direct recruitment to Class III and Class IV categories of posts which normally attract candidates to belonging to a locality or a fixed region are fixed in proportion to the population of the Scheduled Tribes in the respective State and Union Territory.

6. Cooperation. The tribal people are almost invariably exploited by the money lenders, forest contractors and other non-tribals and there is urgent need to save the tribals from the clutches of these exploiters.

7. Transport and Communication. Most of the tribal people are living in hilly, mountainous of forested areas which are inaccessible and isolated. Such a situation creates great hindrance in the development of their life style. Therefore, it is necessary that areas inhabited by the tribes should be provided with transport (roads and railways) and proper means of communication so that they are absorbed and assimilated in the national stream.

8. Marketing. The tribal people are known for their handicrafts and produce a large variety of goods which do not need modern sophisticated technology. They are also well trained in collecting a variety of goods from the forests, some of which are very rare. They are exploited by the purchasers because the purchasers do not offer them the remunerative price for their goods. In order to overcome this difficulty, proper marketing facilities should be provided to them.

9. Tribal Development Agency Projects. The Tribal Development Agency Projects were started in 1971-72 in some areas on an experimental basis. The work of these agencies is implemented in some selected districts under the chairmanship of district collector. Such agencies have full-time project officers and other district officers as their members.

10. Other Schemes. In addition to the above mentioned schemes, several other schemes were also undertaken to improve the living standard of the tribals by providing them proper facilities of education, health, sanitation, etc.

Critical Appraisal of the Tribal Area Development Plan

The Tribal Area Development Plan has achieved great success in serving the tribals, improving their lot and bringing them in the main stream of the Indian society, yet some of the glaring shortcomings have been noticed, as is clear from the following points :

- **Achievements of the plans**
  1. Several policies adopted by the Central and the State Governments have helped in uplifting the tribal people and changing the mode of thinking and attitude of many tribals.
  2. The educational policies, reservation for tribals in government jobs, help in the field of agriculture, co-opertion, communications, industrialisation, social service, etc. have brought tribals closer to the main stream of national life.
  3. Tribal markets have been linked with the main stream markets which has given greater opportunities for economic progress to tribals and creating commercial aptitude among them.
- **Failures of the Plan**
  1. Benefits of the government policies could not percolate to the lower strata of the tribal community and remained concentrated in the upper crust of the tribals.
  2. The Tribal Development Blocks (TDBs) are usually criticised because they have not bothered about the participation of the tribal people in the preparation and implementation of the plan.
  3. The rigid, self-centred and unchanging bureaucracy has failed to appreciate the problems of the tribals and to fulfill the role of development agency.
  4. Local politicians also do not work much to safeguard the interests of the tribals and always work in their own interest.
  5. Large industrial projects in the tribal areas have resulted in large scale displacement of the tribals.

Area Development Programme

This is an integrated programme which has been prepared for areas with more 50 per cent or above of its population consisting of tribes. Emphasis has been laid in the sub-plan with the following aims in mind :

1. Narrowing the gap in the level of development between the tribals and non-tribals.
2. Improving the standard of living of the tribals.

Tribal Sub-plan

Different tribal areas have different environment and bio-diversity and their problems are also different from one another. Therefore different methods have to used for solving the tribal problems in different parts of the country. Taking these facts into consideration, Tribal Sub-plan was proposed during the Fifth Five Year Plan. Tribal areas of 19 States and 2 Union Territories were identified under this sub-plan. Financial assistance for this programme was provided by the Central Government and the State Governments.

- **Aims of the Tribal Sub-Plan**
  1. To relieve the tribal people from their exploitation by the money lenders and contractors.
  2. To improve the economic, social and cultural position of the tribal people.
  3. To bridge the gap between the development of tribals and non-tribals.
  4. To evaluate the resources from different sources.
  5. To prepare programmes for the Tribal Sub-plan.
  6. To develop proper structure of administration.
- **Strategies of Achieve the Goals**
  1. Checking the exploitation of the tribals as all levels.
  2. Developing the tribal economy by reforms in agriculture, land reforms; soil conservation, forest conservation and afforestation, irrigation, etc.
  3. Improving the infrastructure by providing facilities of education, health, training, electricity, etc.
  4. Understanding the problems of displaced, migrated, liberated bonded labourers, forest dwellers, Jhum cultivators and other backward groups and solving these problems.
  5. Arranging for numerative prices of tribal products.
  6. Improving the environmental conditions.

Three Tier Structure of the Tribal Sub-plan

The Tribal Sub-plan has three tier structure involving micro, meso and macro levels of planning. The ***micro-region*** is coterminous with development block, ***meso region*** is contiguous to the development block having a population of 3 to 5 lakhs and its boundaries are generally determined by the boundaries of talukas or tehsils. The ***macro region*** is a bigger tribal belt which may contain the entire tribal area of a state. The functions at the micro, meso and macro levels have been visualised as follows :

1. Micro Level. Functions at the micro level include :

(*i*) education upto higher secondary level

(*ii*) elementary and complementary health services

(*iii*) agricultural research extension

(*iv*) supply of agricultural inputs

(*v*) minor irrigation schemes

(*vi*) elementary veterinary services

(*vii*) multipurpose co-operatives

(*viii*) local panchayats

(*ix*) household industry

(*x*) village approach roads.

2. Meso Level. Functions included at the meso level are :

(*i*) higher general education

(*ii*) technical and vocational training

(*iii*) manpower planning and employment services

(*iv*) advanced health services with referral facilities

(*v*) agricultural research extension

(*vi*) seed multiplication forms

(*vii*) soil conservation and land management

(*viii*) apex interpreted credit marketing structure with adequate storage and buffer stock facilities.

(*ix*) development of road and communication infrastructure connecting markets with state/district highways

(*x*) distribution of network of power, rural electrification etc.

(*xi*) local resource based industries with adequate market linkages

(*xii*) forest management

(*xiii*) horticulture development

(*xiv*) complementary development programme in hinterland and the bigger industries

(*xv*) medium irrigation projects

(*xvi*) research strategies and evaluation.

3. Macro Level. The macro level function include :

(*i*) coordination of activities in tribal development projects

(*ii*) agricultural research on regional basis.

(*iii*) direction of various sectoral programmes in the project

(*iv*) major irrigation projects
(*v*) river valley development
(*vi*) industrial and mineral development
(*vii*) marketing support projects
(*viii*) evaluation

Some of the problems are still, un-attended and need immediate attention. These problems are : (*i*) land alienation, (*ii*) indebtedness and exploitation, (*iii*) bonded labour, (*iv*) low standard of education, (*v*) low agricultural production and productivity, (*vi*) inadequate supply of essential consumer goods, (*vii*) land reclamation, (*viii*) inadequate irrigation facilities, (*ix*) shortage of drinking water, (*x*) inadequate facilities of communication, (*xi*) shortage of houses, (*xii*) inadequate marketing facilities, (*xiii*) lack of employment opportunities, (*xiv*) under-developed state of health services.

Critical Evaluation of Tribal Sub-Plan

Although this plan has many merits and has served the intended purpose to a great extent, yet it has some of the glaring drawbacks, as is clear from the following points :

1. This sub-plan is just a part of the departmental plan of the state plan and does not enjoy the privilege of independent functioning.
2. Since it has been integrated with the state planning, it has failed to address the local problems.
3. The basic structure of the ground level information regarding development is overlooked.
4. The pattern of administrative unity within the sub-plan is lacking.

Suggestions for Improvement

1. The Tribal Sub-plan should be separated from the main State Plan and a separate plan for the tribal people should be prepared.
2. The Planning Commission should make separate financial provision for this plan so that it is not financially dependent on the State plan.
3. The department for Tribal Development should act as a coordinating unit in each state.
4. There should be separate financial provision for each department so that local problems are solved.
5. Participation of the tribal people is very essential for the proper preparation and implementation of the Sub-Plan. This will help in understanding the real problems of the tribal people and finding solution to such problems.

Strategies for Development

1. Problems of Agricultural Development. Developmental programme for increasing agricultural production and productivity should include : (*i*) increase in irrigation facilities; (*ii*) soil conservation; (*iii*) provisions of modern agricultural inputs at affordable prices; (*iv*) arranging for economic size of the holdings; (*v*) improving agricultural marketing facilities and (*vi*) making tribal farmers aware of the latest techniques used in agriculture.

2. Problem of Land Alienation. A large part of land belonging to the tribal people has been grabbed by the money lenders and forest contractors. Some strong steps are to be taken to check this trend which include : (*i*) legal protection to the tribals; (*ii*) making tribals conscious of their rights; (*iii*) improving and up dating the land records. Unfortunately there are no land records in some of the tribal areas.

3. Development of Transport and Communication. Roads and different modes of communication need to improved to provide better accessibility, social inter action and opportunities of economic well being to the tribals.

4. Forest Policy. The last Indian Forest Policy was framed in 1988 which needs to be revised keeping in view the interests of the tribal people so that they are not deprived of the benefits of the forests. It is worth mentioning that most of the economic activities of the tribes are based on forests.

5. Development of Allied Agricultural Activities. Allied agricultural activities such as dairing, poultry, bee-keeping, animal husbandry, piggery, etc. should be developed to supplement the income of the tribals.

6. Development of Public Distribution System. Development of public distribution system is needed for proper supply of essential consumer goods to the tribals.

7. Development of Cottage and Small Scale Industries. Cottage and small scale industries can provide additional employment and these industries should be developed at least in some selected growth centres. These industries can be useful especially to those who are displaced from their original habitats by development projects like dams, large scale industries; transport routes etc.

8. Provisions of Social Services. Social amenities like medical and health facilities, nutrition, drinking water, housing etc. are to be provided to the tribals so that they are able to lead a reasonably good life.

9. Co-operation. Co-operative movement and Panchayati Raj institutions can go a long way in improving the lot of the tribals because they have a strong community feeling and long tradition of democratic institutions.

10. Educational Facilities. Provision of education facilities is of utmost importance to have a sustainable economic development among the tribal people.

11. Prevention of Exploitation. Poor, ignorant, illiterate and helpless tribals have been exploited since a long-time by the money lenders, landlords, forest contractors, government officials, panchayat members etc. It is practically difficult to put a check on such a large variety of powerful people but this is necessary if we want to see our tribals leading a peaceful and respectful life.

12. Change in Administrative Set-up. Administrative set-up should be changed in such a way that it becomes more responsive to the needs of the tribal people.

13. Periodic Evaluation. All the plans and programmes meant for the tribals need periodic evaluation so that old programmes may give way to new programmes and 'timely correction' is assured.

Case Study of Tribal Development Block—BASTAR

Although Bastar district has been divided into a number of districts, our purpose is served only by treating the erstwhile district of Bastar as an area of tribal study. Over 65% of the total population of Bastar district is tribal. Some of the tribes form a compact region, each conforming with physical division of the territory.

Location and Space Relations. Bastar district is situated in the southern corner of Chhattisgarh. It is bounded by Odisha in the east, Maharashtra in the west and Andhra Pradesh in the south. It is located at a distance of about 160 km from the port of Vishakhapatnam on the Andhra Coast along the Bay of Bengal and 88 kms from Raipur-Bhilai industrial complex in the north. It lies on the leeward side of the Eastern Ghats and, therefore, is devoid of any oceanic influences from the east. It, thus, has an interior location.

The Bastar tribal block is over 288 kms in north-south and 200 kms in east-west direction. With its total area of 37,750 sq kms, it is one of the largest districts of India and is larger than some states of India.

Physiography. A large part of this district is a plateau area between Mahanadi valley in the north and the Godavari valley in the south. The general elevation of this plateau is 600 metres above the mean sea-level. We can divide the entire area into the following five physiographic divisions (**Fig. 14.5**).

(*i*) **The Northern Mahanadi Plains.** This is a part of Mahanadi basin and is 300 to 450 metres above the mean sea-level. It slopes north-wards and continues into Chhattisgarh plain of Drug and Raipur districts.

(*ii*) **The Abujhmar Hills.** The Abujhmar hills are located in the western part of the Bastar district. Their height varies from 450 to 750 metres above the mean sea-level. The area consists of high ridges and deep valleys created by numerous streams. Thus, it is a highly rugged and undulating area. The hills and valleys have created an effective physical barrier from all sides and have isolated the area from the rest of the region.

(*iii*) **The North-western Plateau.** It is marked by steep scarps to its north, south and west. Its elevation varies between 450 and 730 metres above the mean sea-level. Indrawati plain lies towards its south at a height of 400-600 metres above the mean sea-level.

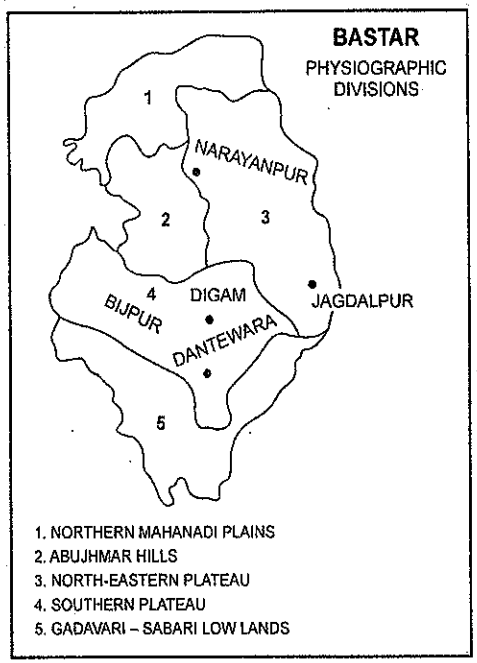


FIG. 14.5. Bastar : Physiographic Divisions

(iv) **The Southern Plateau.** This area is situated at an average height of 300 to over 750 metres above the mean sea-level. This plateau region has the Bailadila and Tikampalli hills in its middle. The small Dantewara plain lies in the north. Bailadila means ***'hump of a bullock'*** which is the highest hill in the Bastar district. It rises up to 1,200 metres above the mean sea-level. It has two parallel ridges which form physical barrier due to its height.

(v) **The Godavari-Sabari Lowlands.** This lowland is just 150 to 300 metres above the mean sea-level and is a rolling plain except two hills in its south and along the southwest. It extends from the southern boundary of the district to the base of the southern plateau.

Drainage. The deep relationship between relief and drainage of Bastar district is easily seen by observing the lines of natural drainage separated by a number of hills (*See* **Fig. 14.5** and **14.6**). **Mahanadi** flows through this area, just after leaving its source beyond this district. Being in its upper reaches, it is still a small river in the extreme north of the district and a few tributaries join it from the south. **Godavari** drainage basin is the largest in the area. The main river flows only along the southern boundary of the district. There are high banks on its both sides. **Indrawati** and **Sabari** are the major tributaries of Godavari. ***Indrawati*** is the principal river flowing westwards through the middle of the area. ***Sabari*** flows along the south-eastern boundary of the district. Most of the rivers are perennial although the amount of water in these rivers fluctuates according to season (increasing in rainy season and decreasing in dry summers).

Climate. The whole of Bastar district has hot tropical monsoon type of climate. The mean annual temperature is 24.5°C and the average annual rainfall is about 120 cm. There are three distinct seasons of dry early summer, wet late summer and winter. Most of the rainfall is caused by the Arabian Sea branch of monsoon and only 8 cm of rainfall occurs in the winter season. The windward side of north-west and south-west of Bastar experiences more rainfall

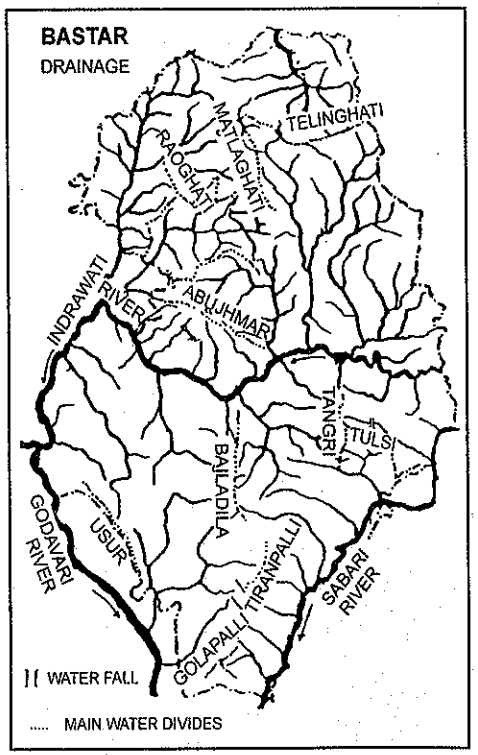


FIG. 14.6. Bastar Drainage

varying between 137 and 150 cms. The hills in the middle have created a rain-shadow area in the central Bastar and this area does not receive more than 120 cm of annual rainfall. Further east. It again increases to over 125 cm. Although there are no well-marked regional differences in climatic conditions, yet there are strong variations from one season to another.

The Resource Base. The two major resources of Bastar district are forests and minerals. The soils are thin and infertile and cultivated land is limited.

(i) **Soil Resources.** Larger parts of the district have metamorphic and granite rocks which produce only poor red soil after weathering. The soil is thin in uplands and relatively deep in lowlands. It is converted into laterite soil on the uplands due to alternate dry and wet seasons of hot climate. Heavy rainfall has caused large-scale soil-erosion particularly on the bare hill slopes. The shifting agriculture, particularly on the Abujhmar hills, has further added to the loss of soil and vegetation cover. The vegetation does not add much humus to the soil.

(ii) **Forest Resources.** The forests in Bastar are the most extensive resource. About three-fourth of its area is under natural forests. There are mostly moist deciduous forests consisting of hard woods. Teak, sal and laurels account for about 80% of the volume of wood found in these forests. The forests have not only provided protection to tribals of Bastar, but have also provided them with sound economic base for carrying out wood-based activities. Besides timber, these forests are the sources of gum, leaves, fruits, flowers and roots which are gathered by the tribal people.

(iii) **Mineral Resources.** Bastar district is very rich in mineral resources particularly iron-ore. There are three vast tracts containing large quantities of iron-ore. These are :

(*a*) Raoghat hills in Narayanpur,

(*b*) Chargaon-Kondapakha-Haliladdi hills in the north-west, and

(*c*) Bailadila hills in Dantewara (now a separate district). The Raoghat hills situated on the northwestern border of north-eastern plateau have six bodies of iron-ore of high metallic content. The total reserves are estimated at 738 million tonnes. The Chargaon-Kondapakha-Haliladdi hills in north-western Bastar has about 83 million tonnes of ore having 56-59% metallic content.

The Bailadila range runs north-south along the western boundary of Dantewara. It is a 34 km long and 10 km wide range varying from 300 to 900 metres in altitude. It has an estimated iron-ore deposit of 1,153 million tonnes with 60 to 70% iron content. This iron-ore area is now opened up and linked with Vishakhapatnam port through which it is exported to Japan.

Besides iron-ore, Bastar has rich deposits of mica, limestone, bauxite, manganese, clays, glass sand and building stone. The utilization of most of these mineral resources is not being done due to low level of technology and the lack of modern skills among the tribal people.

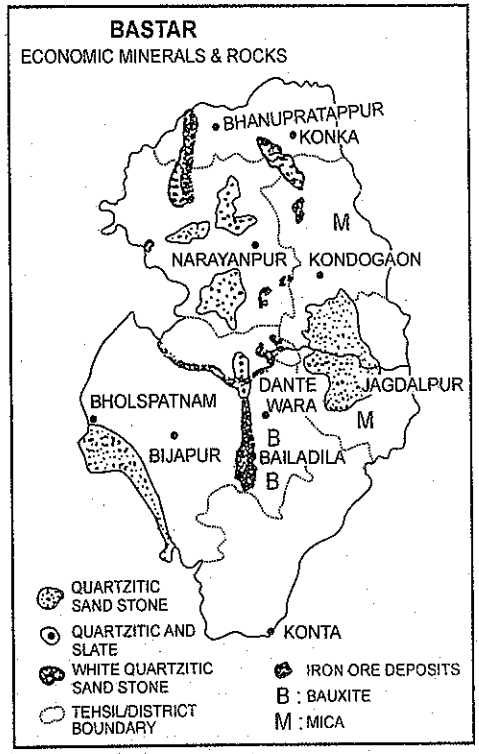


FIG. 14.7. Bastar : Economic Minerals and Rocks

Physiography and Human Life. The physiographic variations have led to the differences in human life and distribution of population. The

lowlands offer many advantages for better agriculture and have comparatively higher density of population. The uplands are mostly covered by forests and have generally low density of population. But there are two exceptions to it. The southern plateau has been cleared off the forests for cultivation in spite of its wild hilly terrain. The other example is that of Abujhmar hills where cultivation is done on hill slopes instead of valleys. The Abujhmar tribes have settled on the lower margins of the upper hill slopes because there is more free air movement on hill slopes as compared to the valley bottom. These sites offer the advantages of nearness to forest upslopes, better drainage around the settlements and water points downslopes. Shifting agriculture is still practised in many areas.

The influence of physiography is clearly seen on the cropping pattern. Rice is grown in lowlands while millets and poor pulses are the main crops of the uplands. The topography has restricted the availability of underground water, hence no wells can be dug up particularly on higher slopes. Tanks, therefore, are the only source of collecting and storing water. High hills and steep slopes do not favour the construction of roads. Moreover, construction and maintenance of roads is very costly. There are cart tracks or a few fair-weather roads.

Climate and Human Life. With hot tropical monsoon type of climate and with little facility of canal and well irrigation, the agriculture is largely rainfed. About 90% of the net sown area is occupied by *kharif* (monsoon) crops when sufficient amount of water is available. The area under *rabi* crops is limited. In hot dry summers, agricultural productivity is at its minimum. During wet summer, enough fodder is available for the animals. Fishing is also carried on in some areas. As the winter temperature is comparatively higher in southern Godavari lowlands, *jowar* is grown both as *kharif* as well as *rabi* crops.

In hot dry summer season there is practically no agricultural activity and people gather forest produce and repair their thatched houses to withstand the heavy rainfall of the coming rainy season. The onset of rainy season brings diseases and cut off many villages from one another. Since the poor tribals have very little clothing, even the moderate winters are too severe to protect them from chill.

Population. More than two-thirds of the population of Bastar district belongs to Scheduled Tribes. Thus population is predominantly rural, living in small hamlets, in separate clearings in scattered forests and subsisting on farming wherever arable land is available. It is mainly concentrated in the lowlands or in basin shaped regions bordered by hills to provide them natural protection. The hills and forests are devoid of any population. The higher population concentrations are found in the Mahanadi basin (Kankar district), Indrawati basin (Jagdalpur), Kotri plain (Bhanupratappur), Dantewara plains (northern Dantewara) and Sabri plains (northern Konta). People are also concentrated in Kondagaon (north-eastern plateau) and southern Dantewara because these tracts are isolated basins providing a sort of privacy to the tribals. **Figure 14.8** shows the distribution of population in Bastar district.

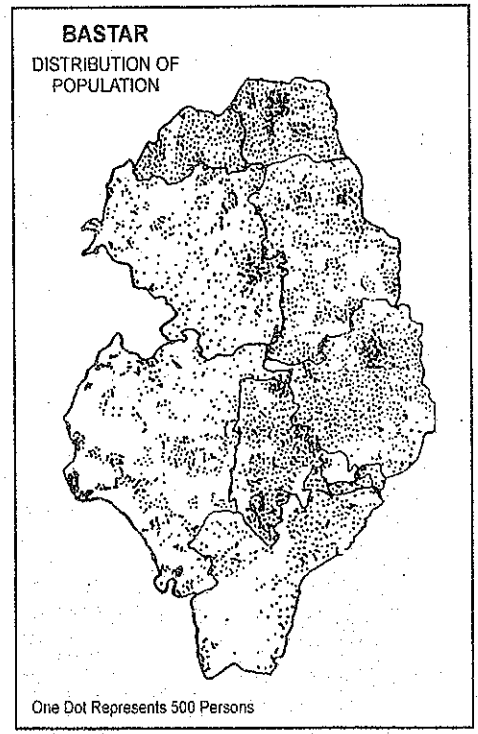


FIG. 14.8. Bastar : Distribution of Population-1991

Important Tribal Regions of Bastar District. The tribal population in Bastar district is not homogeneous. The physical isolation created by difficult terrain has led the different tribal communities to live in their own worlds, developing their own customs, rituals and beliefs. Each one of the groups wants to preserve its identity and way of life. The whole district is divided into seven major cultural regions which are inhabited by numerically important major tribes. These regions differ amongst each other in respect of house types, food, dress, beliefs, language, customs and techniques, and tools which they use in the production process.

(*i*) The Abujhmar or Hill Maria Tribal Region. The Abujhmar hills are located in the middle of western part of this district. This is the remotest and most backward region in Bastar. The word *'Abujhmar'* means ***'the unknown highlands'*** and the Abujhmaria are living in the stone age even in this modern age. The ruggedness of the terrain, the thinness of soil and lack of rich resource base have kept these tribes economically very backward. They meet their economic needs from the local products and have very few material possessions.

They do not know the use of plough and depend on shifting agriculture (*penda*). They cultivate the thin and poor upland soils and frequently shift the site of cultivation as deteriorating soils cannot sustain them for long. Their needs are small and population density is low. They are, therefore, averse to the modern development like roads, markets and other infrastructure. They are favourably inclined to accept such type of facilities as dispensary, poultry schemes and approach roads. There is a cultural barrier to change and it may take time to accept such changes.

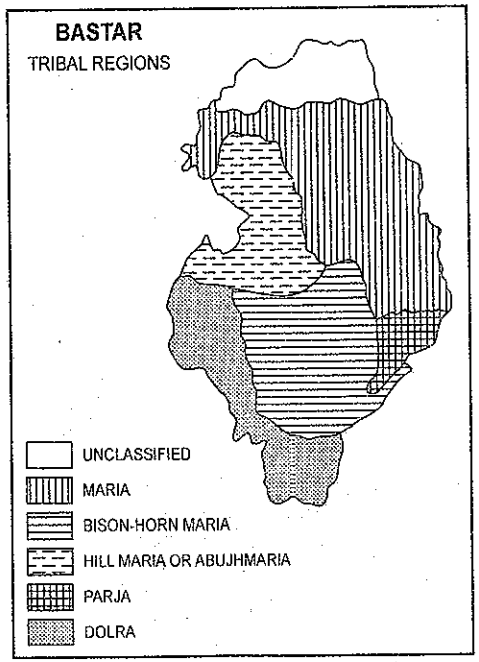


FIG. 14.9. Bastar : Tribal Regions

(*ii*) The Maria Tribal Region. This is the biggest cultural region of Bastar district and extends over north-east plateau and its adjoining areas. This tribe is mainly engaged in subsistence agriculture and produce rice and millets. Kosra is the most important millet crop. They also gather sufficient quantity of forest produce from the surrounding areas. The Marias in central Jagdalpur and southern Kondagaon areas are culturally more advanced and are known as 'Raj Maria' tribes. The life-style of these tribes is changing fast. They are more open to the forces of market and their demands now include cloth, utensils and ornaments.

(*iii*) The Bhatra Tribal Region. Culturally, this region is also quite advanced. This is almost a flat area covering eastern part of Indrawati plain in Jagdalpur tehsil. Good soil and easy communications have favoured the cultural advancement of the people of this region. Their main occupation is agriculture. Although rice is the main crop, oilseeds, sugarcane as well as wheat are intensively grown. The proximity to Jagdalpur, the district headquarters of Bastar, have also influenced the life style of the people of this region. This town stands at the junction of Raipur-Vishakhapatnam National Highway with all-weather feeder roads to many places.

(*iv*) The Dolra Tribal Region. It is located in the Godavari-Sabri lowlands along the boundary of Andhra Pradesh and has been influenced by Andhra culture. The Dolra tribals are more advanced than the Bhatra tribals. They are fond of coconut oil but do not cultivate any oil-seeds. Rather they obtain coconut oil from the market. They collect *mahua* seeds from the local forests to obtain edible oil.

(*v*) The Parja (Dhurwa) Tribal Region. This region extends over the southern part of Jagdalpur and lies between north-eastern plateau and Sabari lowlands. The difficult terrain and thick forests have

restricted the internal communication. Culturally, these tribes are less advanced than Bhatra and Maria. But Parja (Dhurwa) have been closely connected with the old ruling family of Bastar for long. They are, thus, advanced as compared to their Bison-Horn Maria neighbours. They have developed high skills in the bamboo work.

(*vi*) The Bison-Horn Maria Tribal Region. This is one of the most backward tribal regions of Bastar. It extends in Dantewara region and parts of Bijapur east and Konta north regions. These people use bison horns at the time of dancing which has given this name to them. The Dantewara basin is partly plain and partly plateau. They do not practise shifting agriculture but follow a system of rotation which they practise on the hill slopes and permanent cultivation on the valley floor. The highest number of murders and suicides in Bastar occur here. Another sign of backwardness is that a high proportion of plough animals—cows and bullocks, are often killed for beef. The construction of a railway line between Kirandul and Vishakhapatnam and mining of the iron-ore in Bailadila are two important developments in this region.

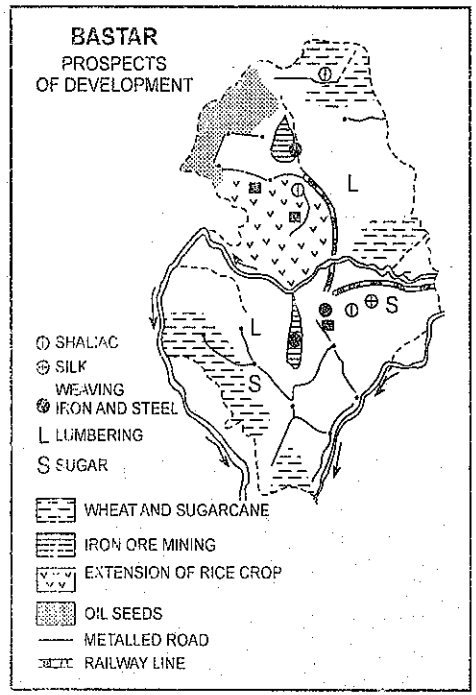


FIG. 14.10. Bastar : Prospects of Development

(*vii*) An Unclassified Gond Tribal Region. This region exists in the Mahanadi basin in the north extending over Kankar and Bhanupratappur. Its proximity to Chhattisgarh plain has helped in making better contacts with relatively advanced people of that area. This has resulted in economic and cultural advancement of these people. Its accessibility, low land relief and good soils are also instrumental in getting rid of backwardness. The economy of the region is fully agricultural. Rice is the dominant crop. The Kankar and Bhanupratappur are two nodal points which are connected with Raipur and Jagdalpur.

Planning the Development. Bastar has been attracting attention of the planners right from the beginning of the five- year plans. The two Special Multi-purpose Tribal Blocks, set up in the district for intensive development of tribal areas in 1956-57, were renamed as Tribal Development Blocks during the Third Five-Year Plan period. This strategy aimed at an integrated intensive programme covering all aspects of tribal life.

The idea of tribal development block emphasised the importance of soil-conservation, afforestation, social welfare, education, health, co-operation and communication. The opening of the Bailadila iron-ore mining and laying of railway and road network have ushered the era of economic development. The tribal people have welcomed the health facilities. Some changes in their consumption pattern and life style have been noticed. Agriculture and forestry are the two occupations of the people of this area. These two occupations have got to be strengthened. This requires suitable skills and enough inputs. Outside agencies may help in the economic development but the cultural heritage of the tribal people of this district will have to be safeguarded.

Failures of Development Plans. The Tribal Development Block could not deliver the desired result because blocks have been found to be too small an area for purposeful planning by the *Shilu Ao Committee*. Moreover, the development planning has been fragmented and some of the schemes which were introduced in tribal areas were actually meant for advanced communities. The employment-generating activities have not been taken up properly.

The active participation by the local people had been badly lacking. Most parts of the district are yet to be properly surveyed and the real potential of the area cannot be properly worked out. The land records are also not complete and up-to-date. The land laws should protect the ownership rights of the tribals. Care should be taken that outsiders with better skills and technology do not exploit the tribal people.

Multi-Level Planning

Planing is the process which may be conceived in the form of either single level or multi-level. In India, single level plan is formulated at the central level while in multi-level plan, states, districts, blocks and villages play their respective roles. Under the multi-level planning, formulation of the plans takes place at different levels and the combination of plans at different levels gives a macro system of planning. Multi-level planning may be defined as "*planning for a variety of regions which together form a system and subordinate systems*." Multi-level planning is more effective than the single level planning because every region (state, district, block or village) is involved in the planning process and there is direct participation of the people at the grass root level.

History of Multi-level Planning in India

During the first three Five Year Plans, planning was mainly formulated by the Central Government and implementation of the plans was also the responsibility of the Central Government. These plans were prepared by the Planning Commission of India which was governed by the Central Government. Some State Governments prepared their own plans during the Fourth Five Year Plan. B.R. Mehta Committee (1957) and Administration Reforms Committee (1967) recommended planning at the district level. The Government of India issued guidelines for district level planning in 1969 and some states started preparing their own state level plans following these guidelines. For example, Maharashtra and Gujarat prepared state level plans in 1972 and 1979 respectively. Emphasis was laid on decentralization while preparing state level plans in 1972. During 1978 and 1983, the block level planning was encouraged. This enabled the concerned agencies to gain experience in multi-level planning and helped in concentrating on the proper utilisation of the local resources.

In 1977-78, Dantewala Committee and Ashok Mehta Committee were constituted to suggest ways and means for implementing plans in the right perspective. Dantewala Committee suggested that the plans should be implemented at the block level. The activities involved in the block level planning should include miner irrigation projects, poultry, soil conservation, water management, social facilities etc. According to Dantewala Committee, block should be basic unit for planning because it has small size having limited population. These factors are quite convenient for establishing a close contact between the planners and the people. Ashok Mehta Committee emphasized upon the role of Panchayati Raj and stressed upon planning at the village level. On the recommendations of these two committees more emphasis was laid on rural development and rural planning during the Six Five Year Plan (1978-83).

The Present Day Multi-Level Planning in India

At present planing is done at five different levels which are at the level of (1) Centre, (2) State, (3) Districts, (4) Blocks, and (5) Villages. Before the 73rd and 74th Constitutional amendments in 1992, the task of plan formulation was primarily carried out by the centre and the state governments and the other levels (namely district, block and village) of planning process came into picture only at the implementation stage. But after these Constitutional Amendments, the lower levels of planning have been duly recognised and financial assistance has been provided to multi-level planning. Different levels of planning are briefly described as under :

1. The Central Level Planning. Also called First Level Planning, this is the first and the foremost level of planning which is formulated by the Central Government,. The central plans are prepared by the Planning Commission of India headed by the Prime Minister. Its members are some central ministers and 3-4 planning experts. The final assent to the plan is granted by the President of India who acts on the advice of the Council of Ministers which is binding on the President.

The business of the government is transacted through a three tier set-up. The *first layer* is constituted by the Prime Minister, Cabinet Minister, Minister of State, Deputy Ministers and Parliamentary

Secretaries. The ***second layer*** is constituted by the secretariat organisation of the ministry with secretary as its head. The ***third layer*** consists of executive organisation of the department.

2. The State Level Planning. This is also known as Second Level Planning under which all the states are entitled to frame and execute their own plans aimed at economic growth and in the interest of the general public. The plan is prepared by the State Planning Commission headed by the Chief Minister and is sent to the State Governor for his assent on the advice of the Council of Ministers which is binding on the Governor. The Council of Ministers works through the secretariat which is headed by a secretary. The State Planing Commission, in addition to the Chief Minister, has some ministers and a few professional experts in planning which assists the Council of Ministers in the planning process. The Council of Ministers has various departments functioning under it. These departments can be classified into the following three categories :

1. Development departments (agriculture, animal husbandry, rural development, public works and industries).
2. Social welfare department (health, education and social welfare).
3. Coordinating departments (home, revenue, finance, and planning).

Like the Central Planning, the State Level Planning is also of five year. However, the finances for the State Level Planning are to be arranged by the concerned state although there is a provision for financial assistance and loans from the centre.

The Constitution of India has provision for division of powers between the Centre and the States with reference to planning so that the chances of confrontation between the two may be minimised. The Seventh Schedule and Article 246 of the Constitution of India gives three lists of subjects (*i*) ***Union List*** (containing 97 items), ***State List*** (containing 66 items), and ***Concurrent List*** (containing 49 items).

The Central Government enjoys the power to legislate on the subject given in the Union List whereas the State Governments have power to legislate on the subjects contained in the State list. But both the Central and State Governments have powers to legislate on the subjects contained in the Concurrent List. However, the Central Law prevails whenever there is a conflict between the Centre and the States. According to the Prevailing law, organised activities like minerals, industries, railways, and telecommunications come under the Centre's purview while agriculture, collection of land revenue, irrigation, power, public health, education, local self government and several other important subjects are the responsibilities of the State Governments.

3. The District Level Planning. This is the Third Level of Planning where local planning starts. The District Level Planning is the responsibility of the District Planning Committee which is directly under the control of the district collector (also known as deputy commissioner in some states). He is responsible for maintaining law and order in the district and also acts as a coordinator among various departments. The main departments are those of agriculture, irrigation, animal husbandry, fishing, dairying, forestry, education, health, public works, industries, cooperation, social welfare, transport, panchayati raj, etc. Besides there are offices of the autonomous bodies, like those of Electricity Board, State Road Transport etc. Municipality for Urban Planning and Gram Panchayat for Rural Planning play an important role.

4. Block Level Planning. The Block Level Planning is lower than the District Level Planning but higher than the Local or Panchayat Level Planning. This level of planning was started right in the First Five Year Plan. For planning purposes, each district was divided into a number of blocks. Each block consisted of about 100 villages and a population of about 60,000. Participation of the local people is very important and decisions by the local people are intended to use the local resources in a better way. This level of planning is executed by the ***samiti*** of the villagers headed by the Block Development Officer (BDO). The general supervision of blocks is done by ***Block Samitis*** under the chairmanship of the ***Block Pramukh*** and elected representatives.

The institutional set up consists of a Block Development Officer (BDO) and five extension officers each of whom assists the BDO in the field of agriculture, animal husbandry, co-operation panchayats and rural industries. Apart from this, there is an oversear, a social education organiser, a progress assistant and village level workers on the staff. Also there are veterinary stockman, a medical officer, a sanitary inspector and a lady health visitor. Some states have an extension officer for programmes related to women and children.

The primary aim of the Block Level Planning is to understand the problems of the local people, to find ways and means to solve those problems and formulate as well as execute the development plans. Proper understanding of the local problems helps in optimum utilisation of the local resources. It generates employment opportunities and the way for planning. In fact the entire strategy of the Block Level Planning is based on employment planning, growth-centre planning and credit planning. The main activities of this type of planning include (*i*) agriculture and allied activities, (*ii*) soil conservation and water management, (*iii*) animal husbandry and poultry, (*iv*) fisheries, (*v*) forestry, (*vi*) processing of agricultural produce, (*vii*) organising input supply, credit and marketing, (*viii*) cottage and small scale industries, (*ix*) local infrastructure, (*x*) social services (drinking water supply, health and nutrition, education, housing, sanitation, local transport and welfare programme) and (*xi*) training of local youth and updating of skills of local population.

5. Local or Panchayat Level Planning. This is the lowest level of planning for which the Village Development Officer (VDO) and secretary are responsible. It is supervised by the *Gram Sabha* which is headed by the *Gram Pradhan*. It formulates plans for the welfare of the villagers. Funds are directly allocated from the centre for executing rural development programmes such as Integrated Rural Development Programme (IRDP) and Jawahar Rojgar Yojna (JRY). In addition, the *Panchayat* is also responsible for (*i*) promotion of agriculture; (*ii*) rural industries, (*iii*) health, (*iv*) maternity, women and child welfare, (*v*) common grazing grounds, (*vi*) village roads, tanks, wells, (*vii*) sanitation, and (*viii*) socio-economic development programmes.

DAMODAR VALLEY CORPORATION (DVC)

The Damodar river is a tributary of the Hugli river. It flows more or less in the west to east direction through Jharkhand and West Bengal. Its total length from its source in the hills of Chotanagpur plateau in Jharkhand to its confluence with Hugli in West Bengal is about 541 kms, 270 kms of which is in Jharkhand and the remaining 271 kms lies in West Bengal. In its upper reaches, it is known as Deonadi. It drains Ranchi, Hazaribagh, Dhanbad and Santhal Parganas districts of Jharkhand and Bankura and Bardhman districts of West Bengal. It takes a southerly turn from Bardhman town and joins river Hugli about 50 kms upstream from Kolkata. Damodar valley covers an area of 24,235 sq km in Jharkhand and West Bengal. Bokaro, Barakar, Konar are its important tributaries.

Physical Setting. Damodar valley runs through the middle of Chotanagpur Plateau in Jharkhand. It lies between the plateaus of Chotanagpur and Hazaribagh in the north and of Ranchi in the south. The average elevation of this plateau complex varies between 300 and 600 metres. The river originates at an altitude of 510 metres above sea-level and joins the Hugli at an altitude of less than 30 metres above the mean sea-level. It leaves plateau at a height of about 150 metres and reaches the plains in Bardhman district **(Fig. 14.11).**

The Damodar valley is a rift valley or a sunken trough, bounded by broken and tilted edges of the plateaus. As there are sudden descents from one level of plateau surface to the other, the whole topography of the surrounding area has an undulating nature. The break points, where tributary streams join the main Damodar river, have provided suitable sites for power houses. The residual hills of hard rocks left here and there in the basin have been joined to construct dams across the streams. The undulating nature of topography and faulted nature of strata have also favoured the extraction of coal.

Climate. The region receives annual rainfall of about 125 cms. This is monsoon rainfall which is concentrated between June and September. As the area lies in the path of tropical cyclones from the Bay of Bengal, there are chances of stormy rainfall many a times. Generally, the amount of rainfall is more in upper slopes than at the valley floor and more in the west than in the east.

Hydrology and Water-Power Development. The erratic monsoonal rainfall and heavy downpour due to tropical cyclones poses serious problem of

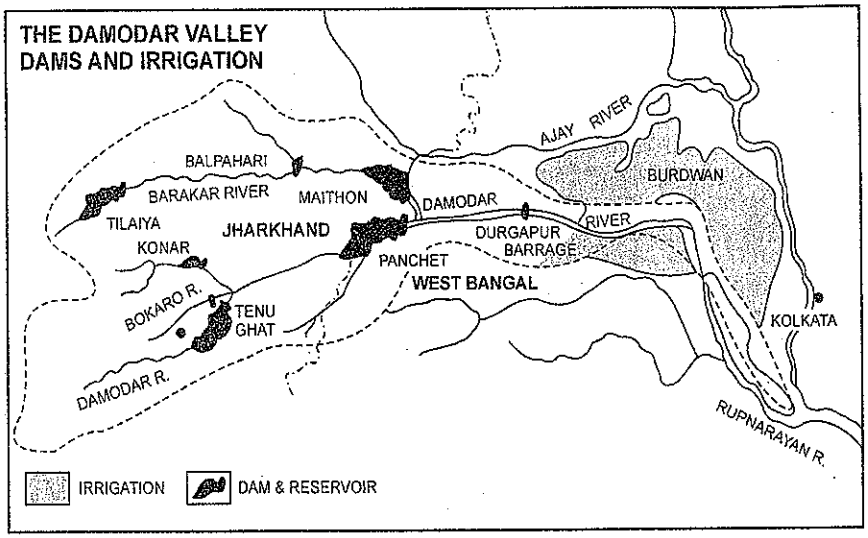


FIG. 14.11. The Damodar Valley : Dams and Irrigated Area

floods. The channel of the river is unable to accommodate the flow of water during the rainy season. The rocks suffer weathering in the hot and humid climate causing much erosion over sandstones and slates. This adds to the load of debris which often chokes the channel and aggravates the flood situation. The deforestation in the upper hills has made the problem more complicated. As soon as the total drainage converges and crosses through a narrow bottleneck amidst the rocks at Asansol and emerges on the plains near Bardhman, the heavy amount of sediments choking its peak flow is burst open. The plains below Bardhman get submerged under flood waters, sometimes to a depth of 2 to 2.5 metres causing great damage to life and property. Thus, the river Damodar became notorious for its floods and was known as ***'River of Sorrow'*** or ***'Sorrow of Bengal'*** and even ***'Sorrow of region'***. Its notoriety was demonstrated by the devastating floods in 1823, 1848, 1856, 1859, 1863, 1882, 1890, 1898, 1901, 1905, 1907, 1913, 1916, 1923, 1935 and 1943. While major floods occur at intervals, minor floods are experienced almost every year. The sediments brought by the Damodar create the problem of sedimentation in the Hugli which, in turn, endangers the Kolkata port.

In order to control the floods and other related problems, the Central Government, in consultation with the state governments of the then Bihar and West Bengal, worked out a unified development project for Damodar basin. The Damodar Flood Enquiry Committee suggested a comprehensive plan. This plan was based on the memorandum submitted by W.L. Voorduin, an engineer with the Tennessee Valley Authority (TVA) in the USA. The Damodar Valley Corporation (DVC) was established on 18th February 1948 to execute the Damodar Valley Project. The original plan was to construct seven major dams. These dams were Aiyar and Panchet Hill on the Damodar river; Maithon, Belpahari and Tilaiya on the Barakar river; Konar on the Konar river and Bokaro on the Bokaro river. But the DVC has constructed only four dams (Tilaiya, Maithon, Konar and Panchet). These dams are briefly described as under : **[Fig. 14.11]**

(*i*) **Tilaiya Dam.** This dam has been constructed on Barakar river. The construction on this dam was started in 1950 and completed in 1953. Its length is 366 metres and the maximum height above the river bed is 30 metres. Its gross storage capacity is 395 million cubic metres and its live storage capacity is 321 million cubic metres. It is the only concrete dam in the area. Two power stations of 2000 kW each have been set up here. The dam provides irrigation facilities to forty thousand hectares of land.

(*ii*) **Konar Dam.** It has been constructed on Konar river in Hazaribagh district of Jharkhand. It is 3,549 metres long and its maximum height above river bed is 49 metres. It is an earthen dam with concrete spillway. Its gross storage capacity is 337 million cubic metres and live storage capacity is 276 million cubic metres. Construction on this dam started in 1950 and it was completed in 1955. It has an installed capacity of ten megawatts. Bokaro steel plant and Bokaro thermal plant receive hydroelectric power and clean water respectively from this dam. It provides irrigation to 45,000 hectares of agricultural land.

(*iii*) **Maithon Dam.** It has been constructed on Barakar river, a little upstream from the confluence of rivers Damodar and Barakar. It is 994 metres long and its maximum height above the river bed is 49 metres. Its gross storage capacity is 1,357 million cubic metres. Construction on this dam was started in 1951 and completed in 1958. It has an installed capacity of 60 megawatts.

(*iv*) **Panchet Hill Dam.** This is also an earthen dam with concrete spill-way which is constructed on the river Damodar. Construction started on this dam in 1952 and was completed in 1959. This dam is 2,545 metres long and its maximum height above the river bed is 49 metres. Its gross storage capacity is 1,497 million cubic metres while its live storage capacity is 1,307 million cubic metres. It has an installed capacity of 40 megawatts and it irrigates about 28 lakh hectares of agricultural land.

Durgapur Barrage. The Durgapur barrage located at about 23 kms from Raniganj has been created for the storage of irrigation water. It is 831 metres long and about 12 metres high. It stores the water from Konar, Tilaiya, Maithon and Panchet Hill dams. The bulk of the water for storage is provided by Maithon and Panchet hill dams. This irrigation water is regulated through a network of canals extending over an area of about 5,000 sq kms in Bankura, Bardhman, Hugli and Haora districts in West Bengal. The barrage was completed in 1955. About 4 lakh hectares of land is irrigated mainly along the left bank in Bardhman and Hugli districts. The hilly nature of the terrain in Jharkhand has restricted the irrigated area.

The left bank of Damodar canal is navigation-cum-irrigation canal connecting Kolkata with the Damodar valley coal-fields. It is 137 kms long which carries 20 lakh tonnes of goods annually.

Benefits from the Project. Damodar Valley Project is a big landmark in the economic development of this region. Following are the main benefits drawn from the project :

(*i*) Flood control in the flood prone areas of Jharkhand and West Bengal.

(*ii*) Irrigation facilities to about 5.15 lakh hectares of land.

(*iii*) Installed capacity of 2,60,000 kW of hydro-electricity at various dam sites.

(*iv*) Check on soil-erosion through regulated flow of water.

(*v*) Additional land reclamation for agriculture.

(*vi*) Navigation in Damodar river, its tributaries and channels.

(*vii*) Promotion of public health through control on malaria and other diseases as a result of proper drainage of water.

(*viii*) Encouragement to fishing in the reservoirs and other water bodies.

(*ix*) Promotion of tourism.

(*x*) The project has provided a broad industrial base to the area.

Soils. Soils in the Damodar Valley are heavy clays and loams. They are deep and heavy on flat coal layers or low-lying tracts and light, coarse and thin in the uplands. Most of the land in the upper part of the basin in Chotanagpur region of Jharkhand is of relatively low fertility. The terrain is undulating and lacks irrigation facilities.

Forests. Over 40% of the region in Chotanagpur is under forests. There are valuable forest products. Besides *sal* wood, minor produce is collected from a number of other trees. Forest cover is poor on high hill slopes, having only palm, *ber*, *sabai* grass, *dhak*, bamboo and the thorny plants.

Soil-Conservation and Afforestation. The Damodar Valley Corporation has been assigned the task of soil-conservation and afforestation. The main objective of soil conservation and afforestation in the catchment area is to reduce the soil erosion and save the reservoirs from heavy siltation. The problem of soil-erosion is being tackled on watershed basis. The

measures adopted for soil-conservation are survey of soils taking into account the various 'physio-chemical properties of the soils, degree of slope, extent of erosion, present land use and suitability of irrigation', demonstration of better methods of land management and assessing the soil-fertility.

Afforestation within the catchment of Damodar valley is being carried out by the Forest Division of the Corporation as well as the forest departments of the state governments of Jharkhand and West Bengal.

Agriculture. The agricultural pattern is similar to that prevailing in other parts of Chotanagpur plateau in Jharkhand. For most parts of the Damodar basin, it is one-crop culture, *i.e.*, only one crop is grown in one agricultural year. Rice is the main crop of lowlands while uplands are more suitable for maize and pulses. These crops are just sufficient to meet the local requirements only.

The agricultural productivity of the area is low. The population density is not very high but limited nature of arable land available to the peasants has brought down the land-man ratio. There is only 0.1 to 0.4 hectares of land of poor type of net sown area for each individual peasant. In Jharkhand portion, besides some fairly big stretches of cultivated blocks in the lower portion of upper valley floor, Dhanbad district in its lower portion has the most extensive cultivation, amounting to 23% of its total area. The progress of coal mining, its heaps, mining settlements, a dense network of communication lines, thick forests and disturbance of local drainage because of huge mining operation, have all damaged the basin's cultivation.

Mineral Resource Base. The Damodar valley region is the most mineralised region of our country. As a matter of fact, the Chotanagpur plateau, in which this valley is located, is known as the ***'mineral heartland of India'*** **[Fig. 14.12].** Some important minerals are briefly described as under :

Coal. The Gondwana sedimentary rocks in the valley contain rich coal deposits. The richest, largest and most productive coal-fields lie in this region. The Damodar valley has about 60% of the country's reserves of medium grade coal and produces about half the output of coal in India. Most of the coal-fields are situated in the main valley of Damodar to the north of the river. Following are the important coal-fields of this area.

(*i*) Raniganj Coal-Fields. The coal mining in India started at Raniganj over a century ago. In this way, it is the oldest coalfield in India. Raniganj coal-fields spread over 1,500 sq km across Burdwan, Purulia and Bankura in West Bengal. A large quantity of coal from Raniganj is used for producing thermal power at Bandel, Durgapur and New Kashipore. The

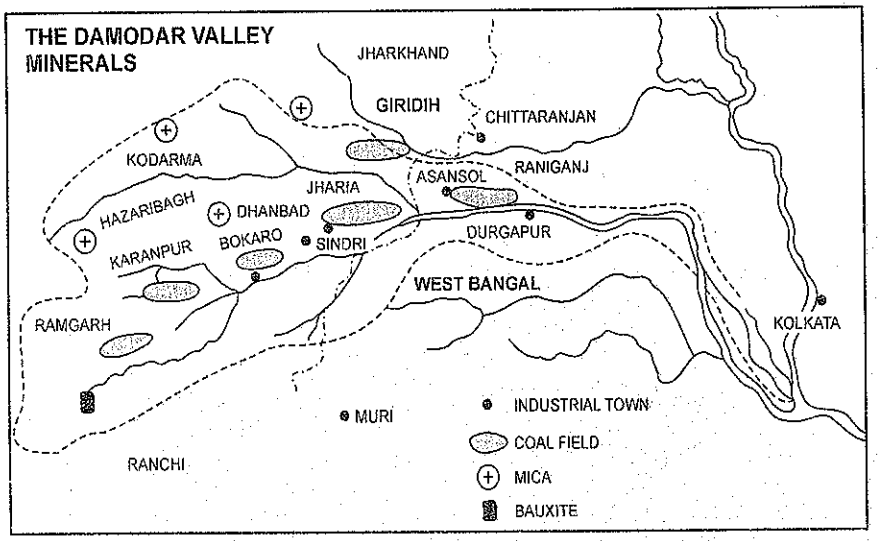


FIG. 14.12. Damodar Valley : Minerals

total reserves of this field are estimated at 13,290 lakh tonnes of high grade bituminous coal.

(*ii*) Jharia Coal-Field. Jharia is the most important of all the coal-fields of India with regard to reserves and production. It has total reserves of about 1,698.5 crore tonnes and produces about 20% of India's coal. It spreads over an area of 440 sq kms lying entirely in Dhanbad district.

(*iii*) Bokaro Coal-Field. This is the third important coal-field after Jharia and Raniganj. It is located in Hazaribagh district of Bihar. It has total reserves of 4,47,737.3 lakh tonnes and it produces about 6.2% coal of India.

(*iv*) Ramgarh Coal-Field. This is located in upper Damodar valley in Hazaribagh district and spreads over an area of 100 sq kms. Its reserves are estimated at 10,592 lakh tonnes.

(*v*) Karanpura Coal-Field. This coalfield spreads over an area of 1,522 sq kms in Hazaribagh, Ranchi and Palamau districts. The total reserves are estimated at 1,88,686 lakh tonnes and its production accounts for nearly 6% of India.

(*vi*) Chandrapura. It is more or less a part of Bokaro coal-field. The coal from this field is used in the Chandrapura thermal power station.

Other Minerals. Apart from coal, this region produces a large variety of other minerals, such as iron-ore, bauxite, copper, lead, mica and manganese. Fire clay is an important mineral, capable of resisting high temperature and a raw material for the manufacture of fire bricks and other refractories. This region produces about 10% of India's total production. Graphite in Dhanbad, sands in Damodar, crystalline limestone in the western parts, iron-ore in Dhanbad and scattered quartz elsewhere are also important.

Thermal Power. Thermal power stations have been set-up at Bokaro, Chandrapura, Durgapur, Sindri, Jamshedpur, Burnpur and Sitapur based on the locally available coal. They meet the power requirements of most parts of the Damodar river drainage basin.

Development of Transport Infrastructure. The region has a dense network of railways and roadways. Towards the lower part of Damodar basin, there is a clear convergence of railways from north, north-west, west and south-west. It has the locational advantage of being near to Kolkata. Dhanbad has become the focus of convergence of rails and roads. The grand chord line joining Delhi and Kolkata passes through the northern part of the Damodar valley. This line is now fully electrified. Besides this, many short railway lines criss-cross this area. A number of routes diverge towards west of Asansol. The watershed between the Ajai and the Damodar rivers is not very prominent, hence the railway link to Patna follows it and a branch line links Giridih. The railway line linking Kolkata-Asansol to Gaya-Patna passes through the upper Barakar river valley.

In the upper portion of the valley, the railway line from Dehri-On-Son via Daltonganj runs along the coal-fields belt. A branch line extends southwards to Jamshedpur via Muri. The recession of the scarp-slopes of Ranchi plateau has provided a passage through which routes to Jamshedpur are provided. The western part of the Damodar valley is hilly, forested and thinly populated. Therefore, it represents an undeveloped country-side while eastern part has recorded economic development.

In addition to railways, there is a network of major and minor roads. In more difficult terrain, where rail links cannot be provided, roads have been constructed negotiating the scarps. Sher Shah Suri Marg runs almost parallel to the Grand Chord Railway line in the Dhanbad section of the region. The industrial towns, collieries and washeries have been linked by local roads.

Industrial Development. The rich mineral resources of the region have provided a solid base for the rapid and widespread industrialization of the area. The Damodar valley presents a full industrial landscape which is comparable to any advanced country of the world. The valley is full of large and medium-sized factories. The Sindri fertilizer factory and cement factories at Sindri and Khalari, coal-washeries in Dhanbad, engineering works at Kumardhubi, refractory works at Dhanbad, glass and lead smelting factory works at Tundoo, aluminium factories near Asansol and at Muri, copper smelting at Ghatshila, locomotives at Chittaranjan and steel plants at Durgapur, Bokaro and Jamshedpur combine to make it a great industrial region. Government has contributed a lot towards the industrial growth of the region by setting a number of public sector undertakings. Durgapur and Bokaro steel complexes,

Heavy Engineering Corporation Ltd. at Ranchi, Sindri Fertilizer Plant and Indian Explosives near Hazaribagh provide some such examples. Six industrial complexes have emerged over time in the Damodar valley region. These are : (*a*) Durgapur industrial complex having thermal power plant, coke oven, iron and steel, mining machinery and cement machinery and electrical industries; (*b*) Asansol-Kulti-Burnpur industrial complex with steel factory at Burnpur, Chittaranjan Locomotives, Kulti Foundry Works, and Kumardhubi Engineering Works; (*c*) Dhanbad-Sindri-Jharia industrial area having Sindri Fertilizer Industry, chemical and coal-based industries; (*d*) Bokaro industrial area consisting of steel plant, thermal plants at Bokaro and Chandrapura along with coal washeries; (*e*) Ramgarh-Patratu area with Indian explosives and thermal power plants; and (*f*) Ranchi industrial township with HEC, HMT and foundry plants.

The mining industry has always occupied the place of pride in this region. This is abundantly clear from the structure of the work force in the area. Of the total work force, about 4.8% in Dhanbad, 6.3% in Santhal Parganas, 8.7% in Giridih and 9.8% in Hazaribagh district is engaged in mining.

With the availability of more hydro-electric and thermal power, more industries such as steel plants, coal-washeries, industries based on coal and its by-products and some forest-based industries are likely to grow and the Damodar valley will become large size industrial region of India.

The People. There are large variations in the population density of the Damodar valley. The upper catchment area is hilly and forested where low population density is found. In contrast, the lower part of the valley supports high population density and has experienced more urbanisation. The process of urbanisation is closely related to the rate of industrialisation. As such, the areas having more industries are more urbanised. Nearly 51.3% of the total population in Dhanbad has been recorded as urban. Purbi Singhbhum (52.9%) and Bardhman (35.4%) are other districts. Santhal Parganas and Bankura have low proportion of urban population, which have recorded 6.9% and 7.6% urban population respectively. A major part of the population especially of the Chotanagpur plateau is tribal which has its own problems of development.

The Problems. The Damodar Valley Project was primarily conceived for flood control and this target has not been achieved fully. Heavy floods did occur in 1959, 1970-71 and 1978, though their ferocity has been much reduced. Only four dams have been constructed in place of the original suggestion of seven dams. The over-utilisation of forest and lack of afforestation have aggravated siltation in the dams. Thus, the first line of defence in the form of forests and the second line of defence in the form of dams have failed to eliminate the problem of floods altogether. Hydroelectricity is to be supplemented by thermal electricity because the flood-control dams cannot be taken as power-generating dams in view of the creation of flood cushion before monsoon every year. However, the DVC has been an important example of integrated regional development. Its efficiency can be improved with better management and foresight.

Comparison of Damodar Valley with Ruhr Valley. There are so many similarities between Damodar Valley of India and Ruhr Valley of Germany. Damodar valley produces about 60% of India's coal and Ruhr valley provides 80% of Germany's coal. Both the areas have high grade bituminous coal. Both the areas have high level growth of coal-based industries. The other industries are also fairly developed. Transport facilities in the shape of railways, roadways and waterways are abundantly available to both the areas. Looking at these similarities, the Damodar river basin is often called as the *'Ruhr of India'*.

NATIONAL CAPITAL REGION

Delhi, the national capital of India, has registered a phenomenal growth in population in the twentieth century, especially after independence. **Table 14.3** gives an idea of population growth of Delhi.

The vast economic opportunities available in Delhi have attracted large number of migrants not only from its immediate neighbourhood but also from the far-off places in the country. This large-scale influx of people has put heavy strain on infrastructural facilities of the city which include among other things, housing, employment, transport, electricity, water, sewerage, education, medical treatment, etc. The concept of National Capital Region was conceived to reduce pressure of increasing population on these infrastructural facilities. Any strategy of containing the growth of Delhi within limits will have to be taken within the regional frame in which Delhi exists. The region in the immediate hinterland of Delhi, within which the development had to be planned in order to release pressure from Delhi, is known as *'National Capital Region'*. The Master Plan of Delhi was prepared in 1959 and was finally approved by the Government of India in 1962. The Master Plan contained amongst others a recommendation of setting a statutory NCR Planning Board. Initially, this board was constituted as an advisory body which was reconstructed in 1973.

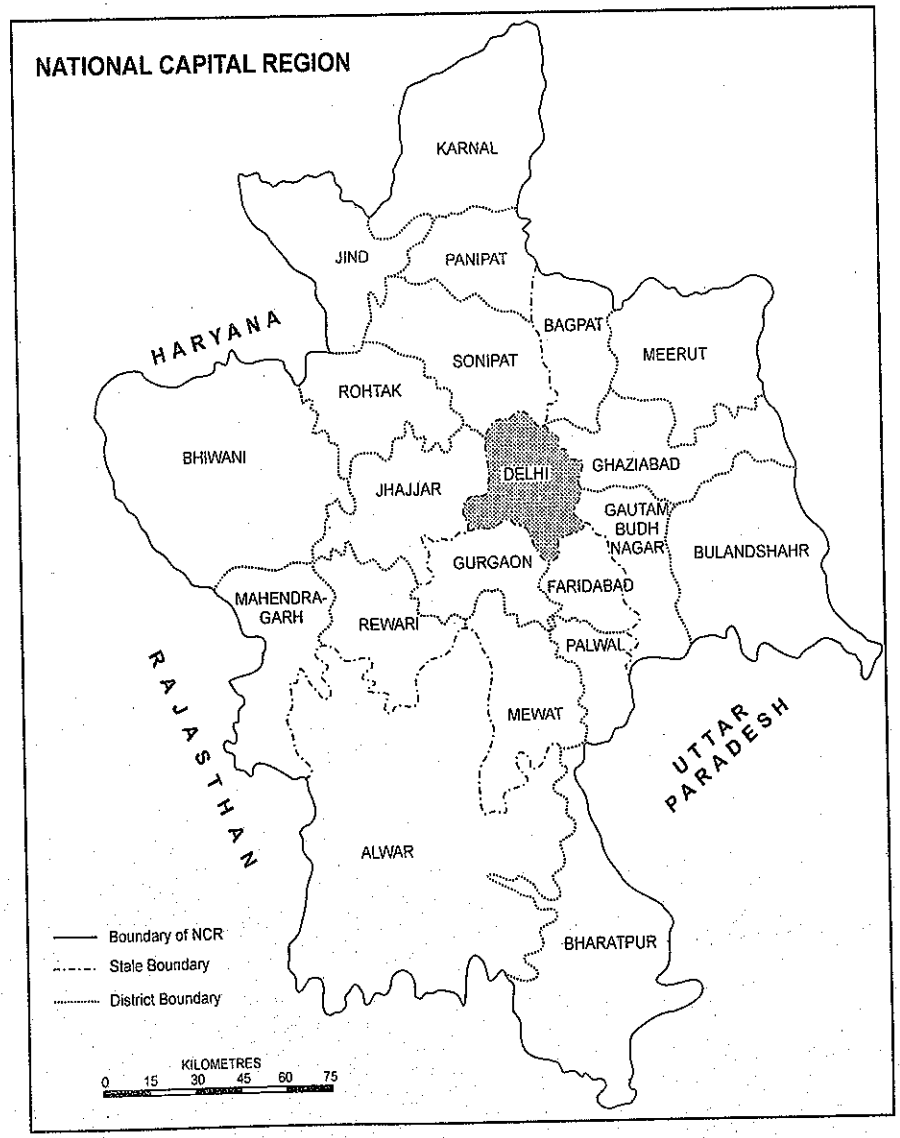


FIG. 14.13. National Capital Region

Its task was of coordinating the development of urban and rural areas in the National Capital Region under a comprehensive regional plan and to secure the collaboration of the concerned state governments in implementing the plan.

TABLE 14.3. Population of Delhi Urban Area

Census Year	Population
1901	2,14,115
1911	2,37,944
1921	3,04,420
1931	4,47,442
1941	6,95,684
1951	14,37,134
1961	23,89,408
1971	36,47,023
1981	57,29,283
1991	83,75,188
2001	1,38,50,507
2011	1,67,53,235

However, it was only in 1985 that a statutory organisation, named as National Capital Region Planning Board could be instituted through the enactment of NCRPB Act with a view to plan, implement and supervise regional development planning in the NCR. The plan was prepared on the basis of expert studies and deliberations between central and the agencies of the concerned state governments and was finally approved by the NCRPB on November 3, 1988 for its immediate implementation.

The Physical Extent of NCR. The National Capital Region extends over the Union Territory Delhi and adjoining parts of Haryana, Uttar Pradesh and Rajasthan. The administrative units constituting the NCR are as under :

(*i*) Union Territory of Delhi (1,483 sq km)

(*ii*) Haryana sub-region comprising 13 districts of Faridabad, Gurgaon, Mewat, Rohtak, Sonepat, Rewari, Jhajjar, Panipat, Palwal, Mahendragarh, Bhiwani, Karnal and Jind.

(*iii*) The Uttar Pradesh sub-region comprising five districts of Meerut, Ghaziabad, Gautam Budh Nagar (NOIDA), Bulandshahr and Bhagpat.

In September 2014, there had been a demand for the inclusion of Saharanpur, Shamli, Muzaffarnagar, Bijnor and Hapur areas of Uttar Pradesh into the National Capital Territory. It is argued that all these areas are within a 100 km radius of Delhi NCR and rightly deserve to an integral part of NCR.

(*iv*) The Rajasthan sub-region comprising two districts Alwar and Bhratpur. 'With an area of 8,380 sq km. Alwar is the largest district in NCR.

Notes : (*i*) Mahendragarh and Bhiwani districts of Haryana and Bharatpur district of Rajasthan were included in the NCR in July 2013.

(*ii*) Karnal and Jind districts of Haryana were included in NCR on January 20, 2014.

The total area of the NCR as is over forty six thousand sq km which is more than the total area of Haryana. The NCR substains a population of about 47.97 millions according to 2011 census which is more than population of Odisha. It accounts for about 7.4 per cent of the GDP of India.

Aims and Objectives

The aims and objectives of the NCRPB can be summed up in the following points :

(*i*) to contain the growing population of Delhi within the manageable limits through integrated development of all the components of the NCR.

(*ii*) to divert the population to ring towns like Faridabad, Ghaziabad, Ballabhgarh, Gurgaon, Bahadurgarh, Sonepat, Narela, Loni, Modinagar.

(*iii*) to re-model the pattern and functional character of the settlement within the NCR through guided growth so as to enable them to play a constructive and co-operative role in the planned development of the NCR.

(*iv*) to decentralise economic activities through proper development of ring towns and also through certain checks in the Delhi metropolitan area.

(*v*) to make arrangements for dispersal of industries and decentralisation of public undertakings including government offices from Delhi to the ring towns.

(*vi*) to provide cheap and efficient transportation system for dispersal of population and economic activities, and

(*vii*) to accomplish a balanced and harmonious growth of urban and rural component of the NCR.

Main Problems of NCR

(*i*) **In-migration.** There is large scale in-migration both from within and without the NCR. Approximately 2 lakh in-migrants move into the NCR every year from outside.

(*ii*) **Widening Gap between Demand and Supply of Essential Sources.** The gap between demand and supply of essential services like water, power, transport, waste disposal, waste treatment and management of solid waste is widening at rapid rate because demand for these services is always outpacing the supply.

(*iii*) **Congestion.** Delhi is suffering from the acute problem of congestion and rapidly growing slum areas.

(*iv*) **Increasing Employment Opportunities.** Delhi is acting as a '*great magnet*' to attract job seekers of all the categories which is great '*pull factor*' for in-migrants. It leads to over population and allied problems.

(*v*) **Collapse of Infrastructure.** The perennial and heavy inflow of population has put heavy burden on the infrastructure which is collapsing under its weight.

(*vi*) **Deteriorating Quality Life.** Due to ever growing demand by the fast growing population and limited supply of almost all essential commodities, the quality of life is fast deteriorating.

(*vi*) **Increase in Crime Rate.** Most of the in-migrants are unskilled or semi-skilled workers. They do not get proper job and resort to all sorts of crimes.

Planning Strategies and Proposals

The regional plan for NCR listed the following strategies and proposals for meeting the challenges in this area :

(*i*) To decelerate the growth of Delhi city.

(*ii*) To control the growth rate of Delhi Metropolitan area.

(*iii*) To develop regional centres with infrastructure and adequate network of services.

(*iv*) To bring down the population growth rate of NCR to 1.2 per cent per annum from the existing 3 to 4 per cent per annum.

(*v*) To bring down the volume of in-migration to 84,000 per annum as against the existing inflow of 2 lakh per annum.

(*vi*) To diversify the functional character of other towns of the NCR.

(*vii*) To revitalise the economy of stagnating urban centres of the NCR.

(*viii*) To select priority towns and develop them on priority basis for a balanced development of the NCR.

(*ix*) To integrate rural-urban development process within the NCR.

(*x*) To develop selected regional centres namely Meerut, Bulandshahr, Panipat, Rewari, Alwar, Bhiwadi Complex, Khurja Complex, Dharuhera, Rohtak, Palwal, Karnal, Jind etc. to accommodate Delhi-bound potential migrants by creating employment opportunities and the secondary and tertiary sectors in these regional centres.

(*xi*) To develop a number of sub-regional centres at focal points as such divisional headquarters, agricultural markets, service centres, and industrial centres.

The Tasks Ahead

(*i*) **Distribution of Population.** The development of some nodal points in NCR is necessary to regulate the population. Some nodal points have already been identified. These are Meerut, Hapur, Bulandshahar, Khurja, Palwal, Rewari-Bhiwadi-Dharuhera Complex, Rohtak, Panipat, Karnal, Jind and Alwar. These centres have the potential to attract migrants.

(*ii*) **Dispersal of Economic Activities.** The dispersal of economic activities is the basic necessity to reduce the population pressure on Delhi. This requires the generation of employment opportunities in different towns of the NCR. The economic activities for which the dispersal plan is envisaged are industries, Central Government and public sector

offices, wholesale and distributive trade and commerce. Medium and large-scale industries have to be restricted in Delhi and incentive for their dispersal have to be given in the form of industrial estates in the selected towns. The government offices and public enterprises which do not perform ministerial functions, protocol functions and liaison functions should be shifted outside Delhi. The wholesale trade which does not serve the consumers in Delhi should also be shifted elsewhere in the NCR.

(*iii*) **Land Use in the NCR.** Agriculture is the main economic activity in the NCR. Growing urbanisation is fast encroaching upon the agricultural land, thus adversely affecting the agricultural output. Urban settlement should be allowed only on less fertile, barren or wastelands. With the reduction in agricultural land only intensification of agriculture will maintain our food production. The development and conservation of forest area as well as social forestry will have to be encouraged. Care should be taken that development does not harm the environment. The sites of the scenic beauty, archaeological sites, parks, national parks, bird sanctuaries within the region will be developed and strengthened in order to provide recreational avenues. A buffer zone of green belt between Delhi Urban Area and Delhi Metropolitan Area has been proposed to be created. The Aravalli hills extending from Delhi to Alwar provides ideal extent for developing a natural forest through conservation.

(*iv*) **Regional Transport System.** Cheap and efficient transportation network increases the flow of passengers and goods and helps in their dispersal. There is proposal to have one inner grid of roads in the NCR connecting Sonipat-Bagpat-Meerut-Hapur-Bulandshahar-Sikandarabad-Faridabad-Rohtak-Gurgaon-Jhajjar-Gohana-Sonipat. The outer grid will link Panipat-Muzaffar-nagar-Meerut-Hapur-Bulandshahar-Khurja-Palwal-Rewari-Jhajjar-Gohana-Rohtak- Panipat.

There is proposal also to develop regional rail bypass connecting Meerut-Hapur-Bulandshahar-Khurja-Palwal-Sohna-Rewari-Jhajjar and Rohtak. The metre gauge railway line in Rajasthan and Haryana sectors, has been converted into high capacity broad gauge system. The EMU services on the ring system of rail tracks may increase the flow of commuters and materials.

To improve the transportation system and to reduce the pressure of passengers on it, Delhi introduced Metro Rail System way back in 2002 and the first 8.3 km long Metro Rail between Shahdara and Tis Hazari was started on December 29, 2002. Today, it has a vast network and its services are available for almost all parts of Delhi. Metro Rail services to some of the satellite towns like Gurgaon, NOIDA and Faridabad has been started and some other towns such as Bahadurgarh and Ghaziabad are also expected to be connected by Metro Rail.

A Highway Corridor Zone is proposed with a minimum width of 500 metres inclusive of green butter on either side of the right-of-way (ROW) along the National Highway (NH) 1, 2, 8, 10, 24, 58 and 91 converging at Delhi to enable the planned and regulated development along the stretches of these highways that are outside the controlled/development/ regulated areas. In addition to the above, the Highway Corridor Zones along the NH 71, 71 A, 7IB, 119, 93, 235, 11A and Expressways have been proposed.

The Yamuna Express Highway from Delhi to Agra has offered fast movement of road traffic and greater connectivity between the two cities. The Kundli-Manesar-Palwal (KMP) expressway has been approved and is under construction.

Planning the Physical Infrastructure. The infrastructure in the NCR will have to be properly developed if it is to function as one integrated region. Uninterrupted power supply in adequate quantity is essential in all the urban and rural areas for industries, transport and for domestic use. The Narora Atomic Power Plant may help in meeting the power shortage to some extent. Power tariff will have to be adjusted in such a way that Delhi becomes less attractive for industrial and commercial power. Another important element of infrastructure is the availability of drinking water to urban and rural areas. Efforts will have to be made to provide drinking water in sufficient quantity. The strict enforcement of Water Pollution Control Act, 1974 and Environmental Protection Act, 1986 may go a long way to restrict the wastage of this cyclic resource. The problem of sanitation, sewerage disposal and storm water drainage will have to be tackled in the urban areas as a first priority. Low-cost sanitation systems may be introduced in urban areas where such a facility does not already exist. The NCR Planning Board is considering to introduce the model of Sulabh International for the disposal of sewerage.

Counter Magnets

Counter-magnet towns are identified as those that can be developed as alternative centres of growth and attract migrants to them rather than Delhi. Promoting growth of counter magnet towns are the principal components of the strategy to reduce both migration and population explosion in the Delhi metropolitan area.

These towns are located in six states—Uttarakhand, Madhya Pradesh and Punjab, in addition to Uttar Pradesh, Haryana and Rajasthan, which are already part of the national capital region.

The criteria for selecting counter magnet towns are : that they should not be within approximately 250 kilometres from Delhi, should have their own established roots and potential of growth and should not be centres of either religious, strategic or environmental importance.

The major counter magnets are Hisar, Ambala, Yamuna Nagar, Karnal in Haryana, Bareilly, Moradabad, Saharanpur, Allahabad, Kanpur in Uttar Pradesh, Patiala, Ludhiana, Bhatinda in Punjab, Jaipur, Kota, Sikar, Ajmer in Rajasthan, Gwalior in Madhya Pradesh and Dehradun in Uttarakhand.

Regional Planning and Development of Island Territories

India has two groups of islands which are treated as Union Territories. In the Bay of Bengal are the Andaman and Nicobar Islands while the Lakshadweep Islands are located in the Arabian Sea. The island territories and the planning strategies for their socio-economic development are briefly described as under :

The Andaman and Nicobar Islands Union Territory. The Andaman and Nicobar archipelago comprising of 572 islands, islets and rocks is situated about 1200 km off the south-eastern coast of India in the Bay of Bengal. Together they constitute one of the Union Territories of India, and are divided into two districts. Andaman group of islands is in the north of 10° channel while Nicobar group of islands is in the south of this channel. The two are separated by about 160 km of sea. Of the 550 islands in the Andaman group, only 26 are inhabited. The Nicobar group has 22 islands out of which 10 islands are inhabited. The total area of this Union Territory is 8249 sq km out of which Andaman Islands account for 6408 sq km and Nicobar Islands spread over 1841 sq km.

Being close to the equator and surrounded by the sea on all sides, these islands have equatorial type of climate. The precipitation is heavy and often exceed 200 cm annually. Both north-east and south-west monsoons bring rainfall to these islands. It rains for about eight months in a year. The temperature is moderate and relative humidity is high. Heavy rainfall is also caused by the tropical cyclone.

These islands are believed to be a continuation of Arakan Yoma mountain range of Myanmar and have undulating terrain with ridges in north-south direction although a few hills run in east-west direction also. Deep inlets and creeks exist between the main ridges. There are a few flatlands and perennial streams. Ground water reserve is limited and soil is mostly acidic and poor in nutrients. The soil types vary from clay to loamy sand.

The cumulative land area is 8,24,900 hectares out of which 7,49,400 hectares, including 1,097,046 hectares of tribal reserve area is under forest cover. These islands are blessed with a unique luxuriant evergreen tropical rainforest canopy comprising of Indian, Myanmarese, Malaysian and endemic floral strain. So far, about 2,200 varieties of plants have been recorded out of which 200 are endemic and 1,300 do not occur in the mainland India. The North Andaman is characterised by the wet evergreen type, with plenty of woody climbers. The Middle Andamans harbour mostly moist deciduous forests while the South Andaman forests have a perfused growth of epiphytic vegetation, mostly ferns and orchids. The Nicobar Islands also have a rich variety of evergreen tropical rainforests.

Andaman Forest abound in plethora of timber species numbering 200 or more, out of which about 30 varieties are considered to be commercial. The major commercial timber species are Gurjan and Padank. The holy Rudraksha and aromatic Dhoop/Resin trees also occur here. These islands have about 50 varieties of mammals, 270 varieties of birds and 225 species of butterflies.

The original inhabitants of Andaman and Nicobar Islands, account for only 12 per cent of the total population. The main aborigines of Andaman group of islands are Sentinelese, Jarawas, Onges, and Great Andamanese of Nagrito origin; whereas the Nicobarese and Shompens are off-shoots of Mongoloid stock and live in the Nocobar group of Islands. The Sentinelese are the sole inhabitants of the North Sentinel Island, about 34 km west of South Andaman. They live in complete isolation, are hostile and semi-nomadic. The Jawaras live in the reserve forest belt of about 639 sq km in the western coast of South and Middle Andaman. The Ongnes live in Little Andaman, an island 130 km south of Port Blair. The vanishing Great Andamanese are settled at Strait Island which is about 46 km from Port Blair. The Shompens inhabit 119 sq km in the interior forest area of Great Nicobar. As per 2011 census figures, the total population of the Union Territory of Andaman and Nicobar Islands is 3,79,944 with a population density of 46 persons per sq km.

Out of a total area of 8,24,900 hectares, only 48,700 *i.e.* 5.9 per cent is used for agriculture. It shows that aborigines are mainly living in forests and little importance is given to agriculture. Paddy is the main food crop and major part of its cultivation is in the Andaman group of Islands. Pulses, oilseeds and vegetables are also grown. Coconut and arecanut are the major cash crops.

There is no major industry although 1375 small scale, village and handicraft units are working. Two fish processing units are export oriented. Three shell and wood based handicraft units are also functioning. The small scale industrial units are manufacturing polythene bags, PV conduit pipes and fittings, paints and varnishes, fibre glass, flour, soft drinks and beverages, shell crafts, bakery, rice milling, furniture, etc. There are only four medium-sized industrial units. The Andaman and Nicobar Islands Integrated Development Corporation is doing a lot for the development of these islands and is taking active part in promoting tourism, fisheries and industrial financing. It also functions as the authorised agency for Alliance Air/Jet Airways.

The development of the Andaman and Nicobar islands is closely related to their strategic location in the Bay of Bengal. These island are extensive enough to be developed as a strong naval base and associated industries. Deep sea fishing can be launched form these locations and related industries can be set up here to diversify and enrich the economy of the people living there. Strong linkage with the mainland is necessary in any programme of development. The efficiency of distribution channels of goods and services from Port Blair to different islands also needs to be improved.

Lakshadweep. Lakshadweep is a group of islands of coral origin in the Arabian Sea. The total area of the Union Territory is 32 sq km. The main islands are Minicoy (4.53 sq km), Androth (4.32 sq km), Karavathi (3.49 sq km), Kadamath (3.03 sq km) Agathi (2.73 sq km) and Amini (2.51 sq km), Minicoy by virtue of its strategic location, is important for the navel defence of the country. All the islands have low level and rise no more than 5 metres above sea level. There are not much variations in the climate and weather remains muggy throughout the year. Beneath a thin layer of vegetal humus there is fine coral sand extending at the surface of all the islands. The average distance from the Kerala coast varies from 200 to 300 km and the shortest distance from Calicut is 108.78 km.

According to census of India 2011, the total population of this Union Territory is 64,429 and only one-fourth of the area is inhabited. However these islands have the fifth highest density of population which was 2013 persons per sq km in 2011. The inhabitants of these islands are ethnically similar to the Kerala's Malayali people, and were influenced by the Arab Traders. However, the people of Minicoy are different from these of other islands. They are descendants of early settlers from Sri Lanka who were originally Buddhists and were later converted to Islam. More than 95 per cent of the people follow Islam.

Cultivation of coconut is the main agricultural activity and coconut is the main wealth of the people. The total area under coconut cultivation is about 2,600 hectares. Another perennial crop is bread fruit, citrus fruit, drumsticks, coarse grains, pulses, vegetables etc. are grown in kitchen gardens. Agriculture Department introduced the use of artificial manures, vegetable seeds and agricultural implements during the Third Five Year Plan (1961-66). Paddy cultivation was started on experimental basis in 1967.

There are no large scale industries but household industries like coir-spinning and copra making form the backbone of the economy. Coir Training-cum-Production Centres have been established where improved methods of coir twisting have been introduced. Fishing is also an important activity. Some hosiery and handloom factories have also been set up. The scenic beauty of these islands attracts tourists, both domestic and international. The only airport is the Agathi Aerodrome in Agathi Island which connects these islands to the mainland by air. The inter island transport is by boats or helicopters.

Development Strategies

The inhabitants of islands in the Bay of Bengal and Arabian Sea are suffering from the perpetual problem of poverty, hunger, starvation, malnutrition, illiteracy, unemployment, housing and are leading a low standard of living. The tribals of these islands have been an extremely exploited lot for the last so many years by the non-tribals. Considering the prevailing condition, the Government of India initiated special steps to improve the living conditions of these people. Some major steps are described as under :

1. Most of the people living especially in the Andaman and Nicobar Island are tribals who heavily depend on forests. As such it is necessary to conserve the forest wealth of these islands. Also it is necessary to develop more national parks and biosphere reserves.
2. There are mangrove swamps and wetlands in the creeks and inland waters which are facing great threat due to the increasing interference of man. These ecosystems are in a delicate balance and this balance has to be maintained at any cost.
3. Most of the islands both in the Bay of Bengal and in the Arabian Sea are of coral origin which are at risk of destruction. These coral ecosystems need to be conserved.
4. Soils are at great risk of erosion and degradation due to heavy rainfall in these islands. This problem can be solved to a great extent by afforestation.
5. Forest based cottage industries and handicrafts should be encouraged because these industries have great potential of providing employment to the inhabitants of these islands.
6. The natural beauty of these islands has great potential to attract tourists from far and wide places, both domestic and foreign. This potential should be harnessed to its maximum so that the living standard of the local people is improved.
7. The buildings should be made earthquake proof because the Andaman and Nicobar group of Islands lies in the highest seismic risk zone V according to Indian Standards.
8. Coastal creeks, attols and bays in the coasts of these islands offer great opportunities to develop fisheries. Thus fishing can provide large scale employment and all possibilities of developing fisheries should be explored.
9. Although a large number of tribes are living in these islands, their population is fast declining. Jarawa, Janget, Orge. Sentinelese etc. are some of such tribes. **Table 14.4.** gives a desperate picture of population of some of the tribes which are struggling for their survival.

TABLE 14.4. Population of Tribals in Andaman and Nicobar Islands

Name of the Tribe	Estimated Population
1. Jarawa	350
2. Shompen	250-300
3. Sentinelese	250
4. Orge	98
5. Great Andamanese	39

Source : Samudrika (2001) pp. 14-15.

10. Plantation of coconut, arecanut, coincona, tea, pineapple etc. should be encouraged as they can enhance the income and living standard of these people.

If the above mentioned steps are taken together, they can complement one another and help in improving the living conditions of the inhabitants of these island groups.

REFERENCES

Agarwal, A.N. (1995) : *Indian Economy, Problems & Development and Planning,* Vishwa Prakashan, New Delhi.

Ahmad, E. (1965) : *Bihar : A Physical, Economic and Regional Geography,* Ranchi University, Ranchi.

Ahuja, Ram (1992) : *Social Problems in India,* Rawat Publications, Jaipur.

Alagh Yoginder, "*Regional Aspects of Indian Industrialization,* University of Bombay, Bombay, Economic Series, No. 25, 1972.

Bagchi, Kanangopal (1977) : "*The Damodar Valley Development and its Impact on the Region*" In Allen G. Noble and Ashok K. Datt (eds.) : *Indian Urbanization and Planning : Vehicles of Modernization,* Tata McGraw Hill Publishing Co. Ltd., New Delhi.

Balakrishna (1948) : *Regional Planning in India,* Bangalore Printing and Publishing Co. Ltd. Bangalore.

Basu, N.G. (1987) : *Forests and Tribals,* Manisha Granthalaya Pvt. Ltd. Calcutta.

Bhat, L.S. (1971) : *Regional Planning in India,* S.P.S. Calcutta.

Bhattacharya, S.N. (1970) : *Community Development* : An Analysis of the Programme in India, Academic Publishers, Calcutta.

Bicamic, R. (1967) : *Problems of Planning,* East and West, Mouton, London.

Blowers A. (ed.) (1993) : *Planning for Sustainable Environment,* Town and Country Planning Association, London.

Bose, Nirmal Kumar (2002), *Tribal Life India,* National Book Trust of India.

Branch, M.C. (1988) : *Regional Planning: Introduction and Explanation,* Pareger, New York.

Census of India, 2011 : *Provisional Population Totals,* Paper 2 of 2011.

Census of India 2011 : *Primary Census Abstract,* released on C.D. in 2013.

Chakraborti, M and Mukherjee D : *Indian Tribes,* Concept Publishing Company, New Delhi.

Chand Mahesh and V.K. Puri (1983) : *Regional Planning in India,* Allied Publishes, Pvt. Ltd., New Delhi.

Chandna, R.C. (2008) : *Regional Planning and Development,* Kalyani Publishers, New Delhi.

Chandrasekhara, C.S. and Sundaram, K.V. (1968) : *Planning Regions of India,* Town and Country Planning Organisation.

Chadrasekhara C.S. (1972) : "*Balanced Regional Development and Planning Regions*", *in Economic and Socio-cultural Dimensions of Regionalisation,* edited by A. Chandrasekhara, Census of India, New Delhi.

Chatterjee, S.P. (1967) : "*Region, Regionalism and Economic Regionalisation*", The Geographer, Vol. XIV.

Chaudhury, Jayasri Rai (2009) : *An Introduction to Development and Regional Planning, with special reference to India,* Orient Black Swan, Hyderabad.

Chaudhury, M.D. (1977) : *The Problems of Multi-Level Planning and Decision-making in India in Antoni Kuklinski* (ed), *Social Issue in Regional Policy and Regional Planning,* Mouton & Co. Hague.

Chaudhury, P. (1979) : *The Indian Economy, Poverty and Development,* Vikas Publishing House, Delhi.

Damodar Valley Corporation, *Eight Years of DVC* (Calcutta, 1956)

Damodar Valley Corporation, *Annual Report,* 1977-78.

Dev and Ranade (1997), Poverty and Public Policy : A Mixed Record in *India Development Report* 1997 Ed. Kirit S. Parikh, Oxford University Press, Delhi.

Dreze, Jean and Sen Amartya (1996) : *Economic Development and Social Opportunity,* Oxford University Press, Delhi.

Dutta-Chaudhary (1971) : "*Regional Planing in India*" in *Issues in Regional Planning* edited by Dunham and Hillhorst, Monton, London.

Dubey, K.N. (ed.) (1990), *Planning and Development in India,* Asia Publishing House, N. Delhi.

Friedmann, J. and Alonso, W (eds) (1964) : *Regional Development and Planning : A Reader,* MIT Press, Boston.

Geddes, P. (1968) : *Cities in Evolution* (New Revised Edition), Benn

George K.K. : *Development of Backward Regions : Strategy Destorted,* The Economic Times, 1 & 2 October, 1976.

Gilkson, P. (1955) : *Regional Planning and Development,* Leiden, Netherlands.

Gili, Richard J. (1975) : *Economic Development : Past and Present,* Prentice Hall of India Pvt. Ltd., New Delhi.

Glasson, John (1975) : *An Introduction to Regional Planning,* Hutchinson and Co. (Publishers) Ltd., London.

Govt. of India (1985) : *Report of Committee on Rehabilitation of Displaced Tribals due to Development Projects,* Ministry of Home Affairs, New Delhi.

Govt. of India (1988) : *Regional Plan 2001*—National Capital Region, NCRIB, Ministry of Urban Development, New Delhi.

Govt. of India (1974) : *Report of Commissioner for Scheduled Castes and Schedule Tribes,* 1971-72 and 1972-73.

Griffin, K. (1976) : *Land Concentration and Rural Poverty.*

Hilhorst, J. (1968) : *Multi-disciplinary Asoect of Regional Development,* OECD. Paris.

Hufsahmidt, M.M. (1969) : *Regional Planning, Challenge and Prospects,* Preager and Co. New York.

India 2014, *A Reference Annual,* Publication Division, Ministry of Information and Broadcasting, Govt. of India.

Jagdish N. Bhagwati and Padma Desai (1970) : *India : Planning for Industrialisation,* Oxford University Press, London.

Lokhoria, R.N. "*Tax Incentives for Backward Areas*", The Economic Times, 17 December, 1974.

Malgankar, P.D. and Chiara, B.M. "*Regional Development : Where and How,* in L.K. Sen (ed), *Reading on Micro-Level and Rural Growth Centres,* National Institute of Community Development, Hyderabad.

Menon, K.S.V. : "*Backward Areas Development,* "the *Economic Times,* 27 May, 1979.

Misra, R.P., Sundaram, K.V. Prakasa Rao, V.L.S. (1974) : *Regional Development Planning in India, A New Strategy,* Vikas Publishing House, New Delhi.

Misra, R.P. (ed) (1992) : *Regional Planning, Concepts, Techniques, Policies and Case Studies,* Concept, New Delhi.

Misra, S.K. and Puri, V.K. (1997) : *Indian Economy,* Himalaya Publishing House, Mumbai.

Mitra, Ashok (1965) : *Levels of Regional Development in India,* Census of India, New Delhi.

Mustafa, Arif M. and James Paul (ed) (2001) : *Understanding Andaman and Nicobar Islands through Samudrika,* Naval Marine Museum.

Nair, M.N.V., Srinivasan, V. and Kumar, S.P. (1977) : *Need for New Policy Perspectives and Regional Development in Backward Area Development : Strategies and Policies,* Management Development Institute, New Delhi.

Nath, V. (1965) : *Resource Development Regions and Divisions of India,* Planning Commission, New Delhi.

Nath, V. : *Regional Development in Indian Planning,* IN *Economic and Political Weekly,* Jan., 1970 *Annual Volume,* pp. 255-56.

Prakasa Rao, V.L.S. (1963) : *Regional Planning,* Asia Publishing House, London.

Patel, V.G. (1969) : *An Analysis of Plan Implementation in India,* Balgovind Prakashan, Ahmedabad.

Pathak, C.R. (1969) : "*Damodar Valley Region*—A Case Study in Regional Development in R.P. Misra, *Regional Planning,* Mysore University, Mysore.

Pathak, C.R. and Kundu, Amitabh (1973) : Regionalisation and Regional Planning—An Axionnate Approach, in *Indian Journal of Regional Science.*

Pathak, Mahesh, T. "*Development of Backward Areas : Problems and Prospects,* Artha Vikas, Vol. X, No. 1-2, January-July, 1973.

Peter Hall (1970) : *Theory and Practice of Regional Planning,* Pamberton Publishing Co. Ltd., London.

Planning Commission, Government of India, *Identification of Backward Areas,* 1969.

Raj, K.N. : "*Growth and Stagnation in Indian Industrial Development,* Mainstream, 21 January, 1976.

Rao Hemlata (1977, June) : "*Identification of Backward Regions and Trends in Regional Disparities*", In *India Artha Vijnana, Vol. 19, No. 2.*

Reddy, Venugopal, Y. (1979) : *Multilevel Planning in India,* Vikas Publishing House, New Delhi.

Sandhu Urmila : "*Identification of Backward Regions—A Brief Critical Review, Margin Vol. 9, No. 2, January, 1977.*

Sen, L.K. (1972) : *Reading on Micro Level Planning and Rural Growth Centres,* National Institute of Community Development, Hyderabad.

Sengupta, P. (1967) : *Principles and Techniques of Regional Planning.* In *The Geographer Vol. 14.*

Sengupta P. and Sdasyuk G. (1968) : *Economic Regionalisation of India : Problems and Approaches,* Census of India, Monograph edited by A Mitra, New Delhi.

Singh, R.L. (ed) (1971) : *India : A Regional Geography,* Ch. 29, National Geographical Society of India, Varanasi.

Subramanyam, K.V. : "*D.V.C. and Flood Control*" Economic and Political Weekly, 11 November, 1978.

Sundaram, K.V. (1978) : "*Delhi : The National Capital*" In: *Million Cities of India* Ed. R.P. Misra, Vikas Publishing House Pvt. Ltd., New Delhi.

Sundaram, K.V. and Misra R.P. (1976) : *Micro Level Planning and Development Process,* Vol. I, University of Mysore.

Vishnu Bhagwan and Vandana Mohla (2012) : *Indian Government and Policies,* Kalyani Publishers, New Delhi.

Walter Isard (1960) : *Method of Regional Analysis,* M.I.T. Press, Cambridge.

Water Resources

Water is one of the most precious natural resources and a key element in the socio-economic development of a country. A person can live without food for a month, but only for for a week without water. Nothing will quench thirst the way water can. Water is an essential part of the modern day life. It is used for drinking, bathing, washing, irrigation, industries and a host of other purposes.

About 71 per cent of the earth's surface is covered by water and that is why our earth is called the ***'watery planet'***. In fact earth is the only planet in the entire solar system which contains water and sustains life. No other planet in the solar system has, so far, shown any trace of water and all the planets, except the earth, are lifeless. But water on the earth surface is distributed in such a way that only a small fraction of total water available on the earth is useful for human consumption (**Table 15.1**).

TABLE 15.1. Earth's Water Resources

Distribution of Water on Earth	
Oceans, saline lakes	97.20%
Ice caps, glaciers	2.15%
Lakes, rivers, streams	0.0085%
Atmosphere, biosphere	0.00015%
Ground water	0.64%

TABLE 15.2. Use of Water

Agriculture	93.37
Municipal and Rural water supplies	3.73
Industries and power generation	1.26
Livestock	1.08
Others	0.56
Total	**100.00**

INDIA'S WATER RESOURCES

Rainfall is the main source of fresh water in India. From precipitation alone (including snowfall), India receives 4,000 km^3 water. Of this, monsoon rainfall from June to September alone accounts for about 3,000 km^3. A good part of it is lost through the process of evaporation and plant transpiration. Large part of water percolates into the ground and is available to us in the form of ground water.

Different authorities have given different estimates about India's water resources. According to the Ford Foundation Team (1959), India has one of the largest supplies of water in the world. A broad assessment of water resources places the total average annual surface run-off as varying from 1,633 BCM to 1,881 BCM (Billion Cubic Metre). According to **K.L. Rao** (1975), the total quantity of water in our river systems is 1,644.5 BCM. The estimates made by the Ministry of Water Resources have put the overall water resources of the country at 1,869 km^3 (or 1,869 BCM). Due to various constraints of topography and uneven distribution of water resource over space and time, the total utilisable water resource is assessed as 1,122 km^3 out of which 690 km^3 is surface water and 432 km^3 is ground water. Obviously water is available in two different forms, *viz.*, (1) surface water, and (2) ground water.

Surface Water

Surface water is available on the surface of the earth in the form of rivers, lakes, ponds, canals, etc.

TABLE 15.3. Surface Water Resources in Major River Basins of India

Basin	Average annual Run-off km^3	Utilisable Flow km^3	Storage completed km^3
1. Indus	73	46	14.52
2. Ganga	501	250	37.4
3. Brahmaputra	537	24	1.09
4. Barak Sub-basin	60	—	—
5. Mahanadi	67	50	8.93
6. Brahmani	36	18.1	4.29
7. Godavari	119	76	17.27
8. Krishna	68	58	32.23
9. Cauvery	21	19	7.25
10.. Penner	6.81	6.81	2.37
11.. Narmada	41	34.5	3.02
12.. Tapi	18	14.5	8.68
13.. Sabarmati	3.8	1.91	1.3
14.. Mahi	41	34.5	30.02

Source : India 1992 : A Reference Annual, p. 418.

However, rivers comprise the most important source of surface water. India is blessed with a large number of major, medium and small size rivers. As many as 13 of them are classified as major rivers whose total catchment area is 252.8 million hectares (m. ha). This is about 83 per cent of the total area of all drainage basins. Of the major rivers, the Ganga-Brahmaputra-Meghna system is the biggest with catchment area of about 110 million hectares (m. ha) which is more than 43 per cent of the catchment area of all major rivers in the country. The other major rivers with catchment area more than 10 m. ha are those of the Indus (32.1 m. ha), Godavari (31.3 m. ha), Krishna (25.9 m. ha), and Mahanadi (14.2 m. ha). The catchment area of medium rivers is about 25 m. ha. It is worth mentioning that about 40 per cent of utilisable surface water resources are in the Ganga-Brahmaputra-Meghna system. An idea of magnitude of our water resources can be had from **Table 15.3**.

Interlinking the Rivers

Although India has vast surface water resources, the same are very unevenly distributed over time and space. While some river basins have vast catchment areas and carry enormous quantity of water, others are small and have comparatively small quantity of water. Most of the Himalayan rivers are large and originate in the snow covered high altitude areas of the Himalayan ranges. As such they carry sufficient water throughout the year and are called ***perennial rivers***. In contrast, the rivers of the peninsular India are seasonal. They carry no or very little water in the dry summer season. During the rainy season, most of the rivers are flooded and large part of water flows down the slope to the sea. Thus much of precious water is wasted and is not available for use. As against this most rivers have insufficient flow of water during the dry season and acute scarcity of water is felt in almost all parts of the country. Besides there is a chronic problem of floods in one part and droughts in other part of the country. Even dry areas like Rajasthan and Gujarat may have floods and wet areas like West Bengal may confront a situation of drought. Keeping these and many more problems in mind, the idea of interlinking rivers through inter-basin linkages or through national grid has been mooted. Such projects aim at reducing disparities in different river basins by transferring water from 'surplus' basins to 'deficit'

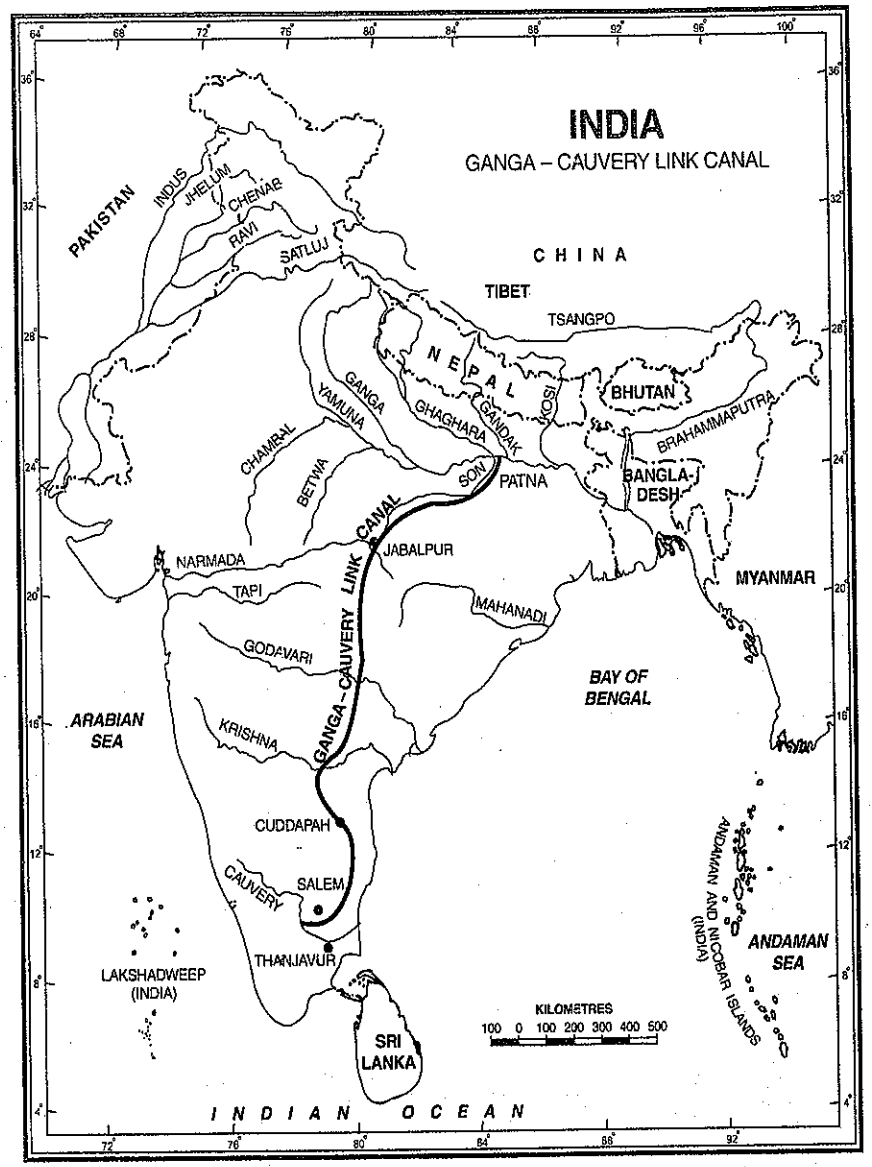


FIG. 15.1. Ganga-Cauveri Link Canal

basins. Some of the important projects are briefly described as under :

The Ganga-Cauvery Link Canal

This project was prepared by the United Nations team at the request of the Government of India. It was proposed by the then irrigation minister **Dr. K.L Rao** in 1950s. The project aimed at reducing the impact of floods in the Ganga basin and supply water to central and eastern parts of the country which suffer from chronic problem of water shortage. This link canal was to take off near Patna, pass through the basins of the Son, the Narmada, the Tapi, the Godavari, the Krishna and the Pennar rivers, and join the Cauvery upstream of the Grand Anicut. Water from Patna barrage will be lifted by large pumps to a point near the boundary of the basins of the Ganga and the Narmada from where it will be distributed by gravity via dug up canals or through existing rivers to the west or south. Flood waters of the Narmada and the Godavari could also be used. However, it was pleaded that water from the Ganga for the inter-basin transfer could be drawn only during four months of rainy season from July to October when the flow of water in the Ganga river exceeds 2,850 cumecs (1,00,000 cusecs).

The proposed Ganga-Cauvery Link Canal was to have been 2,640 km long, withdrawing 60,000 cusecs. from the flood flows of the Ganga for about 150 days in the year, and would have involved a lift of a substantial part of water over 450 metres. From Patna, water would be pumped into a series of reservoirs between water sheds of the Narmada and the Son. From Bargi reservoir on the Narmada (423 m), a linked aqueduct will carry water to south utilising the natural course of the Wainganga, Pranhita and crossing the Krishna and the Pennar to Cauvery upstream the Upper Anicut. It is also proposed to supply about 300 cumecs (10,000 cusecs) of the Ganga water to different parts of Bihar, Uttar Pradesh, Jharkhand, Chattisagarh and Madhya Pradesh by pumping additional water during the lean season. Water would also be diverted to partially meet the demands of chronically drought prone areas of Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Telangana, Karnataka and Tamil Nadu.

The scheme has been thoroughly examined and found impractical because of the huge financial costs and very large energy requirements. Moreover environmental issues put great hindrances in the way of this project. However, the idea survives in the popular mind and comes up whenever water scarcity is felt and conflicts (such as Cauvery dispute) become acute.

The Brahmaputra-Ganga Link Canal

The Brahmaputra is a mighty river and carries a discharge of 3,500 to 5,000 cumecs even during lean period of dry summer. This is because its catchment area receives heavy annual rainfall. The amount of water flowing in this river is more than the requirements of the people living in its basin area. In contrast the lower Ganga basin faces scarcity of water, particularly in the summer season. This unbalanced distribution of water can be rectified by diverting the surplus water of the Brahmaputra basin to the water scarcity areas of the lower Ganga basin.

The Brahmaputra-Ganga link canal project involves the construction of a diversion barrage at Dhubri in Assam and a 320 km long feeder canal to link the Dhubri barrage with the Farakka barrage. A part of the feeder canal will pass through Bangladesh territory for which India will have to reach an agreement with that country. However, this will benefit Bangladesh also because a part of water available in the feeder canal can be used for irrigation or for augmenting the water flow in the Padma river. It is also expected to boost inland navigation in both the neighbouring countries. It is estimated that when completed, this project will be able to divert about 1,150 cumecs of water from the Brahmaputra at Dhubri to the Ganga at Farakka. It will require lifting of water by 10 to 15 metres at suitable intermediate sites.

Experts in various allied fields have grave misgivings regarding the feasibility of this project in view of huge expenditure involved, resource crunch and lack of proper understanding between the concerned neighbouring countries.

National Water Grid

This is the largest ever thought of project of linking all major rivers of India with the help of a network of canals. The idea of linking rivers across India to solve flood, drought, power and other water related problems of the country is not new. It has been mooted in different forms for the last few decades. Sir Arthur Cotton, who pioneered the development of water resources in Southern India from 1839 onwards, had proposed a plan for interlinking of Indian rivers for inland navigation. A small portion of the plan was implemented but was abandoned later in favour of railways. In 1974, the famous engineer of Mumbai, Captain Deen Shaw, presented his scheme to link Indian rivers by constructing a chain of canals. In August, 1980, a National Perspective Plan (NPP) for interlinking of rivers was framed by the Ministry

of Water Resources. A National Water Development Agency (NWDA) was set up in July, 1982 to carry out further studies. In 2002, the Hon'ble Supreme Court of India ordered the central government to complete the project in 10 years. Keeping in view the order of the Supreme Court, the Government of India

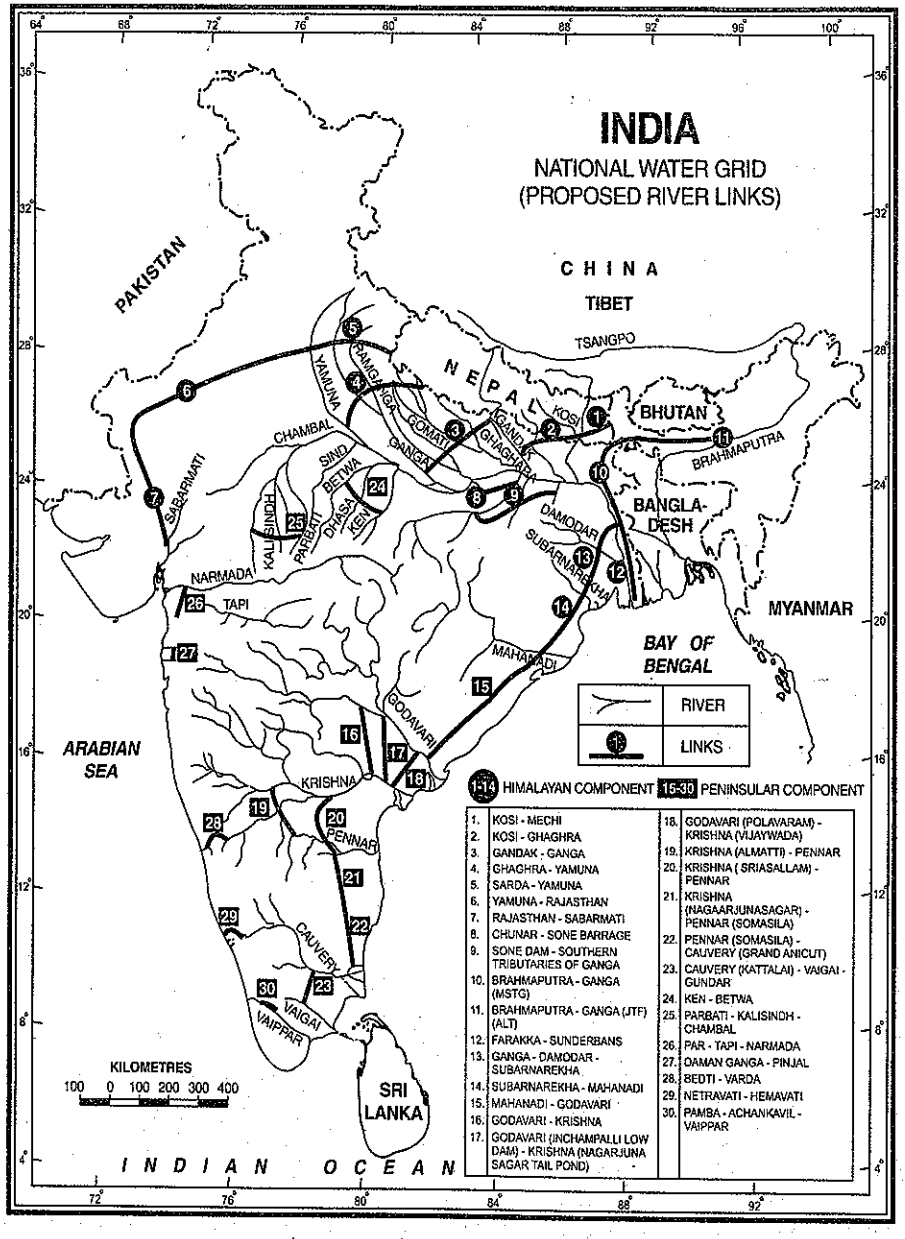


FIG. 15.2. India : Proposed River Links (The Garland Canal System)

constituted a committee in December 2002 to prepare a detailed report of the project. The project envisages linking 26 major rivers of India by constructing 30 different link canals. The National Perspective Plan as well as the NWDA studies have two components of the project *viz.*, (*a*) Himalayan Rivers Development Component and (*b*) Peninsular Rivers Development Component (**Fig. 15.2**). The two can be linked on the Mahanadi.

(a) The Himalayan Rivers Development Component

The Himalayan Rivers Development Component envisages construction of storage reservoirs on the principal tributaries of Ganga and Brahmaputra in India, Nepal and Bhutan alongwith interlinking canal systems to transfer surplus flows of the eastern tributaries of the Ganga to the west, apart from linking of the main Brahmaputra and its tributaries with the Ganga and the Ganga with the Mahanadi. The Himalayan Rivers Development Component shall provide additional irrigation and generation of hydropower, besides providing substantial flood control in the Ganga and Brahmaputra basins. It would also provide the necessary discharge for augmentation of flows at Farakka to flush Kolkata port and enhance the inland navigation facilities across the country.

The Himalayan Component is based on multi-purpose storage giving benefits of hydropower and flood control, besides diverting water to downstream links. NWDA have taken up 11 Himalayan links for study. These include Manas-Sankosh-Tista-Ganga link to transfer Brahmaputra waters to Eastern Ganga Basin. This link envisages high dams on Manas and Sankosh and very large canals running through densely forested as well as populated areas cutting across major drainages and narrow strip of land north of Bangladesh. Other lines proposed are Kosi-Ghaghara, Gandak-Ganga, Ghaghara-Yamuna and Sarda-Yamuna to supplement the supplies of the Ganga and the Yamuna and further transfer water west to Rajasthan and Gujarat.

Under the Himalayan Component, NWDA has already completed water balance studies at 19 diversion points, toposheet studies of 16 storage sites and 19 link alignments and prepared pre-feasibility reports of 14 proposed water transfer links. The feasibility report for these links have already been completed.

(b) The Peninsular Rivers Development Component

This component has four major parts but more important are interlinking the Mahanadi-Godavari-Krishna-Cauvery and the diversion of a few west-flowing rivers towards the peninsular basin across the Western Ghats. It will ease the water situation in the peninsula. The link from Mahanadi would require construction of Manibhadra dam. The Mahanadi-Godavari link would cut across east-flowing drainages. It does not involve any lifting of water. The Godavari is joined by two major tributaries, Indravati and Penganga downstream of the major storage at Shri Ramsagar. Even after meeting downstream basin requirements, the Godavari has surplus water in this reach which can be stored in the available dam site of Inchampalli. The benefits to those rehabilitated from low yield unirrigated farming to high yield irrigated land are so large that the project deserves high priority in implementation. After irrigating about 11.5 lakh hectares of dryland between the Godavari and the Krishna, there will still be about 3 km^3 water left which can be transferred to Cauvery basin and relieve it from occasional shortages. It will also help to resolve the bitter dispute between Tamil Nadu and Karnataka over the water of the Cauvery river.

Under the Peninsular Component, the Agency has already completed data collection and the balance studies of 137 basins/sub-basins and at 77 identified diversion points, toposheet studies of 72 identified storages and 30 toposheet studies of link alignments, and prepared pre-feasibility reports of 17 water transfer links. Presently, the work of field surveys and investigations for preparation of feasibility reports of link schemes is on hand. Feasibility reports of these links have already been completed.

The implementation of the inter-basin water transfer link schemes can be taken up in a phased manner depending on the priorities of the Government and availability of funds. But before this, certain other steps, *viz.*, negotiations and agreements amongst the states involved in interbasin transfer, preparation of Detailed Project Reports (DPRs), techno-economic appraisal of DPRs and investment clearance of the

schemes, funding arrangements and fixing of agencies for execution, etc., would be necessary. In order to expedite the process of arriving at consensus amongst the States, a Group headed by Chairman, Central Water Commission has been formed, so that the work of preparation of Detailed Project Reports could be started. This Group is expected to work independently and on a continuous basis.

If and when completed, this project will give following benefits :

(*i*) Surplus water from the eastern rivers will be transferred to water deficit areas of central, south and western parts of the country.

(*ii*) Flood problem, particularly in Bihar and Assam will be solved to great extent.

(*iii*) 34,000 megawatt (34 million kW) hydroelectricity would be produced. This electricity will be used for irrigation and other purposes.

(*iv*) The implementation of the programme of interbasin water transfer is expected to provide additional irrigation benefit of 35 Mha which will be over and above the ultimate irrigation potential of about 140 mha envisaged from major, medium and minor irrigation projects.

(*v*) Chronically drought affected areas will get sufficient water for irrigation, drinking and other purposes.

(*vi*) As much as 1275.74 billion cubic metre (BCM) water wastefully flowing in rivers originating in the glaciers of the Himalayas will be properly used.

(*vii*) The project will provide ample opportunities for inland navigation and thus reduce pressure on rail and road transport.

(*viii*) It will be of great help in resolving inter-state water disputes.

(*ix*) A minimum flow of water will be ensured in water deficit rivers.

However, the project has been criticized on several grounds and several experts have questioned even the feasibility of such a gigantic project. Following are some of the objections raised against this project.

(*i*) The project will involve a huge cost of ₹ 5,60,000 crore or $ 120 billion which amounts to a quarter of the country's current GDP. A developing country like India can hardly afford such a huge investment in just one project.

(*ii*) The project will entail the construction of several major dams and lengthy canals cutting across various river basins. This is not an easy task and will require engineering skills of high calibre.

(*iii*) The project aims at transferring water from water surplus rivers to water deficit rivers. But hydrologists believe that there are hardly any surplus waters anywhere in the country.

(*iv*) The construction of big dams and long canals will destroy forested areas, fertile soils and agricultural lands and disturb the ecological balance.

(*v*) No provision worth the name, has been made to resettle the displaced people. An estimate of over 30 million people have been displaced by development projects since Independence.

(*vi*) Some experts have expressed doubt about the capability of the project. For example, if water available in the deficit Sabarmati basin is only 300 cubic metres per capita (CMPC), then it is difficult to comprehend how a further 1,400 CMPC can be brought from a surplus basin to solve the problem.

(*vii*) Alternative measures of managing and conserving water resources can prove to be more useful than the proposed project of interlinking the rivers. According to the Central Ground Water Board (CGWB), 37 BCM of ground water can be recharged locally at only ₹ 24,500 crore. Then what is the validity of investing ₹ 5,60,000 crore in obtaining a mere 175 BCM from interlinking of rivers.

(*viii*) Jayanta Bandhopadhyay of Centre for Development and Environment Policy at the Indian Institute of Management (Kolkata) questions the validity of such a project involving high cost and comparatively little returns. According to him, arresting the natural flow of rivers on this gigantic scale could spell "the death knell" of mangroves in the Delta region of West Bengal and Bangladesh and some of the richest fisheries could be lost forever. Salinity would also make inroads into the region, affecting thousands of hectares of arable land. Also the link scheme did not envisage carrying water to some of the most deprived sections of population, including tribals and those living in the highlands.

(*ix*) Neighbouring countries like Bangladesh and Nepal have not been consulted although these countries, along with China, would be affected by the project.

(*x*) Dr. Bharat Singh, Professor Emeritus, Water Resources Development IIT, Roorkee has simply termed it "*A big dream of little logic*". According to him, "there is no convincing argument which can justify taking up the river linking project in its entirety."

In spite of the above mentinoed difficulties, efforts are being made for interlinking some of the rivers where geographical conditions permit the feasibility of such projects and where cost factors are also within the means. The links namely (*i*) Ken-Betwa link, (*ii*) Parbati-Klisindh-Chambal link, (*iii*) Godavari (Polavaram), Krishna (Vijayawada) link, (*iv*) Dhamanganga-Pinjal link and Par-Tapi-Narmada link have been identfiied as priority links.

1. Ken Betwa Link. A tripartile Memorandum of Understanding (MoU) was signed between the Union Minister of Water Resources and Chief Ministers of Uttar Pradesh and Madhya Pradesh on 25th August, 2005 for preparation of detailed project report of Ken-Beta link and the report was completed by the National Water Development Agency (NWDA) in December 2008. It was decided that the report will be prepared in two phases. Phase-I of the project was completed in April, 2010 and the work on phase II is in progress.

2. Parbati-Kalisindh-Chambal Link. Efforts are being made to arrive at consensus between Madhya Pradesh and Rajasthan for the preparation of detailed project report concerning Parbati-Kalisindh-Chambal link. The Rajathan government has asked for the revision of Hydrology which the National Water Development Agency (NWDA) has already accomplished.

3. Par-Tapi-Narmada Link and Damanganga-Pinjal Link. These two projects are concerned with the states of Gujarat and Maharashtra and both the states have given their concurrence for the projects. Detailed project report is being prepared.

4. Godavari (Polvaram)-Krishna (Vijayawada) Link. Planning Commission has given investment clearance for this project of the Government of Andhra Pradesh has taken up the project as per their own proposal.

5. Mahanadi-Godavari-Krishna-Pennar-Cauvery-Vaigai-Gundar Link System. The consesus building for eight more links under Mahanadi-Godavari-Krishna-Pennar-Cauvery-Vengai-Gundur Linkage System has been initiated with the concerned states for preparing detailed project report. The National Water Development Agency (NWDA) has received 36 proposals of Inter-State links from 7 States out of which Pre-feasibility Reports (PFRs) of 15 intra-state links have been completed.

Ground Water

A part of the rain water percolates in the rocks and soils and is available to us as ground water. The assessment of water resources in India dates back to 1949. **Dr. A.N. Khosla** (1949) estimated the total average annual run-off of all river systems in India as 167.4 m. ha m (million hectare metre) based on empirical formula which included both surface and ground waters. Since then, several attempts have been made to assess the ground water resources in the country. The National Commission on Agriculture (1976), assessed the total ground water of the country as 67 m. ha m, excluding soil mixture. The usable ground water resource was assessed as 35 m. ha m of which 26 m. ha m was considered as available for irrigation. The first attempt to estimate the ground water resources on scientific basis was made in 1979 when a High Level Committee, known as Ground Water Over Exploitation Committee was constituted by Agriculture Refinance and Development Corporation (ARDC). Based on the norms for ground water resources computations recommended by this

committee, the State Governments and the Central Ground Water Board computed the gross ground water recharge as 46.79 m. ha m and the net recharge (70% of the gross) as 32.49 m. ha m. The norms recommended by the Ground Water Estimation Committee (1984) are currently utilized by the Central Ground Water Board and the State Ground Water Departments to compute the ground water resources. Based on the recommendations of this committee, the annual replenishable ground water resources in the country work out to be 45.33 m. ha m. Keeping a provision of 15% (6.99 m. ha m) for drinking, industrial and other uses, the utilisable ground water resource for irrigation was computed as 38.34 m. ha m per year.

The methodologies adopted for computing ground water resource are generally based on the hydrological techniques. The main items of supply and disposal of ground water are listed below :

1. Items of supply to ground water reservoir

(*i*) Precipitation infiltration to the water table.

(*ii*) Natural recharge from streams, lakes and ponds.

(*iii*) Ground water inflow into the area under consideration.

(*iv*) Recharge from irrigation, reservoirs and other schemes especially designed for artificial recharge.

2. Items of disposal from ground water reservoir

(*i*) Evaporation from capillary fringe in areas of shallow water table, and transpiration by vegetation.

TABLE 15.4. Basin-wise Ground Water Resource Potential

Sl. No.	Basin	Total replenishable Ground water resource (Million hectares metre per year)	Utilisable ground water for irrigation (Million hectares metre per year)	Level of ground water development (per cent)
1.	Indus	2.55	2.17	79.29
2.	Ganga	17.17	14.59	30.79
3.	Kuchchh and Saurashtra composite	1.39	1.14	39.75
4.	Khambat Composite	0.79	0.67	30.21
5.	Narmada	1.19	1.01	15.31
6.	Tapi	0.82	0.67	20.19
7.	Subaranrekha	0.22	0.19	8.81
8.	Brahmani with Baitarni	0.59	0.50	5.16
9.	Mahanadi	2.13	1.81	4.32
10.	North-East composite	2.28	1.94	13.53
11.	Godavari	4.68	3.94	14.98
12.	Krishna	2.66	2.23	29.11
13.	Penner	0.50	0.43	31.52
14.	Madras composite and south Tamil Nadu composite	2.09	1.78	45.94
15.	Cauveri	1.36	1.16	44.72
16.	Western Ghat composite	1.83	1.54	19.61
17.	Brahmaputra	2.79	2.37	2.12
18.	Meghna	0.18	0.15	3.21
	Total	**45.22**	**38.28**	**27.82**

Source : India 1992 : A Reference Annual, p. 419.

(*ii*) Natural discharge by seepage and spring flow to streams, lakes and ponds.

(*iii*) Ground water outflow.

(*iv*) Artificial discharge by pumping or flowing wells or drains.

As per estimates made in late 1980s and early 1990s total replenishable ground water resources have been estimated at 45.22 million hectare metres per year. Of this 38.28 million hectare metres is utilisable for irrigation. The stage of ground water development is about 28% of the utilisable ground water resources.

According to the Planning Commission, the total water resources are about 178 million hectare metres but because of limitations of physiography, topography, geology, dependability, quality and the present state of technology, only a fraction of it could be utilised. The demand for water for irrigation is increasing rapidly due to rapid increase in population and new technology will have to be developed for making optimum use of the available water resources.

Central Ground Water Board has stopped computing river basin-wise ground water data and instead data according to political divisions, *i.e.*, states/union territories is published now. According to the latest data published by the Central Ground Water Board in 2009, the total replenishable ground water resource in the country is more than 433 BCM/year. Of this, the ground water available for irrigation is about 221.42 BCM/year. Provision for other uses including domestic and industrial purposes is about 21.89 BCM/year. The level of ground water development is 61 per cent.

Table 15.5 shows that there are large variations at the level of states/union territories so far as total replenishable ground water resource is concerned. It varies from 75.25 BCM/year in Uttar Pradesh to 0.044 BCM/yr in Mizoram. In addition to Uttar Pradesh, Andhra Pradesh, Assam, Madhya Pradesh, Maharashtra and West Bengal are some of the large states which have total replenishable ground water resource more than 30 RCM/hr. Among the other states are Bihar, Punjab and Tamil Nadu which have more than 20 BCM/yr. replenishable ground water resource. States with 10 to 20 RCM/yr. replenishable ground water resource are Chhattisgarh, Gujarat, Haryana, Karnataka, Odisha and Rajasthan. States with small replenishable ground water resource of less than one BCM/hr. are Goa, Himachal Pradesh, Manipur, Mizoram and Nagaland. All the Union Territories put together have less than one BCM/yr. replenishable ground water.

Similar variations are observed in the availability of ground water resources for irrigation. As expected, Uttar Pradesh has the largest ground water resources for irrigation which is as much as 46.00 BCM/year. The other states with large ground water resources for irrigation are Andhra Pradesh, Gujarat, Haryana, Punjab, Madhya Pradesh, Maharashtra, Tamil Nadu, Rajasthan and West Bengal. Each of these states has more than 10 BCM/year ground water resources for irrigation.

Entirely different picture emerges when we look at the stage of ground water development. Haryana, Punjab and Rajasthan receive less than 40 cm annual rainfall and are deficient in surface water resources. As such, these states exploit more than 100 per cent of the available ground water for irrigation. Large scale exploitation of ground water is done with the help of tube wells. The demand for ground water for irrigation started increasing in Punjab and Haryana with the advent of Green Revolution in 1960s. The change in cropping pattern has further increased demand for ground water to irrigate the fields. The region is climatically more suited to wheat but farmers' preference for rice crop has changed the entire scenario. This has led to over exploitation of ground water resources and the ground water level is falling rather alarmingly. In fact these three states draw more water, especially for irrigation, than the amount of water replenished in natural course. If this trend of over exploitation of ground water continues unabated, these states will be left with no ground water. Experts have expressed apprehension that *granary of today will be barren land tomorrow*. Rajasthan is a desert area where the rainfall is scanty and the available ground water resources are meagre in comparison with the size of the state. Gujarat, adjoining Rajasthan, also receives less rainfall and has to depend upon ground water resources. This state has developed over 75 per cent of her ground water resources. Uttar Pradesh and Bihar in the Ganga valley are rich fertile tracts where intensive irrigation is required to sustain agriculture. Uttar Pradesh and Bihar have developed over 72 per cent of their ground water resources. West Bengal is comparatively better

placed with respect to rainfall and is less dependent on ground water resources.

In the south, Tamil Nadu also has high level of 80 per cent of ground water development. Here, ground water is primarily used to irrigate the rice crop.

Most of the north-eastern hill states like Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Sikkim have very low level of ground water development. None of these states has level of ground water development more than ten per cent.

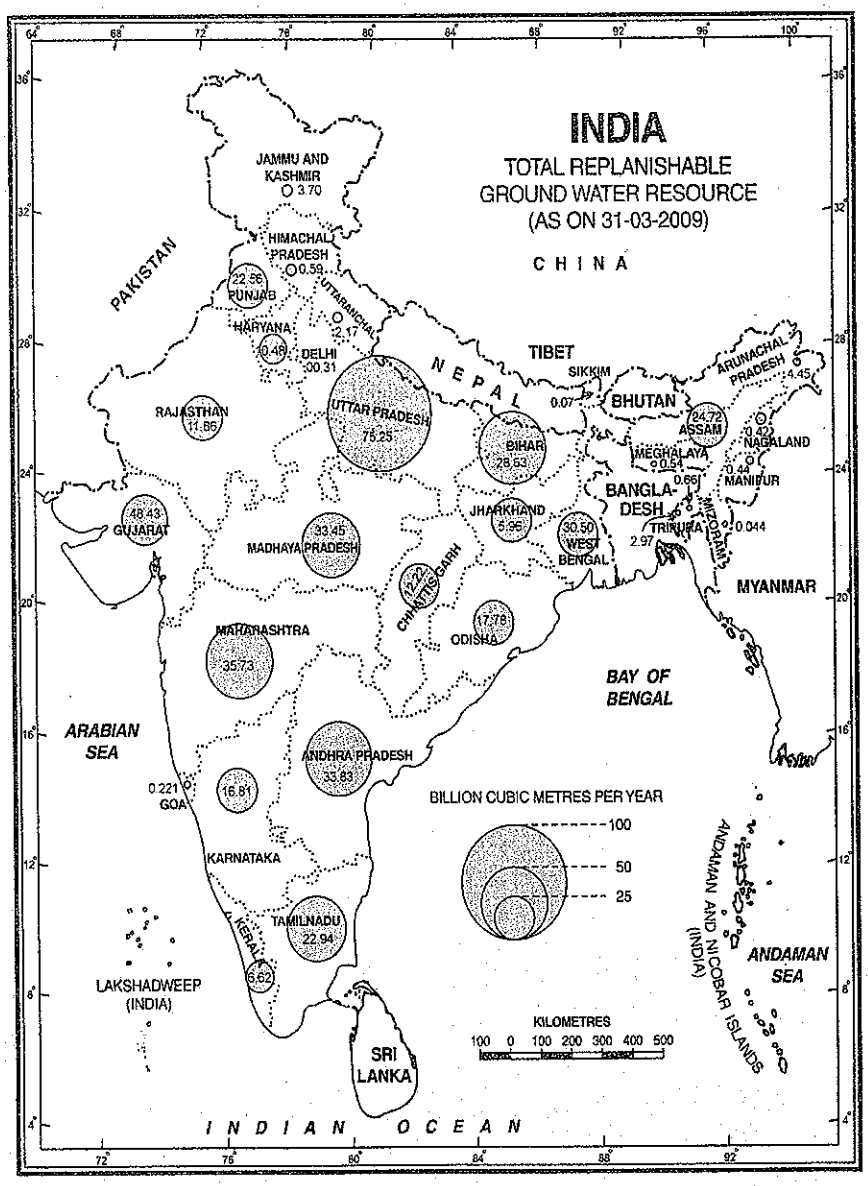


FIG. 15.3. India : Ground Water Resource

TABLE 15.5. State-wise Ground Water Resources Availability, Utilization and Stage of Development as on 31st March, 2009 Annual Groundwater Draft

Sl. No.	States/UTs	Annual Replenishable Ground Water Resource BCM/yr	Natural Discharge during non-Monsoon season BCM/yr	Net Annual Ground Water Availability BCM/yr	Irrigation BCM/yr	Domestic and Industrial uses BCM/yr	Total BCM/yr	Stage of Ground Water Development (%)
1.	2	3	4	5	6	7	8	9
	States							
1.	Andhra Pradesh	33.83	3.07	30.76	12.61	1.54	14.15	46
2.	Arunachal Pradesh	4.45	0.45	4.01	0.002	0.001	0.003	0.07
3.	Assam	30.35	2.537	27.81	5.333	0.69	6.026	22
4.	Bihar	28.63	2.42	26.21	9.79	1.56	11.36	43
5.	Chhattisgarh	12.22	0.64	11.58	3.08	0.52	3.60	31
6.	Delhi	0.31	0.02	0.29	0.14	0.26	0.40	138
7.	Goa	0.221	0.088	0.133	0.014	0.030	0.044	33
8.	Gujarat	18.43	1.08	17.35	11.93	1.05	12.99	75
9.	Haryana	10.48	0.68	9.80	11.71	0.72	12.43	127
10.	Himachal Pradesh	0.59	0.06	0.53	0.23	0.08	0.31	58
11.	Jammu & Kashmir	3.70	0.37	3.33	0.15	0.58	0.73	22
12.	Jharkhand	5.96	0.55	5.41	1.17	0.44	1.61	30
13.	Karnataka	16.81	2.00	14.81	9.01	1.00	10.01	68
14.	Kerala	6.62	0.59	6.03	1.30	1.50	2.81	47
15.	Madhya Pradesh	33.95	1.70	32.25	16.66	1.33	17.99	56
16.	Maharashtra	35.73	1.93	33.81	15.91	1.04	16.95	50
17.	Manipur	0.44	0.04	0.40	0.0033	0.0007	0.0040	1
18.	Meghalaya	1.2343	0.1234	1.1109	0.0015	0.0002	0.0017	0.15
19.	Mizoram	0.044	0.004	0.039	0.000	0.0004	0.0004	1
20.	Nagaland	0.42	0.04	0.38	—	0.008	0.008	2.14
21.	Odisha	17.78	1.09	16.69	3.47	0.89	4.36	26
22.	Punjab	22.56	2.21	20.35	33.97	0.69	34.66	170
23.	Rajasthan	11.86	1.07	10.79	12.86	1.65	14.52	135
24.	Sikkim	—	—	0.046	0.003	0.007	0.010	21
25.	Tamil Nadu	22.94	2.29	20.65	14.71	1.85	16.56	80
26.	Tripura	2.97	0.23	2.74	0.09	0.07	0.16	6
27.	Uttar Pradesh	75.25	6.68	68.57	46.00	3.49	49.48	72
28.	Uttarakhand	2.17	0.10	2.07	1.01	0.03	1.05	51
29.	West Bengal	30.50	2.92	27.58	10.11	0.79	10.91	40
	Total States	**432.43**	**33.73**	**398.70**	**221.29**	**21.83**	**243.14**	**61**
	Union Territories							
1.	Andaman & Nicobar	0.310	0.012	0.298	0.0006	0.010	0.011	4
2.	Chandigarh	0.022	0.002	0.020	0.000	0.000	0.000	0.000
3.	Dadra & Nagar Haveli	0.059	0.003	0.056	0.001	0.007	0.009	15
4.	Daman & Diu	0.012	0.001	0.011	0.008	0.003	0.011	99
5.	Lakshadweep	0.0105	0.0070	0.0035	0.0000	0.0026	0.0026	74
6.	Puducherry	0.171	0.017	0.154	0.121	0.029	0.150	98
	Total UTs	**0.59**	**0.04**	**0.54**	**0.13**	**0.05**	**0.18**	**34**
	Grand Total	**433.03**	**35.03**	**399.06**	**221.42**	**21.89**	**243.32**	**61**

Source : http/cgwb.gov.in

Arunachal Pradesh, Manipur, Mizoram, and Nagaland have negligibly low level of ground water development. These areas receive sufficient amount of rainfall and are thickly forested. Moreover, agriculture is not as intense as in Punjab and Haryana. The topographical constraints also hinder ground water development. Under such circumstances, it is neither desirable nor feasible to develop ground water

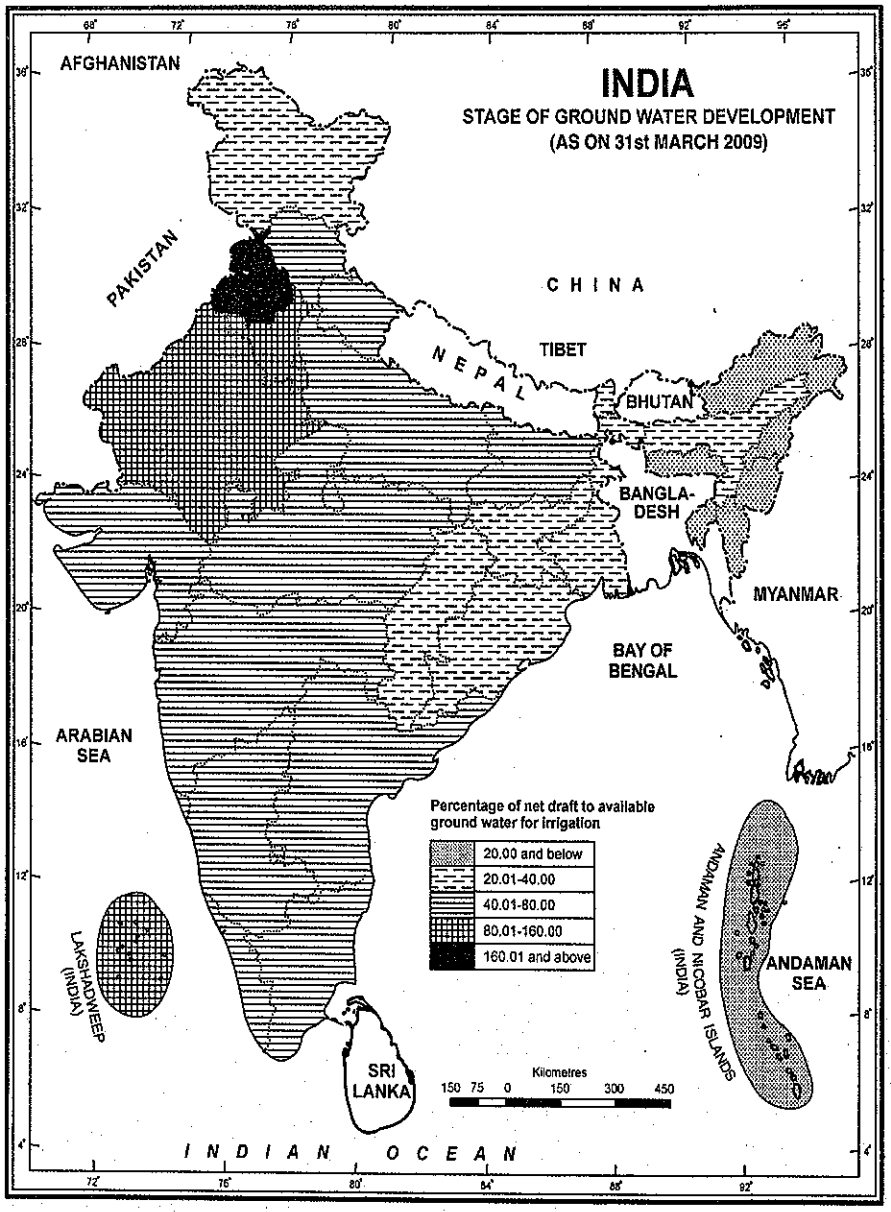


FIG. 15.4. India : Level of Ground Water Development

resources. Goa also receives sufficient rainfall and surface water resources are enough to meet the requirement. Therefore, the ground water resources are not much exploited. Hilly and mountainous terrain in Jammu and Kashmir is not much favourable for developing ground water resources. Surprisingly, Himachal Pradesh and Uttarakhand have developed more than half of their ground water resources.

Most of the peninsular plateau area is composed of hard rocks and is not much favourable for exploiting ground water resources. Most of the states located in the peninsular plateau area have moderate level of ground water development which varies from 20 to 50 per cent. The major states of this category are Andhra Pradesh, Bihar, Chhattisgarh, Goa, Jharkhand, Karnataka, Kerala, Odisha, and Maharashtra. **Figure 15.4** shows the spatial distribution of level of ground water development.

It is estimated that in India, 85 per cent of rural and over 50 per cent of urban water supplies depend upon ground water for meeting drinking and domestic water needs. Increasing demand for water in agriculture sector puts heavy strain on our water resources and ground water resources are over-exploited. In some districts of Punjab and Haryana, the ground water level is falling at an alarming rate of over one metre per year.

The Central Ground Water Board (CGWB) has emphasized that ground water has emerged as the prime source of drinking water and irrigation. It is estimated that 92 per cent of the present ground water withdrawal is being used for irrigation. Thus contributing largely to the ***food security of the country.*** Ground water is the principal source of drinking water especially in rural areas and significantly in urban areas. These facts have resulted in continuous increase in ground water over exploited areas. The Central Ground Water Board as categorised the assessment units as **'*over exploited*'**, **'*critical*'** and **'*semi-critical*'** based on the stage of ground water development and long-term water level declining trend during 1995-2004. **Table 15.6** shows that out of 5,723 assessment units (Blocks/Mandals/Talukas), 839 have been categorized as over exploited, *i.e.*, the annual ground water extraction exceeds the annual replenishable resource. In addition, 226 are critical *i.e.* the stage of ground water development is 90 to 100 per cent of annul replenishable resource with significant decline in long-term water trend in both pre-monsoon and post-monsoon period. There are 550 semi-critical units, where the stage of ground water development is more than 70 per cent.

TABLE 15.6. Categorization of Blocks/ Mandals/Talukas with respect to ground water exploitation (As per March 2009 Estimates)

No. of assessed units	Safe		Semi-critical		Critical		Over Exploited	
	No.	%	No.	%	No.	%	No.	%
5723	4078	71	550	10	226	4	839	15

Source : India 2013 A Reference Annual, p. 963.

Hydrological Situation

India is a vast country having diversified geological, climatological and topographic set up, giving rise to divergent ground water situations in different parts of the country. The prevalent rock formations, ranging in age from the Archaean to the Recent, which control occurrence and movement of ground water, are widely varied in composition and structure. Variations of land forms varying from the rugged mountainous terrain of the Himalayas to the flat and featureless alluvial plains of the northern river valleys and coastal tracts, and aeolian deserts of Rajasthan are no less important. The topography and rainfall virtually control runoff and ground water recharge.

The high relief areas of the northern and north-eastern regions, the Aravali range of Rajasthan, and peninsular regions with steep topographic slope and characteristic geological set-up offer high run-off and little scope for rain water infiltration. The ground water potential in these terrains are limited to intermontane valleys.

The large alluvial tract in the Indus-Ganga-Brahmaputra plains, extending from Punjab in the west to Assam in the east, constitutes one of the largest and the most potential ground water reservoir in the world. The acquifer systems are extensive, thick, hydraulically interconnected and moderate to high yielding. To the north of this tract, all along the Himalayan foot hills, occur the linear belt of Bhabar piedmont deposits, and the Tarai belt down the slope with characteristic autoflowing conditions.

Almost the entire peninsular India is occupied by a variety of hard and fissured formations with patches of semi-consolidated sediments in narrow intracratonic basins. Rugged topography, compact and fissured nature of the rock formation, combine to give rise to discontinuous acquifers with limited to moderate yield potentials. The near surface, weathered mantle forms the all important ground water reservoir, and the source for circulation of ground water through underlying fracture systems. In the hard rock terrain, deep weathered pediments, low-lying valleys and abandoned river channels generally

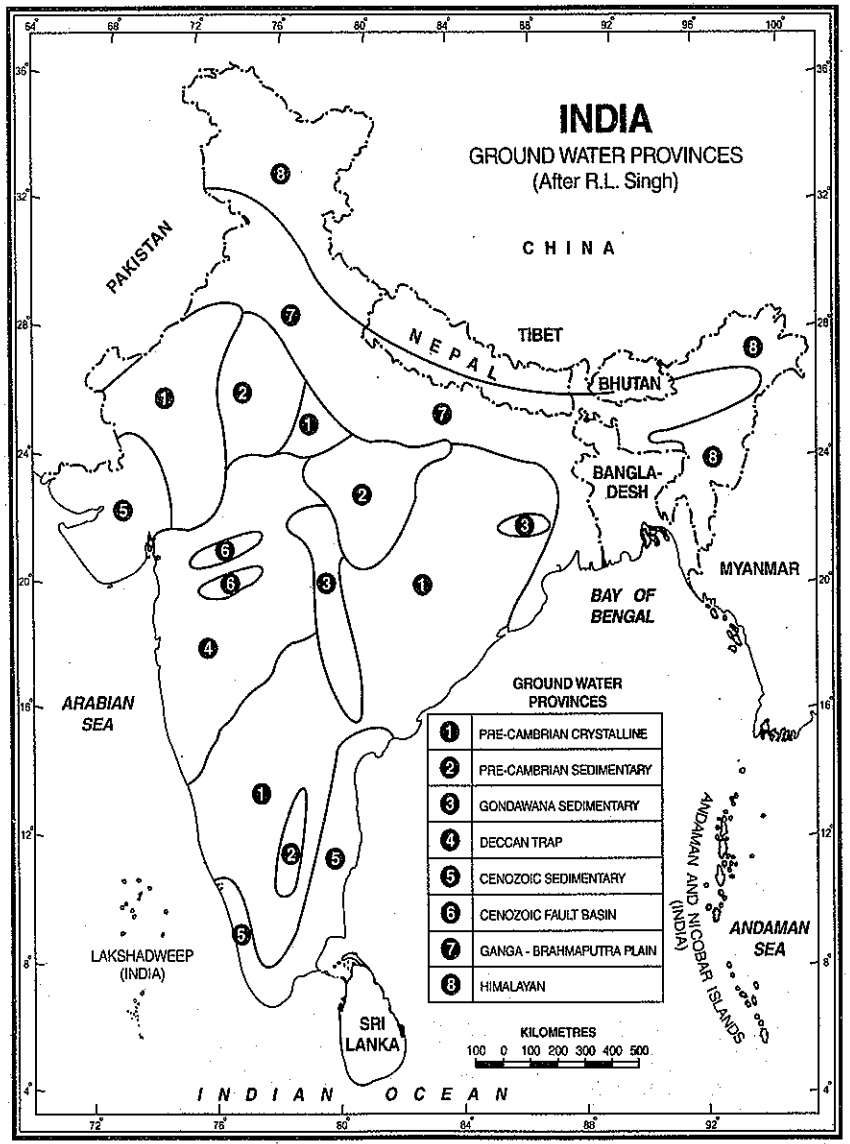


FIG. 15.5. India : Ground Water Provincees (After R.L. Singh)

contain adequate thickness of porous material, to sustain ground water development under favourable hydrometeorological conditions. Generally, the potential water saturated systems occur down to 100 metre depth. The friable semi-consolidated sandstones also form moderate yielding aquifers and auto flowing zones in these formation are not uncommon.

The coastal and deltaic tracts in the country form a narrow linear strip around the peninsular plateau. The eastern coastal and deltaic tract and the estuarine areas of Gujarat are receptacles of thick alluvial sediments. Though highly productive aquifers occur in these tracts, salinity hazards impose quality constraints for ground water development.

The above description leads as to the conclusion that the ground water resources are influenced by a number of natural conditions of which climate (particularly rainfall and temperature), relief features (topography), geological structure and hydrological setup are of outstanding significance. Accordingly Dr. R.L. Singh (1971) has divided India into 8 ground water provinces (**Fig. 15.5**), described as under :

1. **Pre-Cambrian Crystalline Province.** It extends over half of the country's geographical area covering Tamil Nadu, Andhra Pradesh, Telangana, Karnataka, Maharashtra, Dandakaranya, Bundelkhand and Aravali range. This province is deficient in ground water resources.
2. **Pre-Cambrian Sedimentary Province.** It extends over Cuddapah and Vindhyan basins where the rocks belong to Cuddapah and Vindhyan systems. This province is also not much suitable for ground water development and contains inadequate amount of ground water.
3. **Gondwana Sedimentary Province.** The Gondwana sedimentary rocks of the Barakar and Godavari river basins contain good aquifers of ground water.
4. **Deccan Trap Province.** These are 1,200 metre thick covering of impermeable basalt over the surface which obstructs percolation of water. As such, the whole province is deficient in ground water resources. The only aquifers preserved are in the fractures where secondary porosity develops in the weathered *moorums* at times, in the intertrappean beds sandwiched between two impermeable strata as also in the vesicles and amygdales.
5. **Cenozoic Sedimentary Province.** This province includes the Andhra Pradesh, Tamil Nadu, Kerala and Gujarat coasts. These areas have tertiary sandstones and the province as a whole has good acquifers.
6. **Cenozoic Fault Basin.** The rift zone of the Narmada, the Purna and the Tapi provides good resource of ground water in its 80-160 metre thick alluvial cover of sand, silt and clay.
7. **Ganga-Brahmaputra Alluvial Province.** This is the richest ground water province of the country. The bhabar, tarai and the axial belts are well defined. The streams disappearing in the unassorted materials of the bhabar zone seep out in the tarai belt. Moreover, the ground water table is also high.
8. **Himalayan Province.** This complex structural and geographic unit is not very significant with respect to ground water resources. Local springs are common but wells are a rare feature.

Water Scarcity

While water is a renewable resource, it is at the same time a finite resource. The total quantity of water available on the globe is the same as it was thousands of years ago. It is important to appreciate the fact that only 3 per cent of the world's water is fresh and roughly one-third of it is inaccessible. The rest is very unevenly distributed and the available supplies are increasingly contaminated with wastes and pollution from industry, agriculture and households.

Over the years, increasing population, growing industrialisation, expanding agriculture and rising standards of living have pushed up the demand for water. Efforts have been made to collect water by building dams and reservoirs and creating ground water structures such as wells. Recycling and desalination of water are other options but cost

involved is very high. However, there is a growing realisation that there are limits to '*finding more water*' and in the long run, we need to know the amount of water we can reasonably expect to tap and also learn to use it more efficiently.

It is the human nature that we value things only when they are scarce or are in short supply. As such we appreciate the value of water once the rivers, reservoirs, ponds, wells, etc. run dry. Our water resources have now entered an era of scarcity. It is estimated that thirty years from now, approximately once-third of our population will suffer from chronic water shortages. The increasing demands on fresh water resources by our burgeoning population and diminishing quality of existing water resources because of pollution and the additional requirements of serving our spiralling industrial and agricultural growth have led to a situation where the consumption of water is rapidly increasing and the supply of fresh water remains more or less constant. It may be maintained that the water available to us is the same as it was before but the population and the consequent demand for water has increased manifold. The consequences of scarcity will be more drastic in arid and semi-arid regions. Water shortage will also be felt in rapidly growing coastal regions and in big cities. Several cities are already, or will be, unable to cope with the demand of providing safe water and sanitation facilities to their inhabitants.

Indicators of water stress and scarcity are generally used to reflect the overall water availability in a country or a region. When the annual per capita of renewable fresh water in a country or a region falls below 1,700 cubic metres, it is held to be situation of *water stress*. If the availability is below 1,000 cubic metres, the situation is labelled as that of *water scarcity*. And when the per capita availability falls below 500 cubic metres, it is said to be a situation of *absolute scarcity* (Engelman and Roy, 1993). These are also the findings of a study conducted by the Tata Energy Research Institute (TERI). This concept has been propounded by Malin Falkenmark on the premise that 100 litres a day (36.5 cubic metres a year) is roughly the minimum per capita requirement for basic household needs and to maintain good health, roughly 5 to 20 times that amount is needed to satisfy the requirement of agriculture, industry and energy.

At the time of Independence, *i.e.*, in 1,947, the per capita availability of water in India was 6,008 cubic metres a year. It came down to 5,177 cubic metres a year in 1951 and to 1,820 cubic metres a year in 2001. As per figure released by Ministry of Water Resources, India's per capita availability of water has been pegged at 1,541.5 cubic metres a year, including non-personal consumption, such as irrigation—notches below the international threshold of 1700 cubic metre a year. India has only 4 per cent

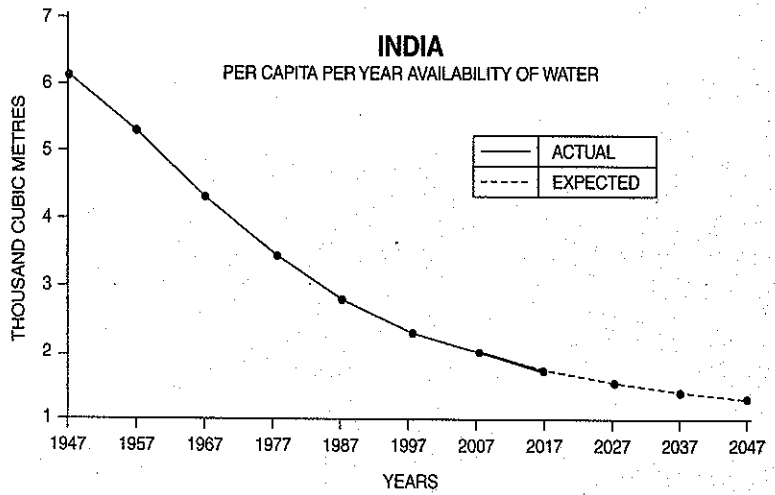


FIG. 15.6. India : Declining availability of water

of the world's water resources, and she has to support over 17 per cent of the world's population and over 15 per cent of livestock. According to mid term appraisal (MTA) of the 10th Plan, per capita availability of water is likely to fall down to 1,340 cubic metre in 2025 and 1,140 cubic metre in 2050. **Figure 15.6** shows the probable trends in per capita water availability for hundred years from 1947 to 2047. The problem of water shortage is further complicated when we look at the areal distribution of water resources with reference to population. From as high as 18,417 cubic metres in the Brahmaputra valley, per capita water availability comes down to a low of 411 cubic metres in the east-flowing rivers between Pennar and Kanniyakumari. Even within the Ganga basin, the availability varies from 740 cubic metres in the Yamuna to 3,379 cubic metres in the Gandak basin (Chitale, 1992).

According to 2011 Census figures 85.5 per cent of India's households have access to safe drinking water (tap/hand pump/tubewell). At 91.4 per cent, urban people are better placed than 82.7 per cent rural households. Punjab has the highest percentage of 97.6 households enjoying the facility of safe drinking water. As much as 96.7 per cent rural and 98.9 per cent urban households in Punjab have access to safe drinking water. Meghalaya is the worst placed where only 44.7 per cent of the total households have access to safe drinking water. The figures for rural and urban areas are 35.1 and 79.5 per cent respectively. Among the Union Territories, Chandigarh is the best placed where 99.3 per cent of the households have access to safe drinking water, while the people of Lakshadweep are very unlucky where only 22.8 per cent of the total households have access to safe drinking water (**Table 15.7**).

However, the above description regarding percentage of households having access to safe drinking water could be misleading and the real picture emerges only when we look at the individual cities. A survey conducted by Tata Institute of Social Science (TISS) showed 50 lakh households in Mumbai, Delhi, Kolkata, Hyderabad, Kanpur and Madurai are water deficient (see **Table 15.8**). World Health Organisation (WHO) specifies that minimum water requirement should be 100-200 litres per day. That is way above the average urban figure, 90 litres.

TABLE 15.7. Access to Safe Drinking Water in Households in India in 2011 (per cent)

Sl. No.	States/Union Territories	Total	Rural	Urban
1.	Jammu & Kashmir	76.8	70.1	96.1
2.	Himachal Pradesh	93.7	93.2	97.8
3.	Punjab	97.6	96.7	98.9
4.	Chandigarh	99.3	98.7	99.4
5.	Uttarakhand	92.2	89.5	98.7
6.	Haryana	93.8	92.0	96.7
7.	Delhi	95.0	87.9	95.2
8.	Rajasthan	78.1	72.8	94.3
9.	Uttar Pradesh	95.1	94.3	97.9
10.	Bihar	94.0	93.9	94.7
11.	Sikkim	85.3	82.7	92.2
12.	Arunachal Pradesh	78.6	74.3	91.3
13.	Nagaland	53.8	54.6	51.8
14.	Manipur	45.4	37.5	60.8
15.	Mizoram	60.4	43.4	75.8
16.	Tripura	67.5	58.1	91.9
17.	Meghalaya	44.7	35.1	79.5
18.	Assam	69.9	68.3	78.2
19.	West Bengal	92.2	91.4	93.9
20.	Jharkhand	60.1	54.3	78.4
21.	Odisha	75.3	74.4	79.8
22.	Chhatisgarh	86.3	84.1	93.9
23.	Madhya Pradesh	78.0	73.1	92.1
24.	Gujarat	90.3	84.9	97.0
25.	Daman & Diu	98.7	97.8	99.0
26.	Dadra & Nagar Haveli	91.6	84.3	98.4
27.	Maharashtra	83.4	73.2	95.7
28.	Andhra Pradesh	90.5	88.6	94.5
29.	Karnataka	87.5	84.4	92.3
30.	Goa	85.7	78.4	90.4
31.	Lakshadweep	22.8	31.2	20.2
32.	Kerala	33.5	28.3	39.4
33.	Tamil Nadu	92.5	92.2	92.9
34.	Puducherry	97.8	99.6	97.0
35.	Andaman & Nicobar Islands	85.5	78.2	98.1
	All India	**85.5**	**82.7**	**91.4**

Source : Economic Survey 2012-13, p. A. 126

TABLE 15.8. Number of Water Deficient Households

City	Number of water deficient households
Mumbai	17,35,756
Delhi	14,73,114
Kolkata	4,36,905
Ahmedabad	4,29,199
Hyderabad	4,13,881
Kanpur	3,29,714
Madurai	1,48,533

Source : Tata Institute of Social Sciences (TISS) Survey, 2005.

Table 15.9 shows that several cities particularly the southern cities are most water deficient. Chennai and Bengaluru suffer from 53.8 and 39.5 per cent deficiency respectively. Andhra Pradesh too has extremes : deficiency is a moderate 24.2 per cent in Hyderabad, an alarming 91.8 per cent in Vishakhapatnam. In the north, Delhi records 29.8 per cent water deficiency and Lucknow, 27.3 per cent. Central India is more water- deficient than the north

TABLE 15.9. Demand, Supply and Deficiency of Water in Selected Cities of India in Million Litres per Day (MLD)

City	Demand	Supply	Deficiency (%)
Mumbai	4,300	3,600	43.3
Delhi	3,830	2,950	29.8
Kolkata	2,258	1,568	44.0
Chennai	3,000	1,950	53.8
Hyderabad	956	770	24.2*
Indore	318	184	72.8
Bengaluru	1,200	860	39.5
Lucknow	560	440	27.3
Jabalpur	239	144.5	65.4
Vishakhapatnam	305	159	91.8**

*least deficient **most deficient

Source : Abdul Shaban (2005), "Water Consumption Patterns in Domestic Households in Major Cities in India. Tata Institute of Social Sciences (TISS), Mumbai.

WATER WOES IN INDIA

- The number of households has increased from 24.1 crore in 2001 to 33.1 crore in 2011 and per capita availability of water has reduced from 1820 cubic metres/yr in 2001 to 1545 cubic metre/yr—notches below the international threshold of 1700 cubic metres/yr.
- 30% of rural Indians lack drinking water supply (World Bank, UNICEF).
- According to National Sample Survey Office (NSSO), 57% of the rural women in India have to walk up to 5 km every day to fetch potable water as compared to just 21% in Urban areas.
- Following findings of the report released by National Sample Survey Office (NSSO) in August, 2014 are worth noting :
  - (*a*) 54% of rural woman in India had to travel between 200 metres and 5 kilometres daily to fetch drinking water in 2012.
  - (*b*) They walked 20 minutes a day, on an average, and spend another 15 minutes at the source of water.
  - (*c*) Every second woman in rural India walked average 173 km to fetch potable water in 2012 making her track 25 km longer than what it was in 2008-09.
  - (*d*) Every second woman has to spend 210 hours in a year for fetching water which means a loss of 27 days' wages for these households. Collectively, these women cover 64,000 times the distance between the earth and the moon.
  - (*e*) Water crisis is imminent in villages because of over harvesting of ground-water resources. About 80% of the country's drinking water needs are met by groundwater.
  - (*f*) 75% of the women in states like Chhattisgarh, Manipur, Odisha and Jharkhand have to travel long distances for drinking water. Time taken for this exercise is highest in Jharkhand (40 minutes) followed by Bihar (33 minutes) and Rajasthan (30 minutes).
- India records worlds highest per capita water-borne diseases even more than some of the lest developed nations.
- In most of the large cities about one-third of water never reaches the consumer because of leaks and poor maintenance. According to Centre for Science and Environment, over 35% of water in Delhi and about 30% in Mumbai is lost because of leakage.
- India is home to 17.5% of world's population but has only 4% of water.

with wide regional variations. For example, Bhopal is 26.4 per cent water-deficient while Indore and Jabalpur record rates of 72.8 and 65.4 per cent deficiency respectively. Mumbai in the west, with

deficiency rate of 43.3 per cent, is similarly situated as Kolkata which clocks at 44 per cent.

Nearly 40 per cent of water demand in urban India is met by ground water. So ground water tables in most cities are falling at alarming rate of 2-3 metres per year. Another factor is water leakage. Delhi loses at least 35 per cent of its water due to leakages in its 83.0 km long pipeline network. Mumbai loses about 30 per cent of its water due to leakage.

Water Disputes and Conflicts

Any commodity which is in short supply is likely to cause disputes and conflicts and water shortage is no exception. Water disputes and conflicts are taking place at the national (inter-state) and international levels in the present day world. Experts believe that the biggest potential destabiliser in the world is water scarcity. Former UN Secretary General, Boutros Bautros Ghali had warned in 1980s that future wars could be fought over water. His successor Kofi Annan was also worried about the fierce competition over water resources that contained the seeds of violent conflicts. Ismael Serageldin, vice president, World Bank, had predicted in 1995 that "if wars of this century were fought over oil, the wars of the next century will be fought over water." Whereas 'oil' had been the bone of contention in many wars of the yester years, the prediction of Mrs. Elizabeth Dowdeswell the "*Major clashes over dwindling supplies of water may well constitute the source of future conflicts between nations*", seems to be coming true, with the waging national and international disputes over water sharing, blowing up to the proportion of an imminent Third World War. It is now feared that "*Third World War if fought, will not be fought for territorial gains or political supremacy but for water.*"

Potential conflicts are likely where rivers and lakes are shared by more than one country. The Nile, the Jordan, the Indus, the Ganga, the Brahmaputra and the Mekong are some of these. In times of water stress and shortages, regions will face water refugees from one region to the other within the country or between two countries.

There could be wars for control of water supplies; or water resources or systems used as a weapon during military conflict; or used as political goal; terrorists could threaten using water resources as a weapon of coercion. Water systems themselves could be targets of military action. Then, with multinational giants having entered the business of supplying water privately for profit, there could be wars for entrepreneurial control. With mismanagement of water resources, mighty rivers can become mere rivulets, unable to reach the sea. With taps run dry and crops wither away, there would be upheavals—mixed as they would be with regional, caste, sectarian and communal colour. All this may be difficult to imagine, but this is calamity about to happen. It is nightmare about to come true.

Inter-state River Water Disputes in India

Most rivers of India are plagued with interstate disputes. Almost all the major rivers of the country are inter-state rivers and their waters are shared by two or more than two states. After independence, demand for water had been increasing at an accelerated rate due to rapid growth of population, agricultural development, urbanisation, industrialisation, etc. These developments have led to several inter-state disputes about sharing of water of these rivers. Following interstate river water disputes are worth mentioning.

(*i*) Cauvery water dispute between Tamil Nadu, Karnataka and Kerala.

(*ii*) The Krishna water dispute between Maharashtra, Karnataka and Andhra Pradesh.

(*iii*) The Tungabhadra water dispute between Andhra Pradesh and Karnataka.

(*iv*) The Aliyar and Bhivani river water dispute between Tamil Nadu and Kerala.

(*v*) The Godavari river water dispute between Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Odisha and Karnataka.

(*vi*) The Narmada water dispute between Gujarat, Maharashtra, Madhya Pradesh and Rajasthan.

(*vii*) The Mahi river dispute between Gujarat, Rajasthan and Madhya Pradesh.

(*viii*) The Ravi and Beas river water dispute between Punjab, Haryana, Himachal Pradesh, Rajasthan, Jammu and Kashmir and Delhi.

(*ix*) The Satluj-Yamuna Link canal dispute between Punjab, Haryana and Rajasthan.

(*x*) The Yamuna river water dispute between Uttar Pradesh, Haryana, Himachal Pradesh, Punjab, Rajasthan, Madhya Pradesh and Delhi.

(*xi*) The Karmanasa river water dispute between Uttar Pradesh and Bihar.

(*xii*) The Barak river water dispute between Assam and Manipur.

Efforts are made to resolve disputes through negotiations amongst the basin states with the assistance of the Central Government. Many of these interstate river water disputes have been settled on the basis of equitable apportionment which is the universally accepted principle. Adjudication through appointment of water disputes tribunals is also resorted to as and when required. So far, the following tribunals have been appointed to resolve inter-state water disputes :

(*i*) The Godavari Water Disputes Tribunal
(*ii*) The Krishna Water Disputes Tribunal
(*iii*) The Narmada Water Disputes Tribunal
(*iv*) The Ravi and Beas Water Disputes Tribunal
(*v*) The Cauvery Water Disputes Tribunal
(*vi*) New Krishna Water Disputes Tribunal

The first three Tribunals have given their final reports.

Cauvery Water Disputes Tribunal gave its interim order in June 1991. The Ravi and Beas Tribunal submitted its report in January, 1987. A further reference was made to the Tribunal comprising of a suo-moto reference by the Central Government and references received from the Governments of Punjab, Haryana, and Rajasthan seeking explanation/guidance on certain points in the report. The New Krishna Water Disputes Tribunal was set up on April 2, 2004.

Central Government has also received request from the State Government of Goa in August 2002 for the constitution of Tribunal for adjudication of water disputes relating to Madei inter-state river among the states of Goa, Karnataka and Maharashtra. Subsequently, Goa expressed the desire in June, 2003 to settle the disputes through negotiations.

In developing country like India, the inter-state river water disputes have to be resolved quickly and amicably. This is most urgent for the proper utilisation of water resources and economic growth.

International Cooperation

Several big rivers of India like the Indus, the Ganga and the Brahmaputra flow through the territory of some neighbouring countries also in addition to their flow through the Indian territory. These rivers call for cooperation between India and her neighbouring countries. India has taken several initiatives to create an atmosphere of cooperation and mutual understanding with the neighbouring countries. A few examples are described below :

1. The Indus Water Treaty. This treaty is concerned with sharing of the waters of the Indus and its tributaries between India and Pakistan. Signed by the two concerned countries on September 19, 1960, this treaty was reached through the arbitration of International Bank of Reconstruction and Development. According to the provisions of this treaty, India has the exclusive rights to use the waters of three eastern rivers (Sutluj, Beas and Ravi), leaving out remaining three rivers (Chenab, Jhelum and Indus) to Pakistan which will also take care of water requirements of the Indian states of Jammu and Kashmir. However, India can utilise only 20 per cent of the total discharge of the Indus river system under the regulations of the Indus Water Treaty.

2. India-Bangladesh Cooperation. An Indo-Bangladesh Joint Rivers Commission (JRC) is functioning since 1972, the year that country came into being. This Commission was set up to ensure the most effective joint efforts in maximising the benefits from common river systems.

The signing of the Treaty between India and Bangladesh on the Ganga water sharing at Farakka on 12th December, 1996, ushered a new era of cooperation in water resources sector between the two countries. Under the agreement India and Bangladesh would share alternately for 10 days each 35,000 cusecs of waters during the lean season (1 March to 15 May) to fulfill their water needs. Since the signing of this Treaty, sharing of the lean season flow of the Ganga waters and Farakka during 1970 to 2005 has been carried out to the satisfaction of both the countries.

Discussions are also continuing for sharing of waters of the Tista river.

Existing system of transmission of flood forecasting data on major rivers like Ganga, Tista, Brahmaputra and Barak during the monsoon season from India to Bangladesh is continuing.

3. India Nepal Cooperation. A Nepal-India Joint Committee on Water Resources (JCWR) is functioning with the mandate to act as Umbrella Committee of all committees groups. A Treaty on Integrated Development of Mahakali was signed between India and Nepal in February, 1996 which came into force in June 1997 (*Mahakali Treaty*). Pancheshwar Multipurpose Project on river Mahakali (known as Sarda in India) is the centrepiece of Mahakali Treaty. Agreement has also been reached with Nepal to take up the joint field investigations, studies and preparation of Detailed Project Report of Sapta Kosi High Dam Multipurpose Project and Sun Kosi Storage Dam-cum-Diversion Scheme.

For dealing with the problems of inadvertent inundation caused by the construction of various works on the border rivers between India and Nepal, a Standing Committee on Incubation Problems (SCIP) between India and Nepal is also functioning since 1986. This committee has been set up for identifying the problem areas and suggest possible solutions on a continuing basis.

4. India-China Cooperation. A Memorandum of Understanding (MoU) between India and China was signed in the year 2002. It makes provision of hydrological information, namely rainfall, water level, discharge and other relevant information on Yaluzangbu/Brahmaputra river in flood season by China to India from 1 June to 15 October every year. The Chinese side had started transmitting the relevant data in June, 2002. The information received from China is very useful for making advance forecasts for floods in the Brahmaputra river in India. The Government of India has also taken up the matter with China for establishing additional hydrological stations on Langquinzagbu (Satluj) and Palongzangbu tributary of Brahmaputra.

5. India-Bhutan Cooperation. A Joint Expert Team (JET) consisting of officials from India and Bhutan is functioning since 1979 to review the progress and other requirements of the "Comprehensive Scheme for Establishment to Hydro-meteorological and Flood Forecasting Network on rivers common to India and Bhutan." A network of 35 hydro-meteorological/meteorological stations is established in Bhutan. Data received from these stations is used by India for flood forecasting. Bhutan has agreed to join a sub-regional plan for sharing river waters and power with India and Bangladesh. That country is willing to divert 12,000 cusecs of water from the Sankosh river to the Tista river and from the Tista to Farakka barrage to be shared by India and Bangladesh. India has also agreed to purchase 4,000 megawatt of hydroelectricity from Bhutan. This power strengthens our National Power Grid and meets the power needs of the north-eastern region.

Conservation of Water Resourses

Water is an important natural resource and is the very basis of our life. We use water for drinking, irrigation, industry, transport and for the production of hydro-electricity. Water is a *cyclic resource* which can be used again and again after cleaning. The best way to conserve water is its judicious use. A large quantity of water is used for irrigation and there is an urgent need for proper water management in irrigation sector. Over-irrigation through canals has led to waterlogging in western Uttar Pradesh, Punjab, Haryana and Hirakud command area. Seepage along the canals can be checked by lining them. The overdraft by tube-wells has resulted in lowering of water table in a number of villages in Haryana, Punjab and western Uttar Pradesh. In arid areas, wherever water has been brought for irrigation, saline and alkaline tracts have emerged, rendering the soil infertile. Wasteful use of water should be checked. Sprinkler irrigation and drip irrigation can play a crucial role in conserving scarce water resources in dry areas. Drip irrigation and sprinkless can save anywhere between 30 to 60 per cent of water. Only 0.5 per cent—nearly half of this in Maharashtra—is under drip irrigation and 0.7 per cent under sprinklers. There is large-scale pollution of water as a result of industrialisation and urbanisation. This trend has got to be checked. Although one-eighth of India is declared as flood prone, there are several thousand villages in India which do not have potable drinking water. The basins should be treated as one unit for planning water utilization. Dry farming should be practiced in dry areas. The experimentation under the National Watershed Development Programme for Rainfed Agriculture is being carried on since 1986-87.

22nd March is observed as "World Water Day" out of 1992 UN Resolution.

There is a great demand of water in industries and the industrial sector offers great opportunities to conserve water. The economy in water-use in this sector will have two benefits. Firstly, the saved water may be used to meet the demand in other sectors. Secondly, the affluents thrown in the water bodies will be less. Water in most industries is used for cooling purposes, thus, it is not necessary to use fresh potable water. Instead, the recycled water may be used for this purpose. By using the recycled water over and over again, fresh water can be conserved.

Demand of water for domestic use can also be reduced. For example, in most urban areas about 12.5 litres of water is used in one flushing. In some cities cisterns requiring only 5 to 7 litres of water in one flushing are now used. Thus if each urban individual adopts smaller cisterns, the amount of water consumption for flushing can be reduced to half. Similarly, if raw water is used for cleaning, gardening, etc., a lot of fresh potable water can be saved. Water used in kitchen sink, wash basin and in bathroom can be collected into a tank and reused for flushing toilet and for gardening also.

Rain Water Harvesting

Rain water harvesting is one of the most effective methods of water management and water conservation. It is the term used to indicate the collection and storage of rain water used for human, animals and plant needs. It involves collection and storage of rain water at surface or in sub-surface aquifer, before it is lost as surface run off. The augmented resource can be harvested in the time of need. Artificial recharge to ground water is a process by which the ground water reservoir is augmented at a rate exceeding that under natural conditions of replenishment. The collected water is stored and pumped in a separate pipe distribution. This is a very useful method for a developing country like India in reducing the cost and the demand of treated water and also economising the treatment plants operation, maintenance and distribution costs.

Need

- To overcome the inadequacy of surface water to meet our demands.
- To arrest decline in ground water levels.
- To enhance availability of ground water at specific place and time and utilize rain water for sustainable development.
- To increase infiltration of rain water in the subsoil which has decreased drastically in urban areas due to paving of open area.
- To improve ground water quality by dilution.
- To increase agricultural production.
- To improve ecology of the area by increase in vegetation cover etc.

Advantages

- The cost of recharge to sub-surface reservoir is lower than surface reservoirs.
- The aquifer serves as a distribution system also.
- No land is wasted for storage purpose and no population displacement is involved.
- Ground water is not directly exposed to evaporation and pollution.
- Storing water under ground is environment friendly.
- It increases the productivity of aquifer.
- It reduces flood hazards.
- Effects rise in ground water levels.
- Mitigates effects of drought.
- Reduces soil erosion.

The New Delhi-based Centre for Science and Environment estimates that merely capturing the rain water and run off on 2 per cent of India's land area could supply 26 gallons of water per person. As such much effort is being made to popularize the concept of rain water harvesting at the grass roots level.

Potential Areas

- Where ground water levels are declining on regular basis.
- Where substantial amount of aquifer has been de-saturated.
- Where availability of ground water is inadequate in lean months.
- Where due to rapid urbanization, infiltration of rain water into subsoil has decreased drastically and recharging of ground water has diminished.

Methods and Techniques

The methods of ground water recharge mainly are :

Urban Areas

Roof top rain water/storm run off harvesting through

(*i*) Recharge Pit
(*ii*) Recharge Trench
(*iii*) Tubewell
(*iv*) Recharge Well

Rural Areas

Rain water harvesting through

(*i*) Gully Plug
(*ii*) Contour Bund
(*iii*) Gabion Structure
(*iv*) Percolation Tank
(*v*) Check Dam/Cement Plug/Nala Bund
(*vi*) Recharge Shaft
(*vii*) Dugwell Recharge
(*viii*) Ground Water Dams/Subsurface Dyke

Urban Areas

In urban areas, rain water available from roof tops of buildings, paved and unpaved areas goes waste. This water can be recharged to aquifer and can be utilized gainfully at the time of need. The rain water harvesting system needs to be designed in a way that it does not occupy large space for collection and recharge system. Roof top rain water harvesting can be a very effective tool to fight the problem of water shortage particularly in urban areas. Roof top rain water harvesting depends upon the amount of rainfall and the roof top area. More the amount of rainfall, more is the harvested water from roof top. Similarly, larger amount of roof top rain water is harvested from roofs with large area. **Table 15.10** gives the amount of harvested water from roof top in cubic metres in relation to the amount of rainfall in millimetres and the roof top area in square metres.

A few techniques of roof top rain water harvesting in urban areas are described as under :

(i) Roof Top Rainwater Harvesting through Recharge Pit

- In alluvial areas where permeable rocks are exposed on the land surface or at very shallow depth, roof top rain water harvesting can be done through recharge pits.
- The technique is suitable for buildings having a roof area of 100 sq m and are constructed for recharging the shallow aquifers.
- Recharge pits may be of any shape and size and are generally constructed 1 to 2 m wide and 2 to 3 m deep which are back filled with boulders (5-20 cm), gravels (5-10 mm) and coarse sand (1.5-2 mm) in graded form—boulders at the bottom, gravels in between the coarse sand at the top so that the silt content that will come with runoff will be deposited on the top of the coarse sand layer and can easily be removed. For smaller roof area, pit may be filled with broken bricks/cobbles.

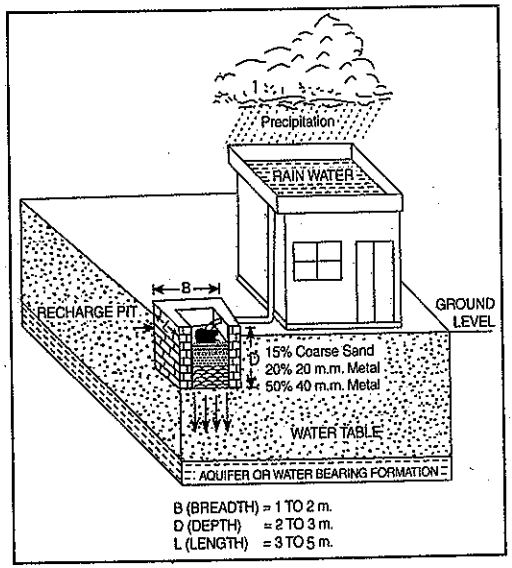


FIG. 15.7. Roof top rain water harvesting through recharge pit

- A mesh should be provided at the roof so that leaves or any other solid waste/debris is prevented from entering the pit and a desilting/collection chamber may also be provided at the ground to arrest the flow of finer particles to the recharge pit.
- The top layer of sand should be cleaned periodically to maintain the recharge rate.

TABLE 15.10. Availability of Rain Water through Roof Top Rain Water Harvesting

Rainfall (mm)	100	200	300	400	500	600	800	1000	1200	1400	1600	1800	2000
Roof top area (sqm)	Harvested Water from Roof top (cum)												
20	1.6	3.2	4.8	6.4	8	9.6	12.8	16	19.2	22.4	25.6	28.8	32
30	2.4	4.8	7.2	9.6	12	14.4	19.2	24	28.8	33.6	38.4	43.2	48
40	3.2	6.4	9.6	12.8	16	19.2	25.6	32	38.4	44.8	51.2	57.6	64
50	4	8	12	16	20	24	32	40	48	56	64	72	80
60	4.8	9.6	14.4	19.2	24	28.8	38.4	48	57.6	67.2	76.8	86.4	96
70	5.6	11.2	16.8	22.4	28	33.6	44.8	56	67.2	78.4	89.6	100.8	112
80	6.4	12.8	19.2	25.6	32	38.4	51.2	64	76.8	89.6	102.4	115.2	128
90	7.2	14.4	21.6	28.8	36	43.2	57.6	72	86.4	100.8	115.2	129.6	144
100	8	16	24	32	40	48	64	80	96	112	128	144	160
150	12	24	36	48	60	72	96	120	144	168	192	216	240
200	16	32	48	64	80	96	128	160	192	224	256	288	320
250	20	40	60	80	100	120	160	200	240	280	320	360	400
300	24	48	72	96	120	144	192	240	288	336	384	432	480
400	32	64	96	128	160	192	256	320	384	448	512	576	640
500	40	80	120	160	200	240	320	400	480	560	640	720	800
1000	80	160	240	320	400	480	640	800	960	1120	1280	1440	1600
2000	160	320	480	640	800	960	1280	1600	1920	2240	2560	2880	3200
3000	240	480	720	960	1200	1440	1920	2400	2880	3360	3480	4320	4800

Source : Rainwater Harvesting Techniques to Augment Ground Water (2003), Central Ground Water Board, Ministry of Water Resources.

- By-pass arrangement be provided before the collection chamber to reject the first showers.

(ii) Roof Top Rain Water Harvesting through Recharge Trench

- Recharge trenches are suitable for buildings having roof area of 200-300 sq m and where permeable strata is available at shallow depths.
- Trench may be 0.5 to 1 m wide, 1 to 1.5 m deep and 10 to 20 m long depending upon availability of water to be recharged.
- These are back filled with boulders (5-20 cm), gravels (5-10 mm) and coarse sand (1.5-2 mm) in graded form—boulders at the bottom, gravel in between and coarse sand at the top so that the silt content that will come with runoff will be deposited on the top of the sand layer and can easily be removed.
- A mesh should be provided at the roof so that leaves or any other solid waste/debris is prevented from entering the trench and a desilting/collection chamber may also be provided on ground to arrest the flow of finer particles to the trench.
- By-pass arrangement be provided before the collection chamber to reject the first showers.
- The top layer of sand should be cleaned periodically to maintain the recharge rate.

(iii) Roof Top Rain Water Harvesting through Existing Tubewells

- In areas where the shallow acquifers have dried up and existing tubewells are tapping deeper acquifer, roof top rain water harvesting through existing tubewell can be adopted to recharge the deeper aquifers.
- PVC pipes of 10 cm diameter are connected to roof drains to collect rain water. The first roof runoff is let off through the bottom of drain pipe. After closing the bottom pipe, the rain water of subsequent rain showers is taken through a T to an online PVC filter. The filter may be provided before water enters the tubewell. The filter is 1-1.2 m in length and is made up of PVC pipe. It's diameter should vary depending on the area of roof, 15 cm if roof area is less than 150 sq m and 20 cm if the roof area is more. The filter is provided with a reducer of 6.25 cm on both the sides. Filter is divided into three chambers by PVC screens so that filter material is not mixed up.

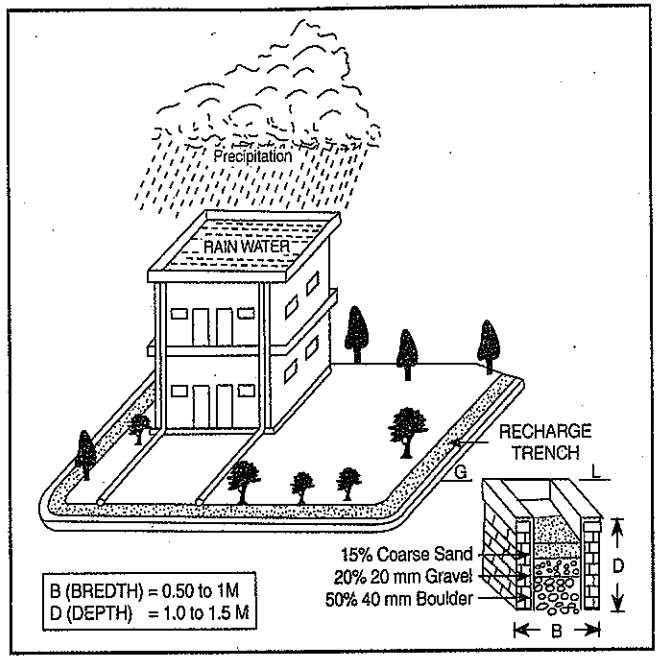


FIG. 15.8. Roof top rain water harvesting through recharge trench

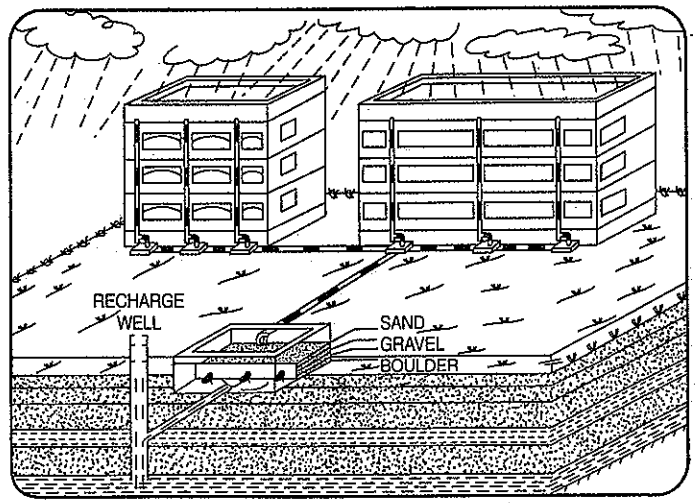


FIG. 15.9. Roof top rain water harvesting through existing tubewells

The first chamber is filled up with gravel (6-10 mm), middle chamber with pebbles (12-20 mm) and last chamber with bigger pebbles (20-40 mm).

- If the roof area is more, a filter pit may be provided. Rain water from roofs is taken to collection/desilting chambers located on ground. These collection chambers are interconnected as well as connected to the filter pit through pipes having a slope of 1 : 15. The filter pit may vary in shape and size depending upon available run off and are back-filled with graded material, boulder at the bottom, gravel in the middle and sand at the top with varying thickness (0.30-0.50 m) and may be separated by a screen. The pit is divided into two chambers, filter material in one chamber and other chamber is kept empty on accommodate excess filtered water and to monitor the quality of filtered water. A connecting pipe with recharge well is provided at the bottom of the pit for recharging of filtered water through well.

(iv) Roof Top Rain Water Harvesting through Trench with Recharge Well

- In areas where the surface soil is impervious and large quantities of roof water or surface runoff is available within a very short period of heavy rainfall, the use of trench/pits is made to store the water in a filter media and subsequently recharge to ground water through specially constructed recharge wells.
- This technique is ideally suited for area where permeable horizon is within 3 m below ground level.
- Recharge well of 100-300 m diameter is constructed to a depth of at least 3 to 5 m below the water level. Based on the lithology of the area well assembly is designed with slotted pipe against the shallow and deeper aquifer.
- A lateral trench of 1.5 to 3 m width and 10 to 30 m length, depending upon the availability of water is constructed with the recharge well in the centre.
- The number of recharge wells in the trench can be decided on the basis of water availability and local vertical permeability of the rocks.
- The trench is backfilled with boulders, gravels and coarse sand to act as a filter media for the recharge wells.
- If the aquifer is available at greater depth say more than 20 m, a shallow shaft of 2 to 5 m diameter and 3-5 metres deep may be constructed depending upon availability of runoff. Inside the shaft a recharge well of 100-300 mm dia is constructed for recharging the available water to the deeper aquifers. At the bottom of the shaft a filter media is provided to avoid choking of recharge well.

Rural Areas

In rural areas, rain water harvesting is taken up considering watershed as a unit. Surface spreading techniques are common since space for such systems is available in plenty and quantity of recharged water is also large. Following techniques may be adopted to save water going waste through slopes, rivers, rivulets and nalas.

(i) Rain Water Harvesting through Gully Plug

- Gully plugs are built using local stones, clay and bushes across small gullies and streams running down the hill slopes carrying drainage to tiny catchments during rainy season.
- Gully plugs help in conservation of soil and moisture.
- The sites for gully plugs may be chosen whenever there is a local break in slope to permit accumulation of adequate water behind the bunds.

(ii) Rain Water Harvesting through Contour Bund

- Contour bunds are effective method to conserve soil moisture in watershed for long duration.
- These are suitable in low rain fall areas where monsoon run off can be impounded by constructing bunds on the sloping ground all along the contour of equal elevation.

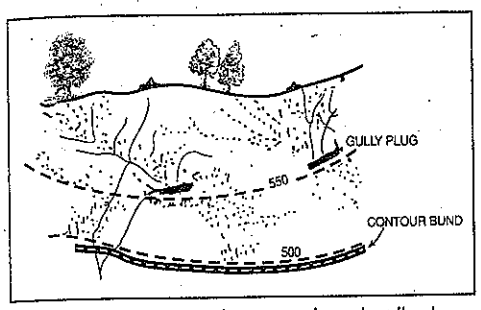


FIG. 15.10. Rain water harvesting through gully plug and contour bund

- Flowing water is intercepted before it attains the erosive velocity by keeping suitable spacing between bunds.
- Spacing between two contour bunds depends on the slope of the area and the permeability of the soil. Lesser the permeability of soil, the close should be spacing of bunds.
- Contour bunding is suitable on lands with moderate slopes without involving terracing.

(iii) Rain Water Harvesting through Gabion Structure

- This is a kind of check dam commonly constructed across small streams to conserve stream flows with practically no submergence beyond stream course.
- A small bund across the sream is made by putting locally available boulders in a mesh of steel wires and anchored to the stream banks.
- The height of such structures is around 0.5 m and is normally used in the streams with width of less than 10 m.
- The excess water over flows this structure storing some water to serve as source of recharge. The silt content of stream water in due course is deposited in the interstices of the boulders in due course and with growth of vegetation, the bund becomes quite impermeable and helps in retaining surface water run off for sufficient time after rains to recharge the ground water body.

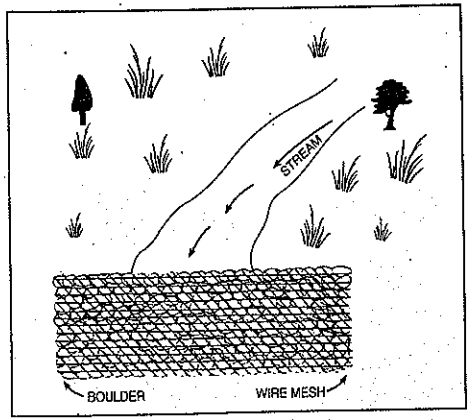


FIG. 15.11. Rain water harvesting through Gabion Structure

(iv) Rain Water Harvesting through Percolation Tank

- Percolation tank is an artificially created surface water body, submerging in its reservoir a highly permeable land so that surface runoff is made to percolate and recharge the ground water storage.
- Percolation tank should be constructed preferably on second to third order streams, located on highly fractured and weathered rocks which have lateral continuity down stream.
- The recharged area down stream should have sufficient number of wells and cultivable land to benefit from the augmented ground water.
- The size of percolation tank should be governed by percolation capacity of strata in the tank bed. Normally percolation tanks are designed for storage capacity of 0.1 to 0.5 MCM. It is necessary to design the tank to provide a ponded water column generally between 3 and 4.5 m.
- The percolation tanks are mostly earthen dams with masonry structure only for spillway. The purpose of the percolation tanks is to recharge the ground water storage and hence seepage below the seat of the bed is permissible. For dams upto 4.5 m height, cut off trenches are not necessary and keying and benching between the dam seat and the natural ground is sufficient.

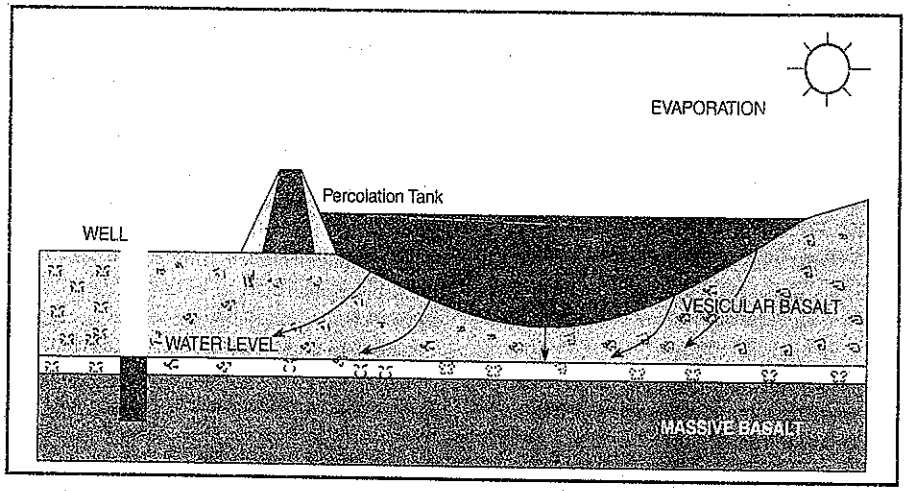


FIG. 15.12. Rain water harvesting through Percolation Tank

(v) Rain water Harvesting through Check Dams/Cement Plugs/Nala Bunds

- Check dams are constructed across small streams having gentle slope. The site selected should have sufficient thickness of permeable bed or wheathered formation to facilitate recharge of stored water within short span of time.

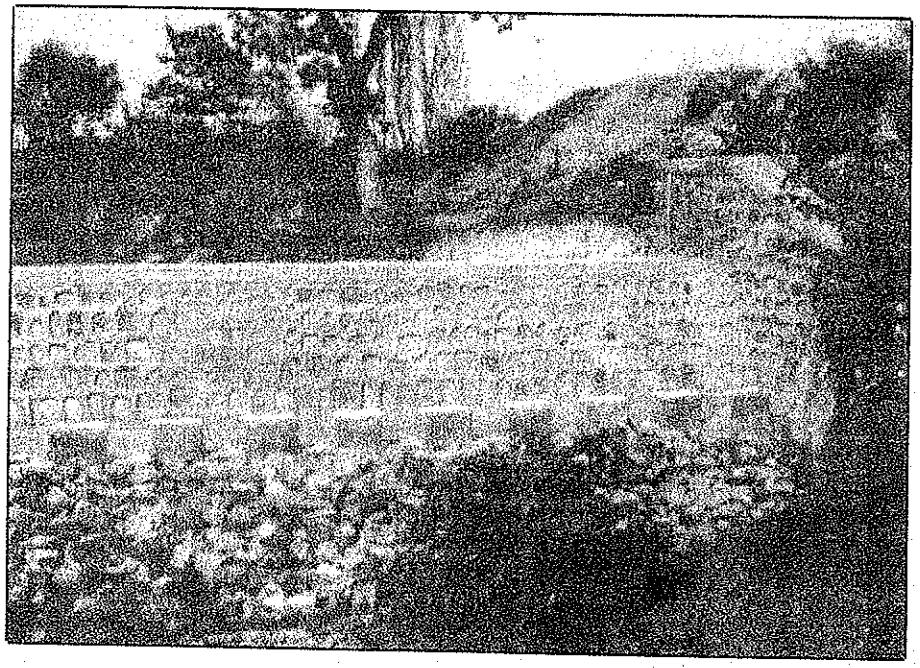


FIG. 15.13. Rain water harvesting through check dams/cement plugs/nala bunds

- The water stored in these structures is mostly confined to stream course and the height is normally less than 2 m and excess water is allowed to flow over the wall. In order to avoid scouring from excess run off, water cushions are provided at downstream side.
- To harness the maximum run off in the stream, series of such check dams can be constructed to have recharge on regional scale.
- Clay filled cement bags arranged as a wall are also being successfully used as a barrier across small nalas. At places, shallow trench is excavated across the nala and absestos sheets are put on two sides. The space between the rows of asbestos sheets across the nala is backfilled with clay. Thus a low cost check dam is created. On the upstream side clay filled cement bags can be stacked in a slope to provide stability to the structure.

(vi) Rain Water Harvesting through Recharge Shaft

- This is the most efficient and cost effective technique to recharge unconfined acquifer overlain by poorly permeable strata.
- Recharge shaft may be dug manually if the strata is of non-caving nature. The diameter of shaft is normally more than 2 m.
- The shaft should end in more permeable strata below the top impermeable strata. It may not touch water table.
- The unlined shaft should be backfilled, initially with boulders/cobbles followed by gravel and coarse sand.
- In case of lined shaft the recharge water may be fed through a smaller conductor pipe reaching up to the filter pack.
- These recharge structures are very useful for village ponds where shallow clay layer impedes the infiltration of water to the aquifer.
- It is seen that in rainy season village tanks are fully filled up but water from these tanks does not percolate down due to siltation and tubewells and dugwells located nearby remain dried up. The water from village tanks gets evaporated and is not available for beneficial use.
- By constructing recharge shaft in tanks, surplus water can be recharged to ground water. Recharge shafts of 0.5 to 3 m diameter and 10 tc 15 m deep are constructed depending upon availability of quantum of water. The top of shaft is kept above the tank bed level preferably at half of full supply level. These are back filled with boulders, gravels and coarse sand.
- In upper portion of 1 or 2 m depth, the brick masonry work is carried out for the stability of the structure.
- Through this technique all the accumulated water in village tank above 50% full supply level would be recharged to ground water. Sufficient water will continue to remain in tank for domestic use after recharge.

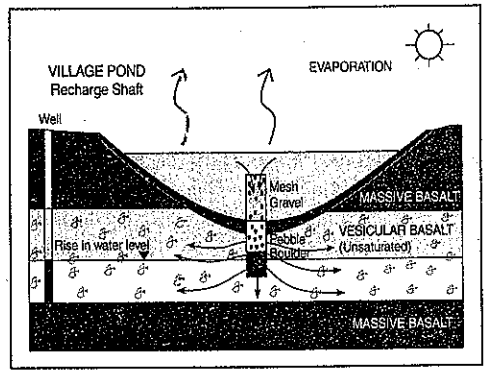


FIG. 15.14. Rain water harvesting through recharge shaft

(vii) Rain Water Harvesting through Dugwell Recharge

- Existing and abandoned dug wells may be utilized as recharge structure after cleaning and desilting the same.
- The recharge water is guided through a pipe from desilting chamber to the bottom of well or below the water level to avoid scouring of

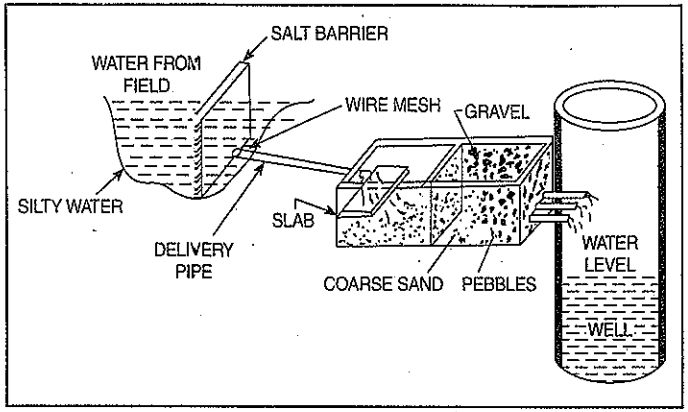


FIG. 15.15. Rain water harvesting through dugwell recharge

bottom and entrapment of air bubbles in the acquifer.

- Recharge water should be silt free and for removing the silt contents, the runoff water should pass either through a desilting chamber or filter chamber.
- Periodic chlorination should be done for controlling the bacteriological contaminations.

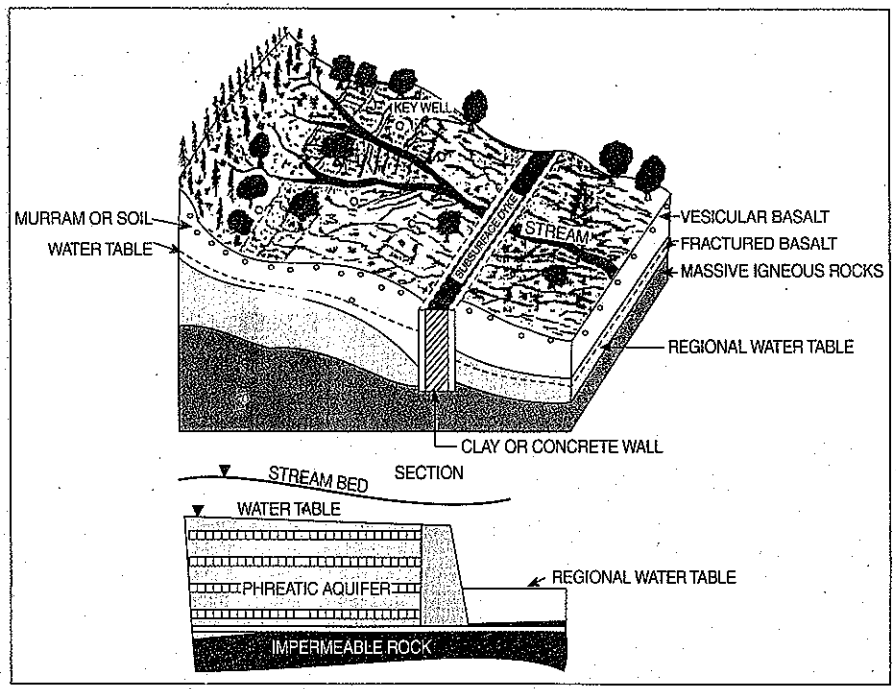


FIG. 15.16. Rain water harvesting through ground water dams or sub-surface dykes

(viii) Ground Water Dams or Sub-surface Dykes

- Sub surface dyke or under-ground dam is a subsurface barrier across stream which retards the base flow and stores water upstream below ground surface. By doing so, the water level in upstream part of ground water dam rises saturating otherwise dry part of aquifer.
- The site where sub-surface dyke is proposed should have shallow impervious layer with wide valley and narrow outlet.
- After selection of suitable site, a trench of 1-2 m wide is dug across the breadth of stream down to impermeable bed. The trench may be filled with clay or brick/concrete wall upto 0.5 m below the ground level.
- For ensuring total imperviousness, PVC sheets of 3,000 PSI tearing strength at 400 to 600 gauge or low density polythene film of 200 gauge can also be used to cover the cut out dyke faces.
- Since the water is stored within the aquifer, submergence of land can be avoided and land above the reservoir can be utilized even after the construction of the dam. No evaporation loss from the reservoir and no siltation in the reservoir takes place. The potential disaster like collapse of the dams can also be avoided.

REFERENCES

Census of India 2011 : Tables on Houses, Household Amenities and Assets, India Series 1.

Central Ground Water Board, Ministry of Water Resources, GOI : *Ground Water Resources of India* (1995).

Central Ground Water Board, Ministry of Water Resources, GOI : *Ground Water Statistics* (2009).

Central Ground Water Board, Ministry of Water Resources, GOI : *Rain Water Harvesting Techniques to Augment Ground Water* (2013).

Central Ground Water Board, Ministry of Water Resources, GOI : *Save Water for Every One* (1997).

Centre for Science and Environment (2012) : Report on Excreta Matter.

Chellancy Brahma (2014) : Water, Peace and War, Oxford University Press, New Delhi.

Dakshinamurti, C. *et al.* (1973) : *Water Resources of India and Their Utilization in Agriculture*, New Delhi.

Dasgupta, S.P. (1989) : India's Water Resource Potential, in S.P. Dasgupta (ed.) *Man and Ecology*, School of Fundamental Research, Calcutta.

D'sMonte, Dorryl : *Current of Dissent*, Hindustan Times, August 19, 2003, New Delhi.

Economic Survey 2013-14, Government of India, New Delhi.

Gurjar, R.K. and Jat B.C. (2008) : Geography of Water Resources, Rawat Publications, Jaipur.

India 1992 2013 and 2014 : *A Reference Annual*, Ministry of Information and Broadcasting, New Delhi.

Khan, K.U., Save the Elixir of Life, *Science Reporter*, Vol. 41, No. 6, June 2004.

Kothari Ashish and Kohli Kanchi : *When Logic doesn't Wash*, Hindustan Times, June 13, 2003.

Krishna, S. Ananda. Is the Water Bank Tricking for India ? *Science Reporter*, Vol. 41, No. 6, June, 2004.

Mathur, P.C. : Performance Improvement of Irrigation Sector : Issues and Options in *Water Asia 1999*, International. Conference and Exhibition, New Delhi.

National Sample Survey Office (NSSO) (2012) : Survey of Water Resources.

NATMO (1990) : *Water Resources Development Atlas of India*, National Atlas of Thematic Mapping Organisation, Kolkata.

Neogi, Saikat, *Lifeline for a pittance*, Hindustan Times, June 27, 2005, New Delhi.

Pathak, B.D. (1984) : *Exploration and Exploitation of Ground Water with Special reference to Recharge* in A. Ramesh (ed.) Resource Geography (Contribution to Indian Geography), Heritage Publishers, New Delhi.

Prasad, R.S., Water Resource Management—Integrated Development of river Basin in *Water, Asia 2000*, International Conference and Exhibition on Asian Water Industry, New Delhi.

Prasad, R.S., Singh Ravinder and Sharma, R.P. Water Resources Assessment for Medium and Long Term Availability and Demand for its Diverse Uses, *in Water Area, 1999*, International Conference and Exhibition, New Delhi.

Rao, K.L. (1975) : *India's Water Wealth*, Orient Longman, New Delhi.

Roy, Dunu : *Garland of Hype (River-Linking A Misplaced Technological Fantasy)* : Times of India, August 27, 2004, New Delhi.

Sharma, S.K. : *Ground Water Management,* Paper presented at the Indo-French Water Week on 19-20th November 1999 at New Delhi.

Sharma, S.K. : *Rain Water Harvesting—An Alternative Technology for Fresh Water Augmentation,* Published in 'National Seminar on Rain Water Harvesting', May 22nd and 23rd, 2000, New Delhi.

Singh, Bharat : *A high dream of little logic,* Hindustan Times, March 9, 2003.

Singh Karan and Sameed Cooshalli : Dwindling Table : *Cities dig deeper,* Hindustan Times, June 27, 2005, New Delhi.

Singh, R.L. (ed.) (1971) : *India : A Regional Geography,* National Geographical Society of India, Varanasi.

Singh, Shivani : *A Balance Gone Awry,* Hindustan Times, June 27, 2005, New Delhi.

Sood, Vikram : *Drying and Cracking (The prospect of wars breaking out over water in near future is very real),* The Hindustan Times, July 30, 2004.

Status of Water Quality in India, 2011, Central Pollution Control Board, Delhi.

Suresh, V. : Issues and Initiatives for Promotion of Sustainable Drinking Water Supply Systems in *Water Asia 2000,* International Conference and Exhibition on Asian Water Industry, New Delhi.

Tikeeu, Alok : *Scope for Optimum Harvest,* Hindustan Times, June 27, 2005, New Delhi.

Vasani, P. Rupesh : Domestic Roof Water Harvesting—Need of the Hour in *Water Asia 2000,* International Conference and Exhibition on Asian Water Industry, New Delhi.

Irrigation

Water is an important input for successful agriculture. Water may be available to crops in the natural course by rainfall or it may be supplied to the agricultural fields artificially by human efforts. *The process of supplying water to crops by artificial means such as canals, wells, tube-wells, tanks, etc. from the sources of water such as rivers, tanks, ponds or underground water is called irrigation.*

NEED FOR IRRIGATION

The geographical conditions, especially the nature of monsoon rainfall, in India make irrigation indispensable for sustainable agricultural development. Unfortunately, rainfall in India is **uncertain, unreliable, irregular, variable, seasonal and unevenly distributed.** The main rain bringing south-west monsoon often fails to keep its date. It may come either before or after the scheduled date of arrival. Normally speaking, the rainfall keeps its date of arrival and withdrawal only in one out of five years. The amount of rainfall may also vary greatly from the normal. Excess rainfall may cause floods but less rainfall forces the farmers to resort to irrigation. Ironically, the variability of rainfall is very high in areas of low rainfall. The north-western parts of the country, especially Punjab, Haryana, Rajasthan and western parts of Uttar Pradesh often suffer from high variability of rainfall. There are large variations in the spatial distribution of rainfall. On the one end of the scale, there are areas in Meghalaya which receive more than 1000 cm of annual rainfall while on the other end there are parts of the Thar Desert which receive less than 10 cm of rain in a year. Only 30.2 per cent of the cultivated area in India receives sufficient rainfall where the annual rainfall exceeds 100 cm. About 35.7 per cent of the cultivated area receives 75 to 100 cm of annual rainfall and 34.1 per cent of the cultivated area receives less than 75 cm of annual rainfall. Therefore, it is clear that about two thirds of the total cropped area needs irrigation facilities. Even in areas of high rainfall, irrigation is necessary to further increase farm productivity. Indian rainfall is characterised by *monsoon gaps*. Consequently it may not rain for two or more weeks during the rainy season and the crops may be badly damaged in the absence of irrigation facilities. The chief characteristic of the Indian monsoon is that it is seasonal. About 75 per cent of the rainfall in India is caused by the south-west monsoons which are active

only for 3-4 months in a year. The remaining 8-9 months are marked by dry season when irrigation is badly needed for successful growing of the crops. The duration of dry season varies from 5 months in Kerala to over 9 months in the north-west India. Moreover, rainfall in most parts of India is torrential. As the popular saying goes, **it pours, it never rains in India.** This leaves little opportunity for soil to absorb water and much of the surface water goes waste. This loss of water by wasteful flow has to be compensated by irrigation.

Apart from the vagaries of monsoon rain as described above, there are certain crops such as rice, sugarcane, jute, cotton, chillies, etc. which require more water and have to be provided with irrigation even in areas of heavy rainfall. It is estimated that yields of irrigated crops are 50 to 100 per cent higher than that of the unirrigated crops under similar geographical conditions. With the introduction of high yielding varieties (HYV) of seeds and heavy doses of chemical fertilizers since the second half of 1960s, irrigation has become a very important ingradient of Indian agriculture. The ever increasing population leads to more intensive agriculture which needs more irrigation facilities, along with other inputs.

GEOGRAPHICAL FACTORS FAVOURING IRRIGATION

Certain geographical factors have helped in developing irrigation in different parts of India. The northern plain of India has extremely rich fertile soils deposited by the mighty rivers flowing from the Himalayan ranges. In fact, the Indo-Gangetic plain is considered to be one of the most fertile plains of the world. The slope of the land is so gentle that canals can carry the irrigation water to far off places. The soft and friable nature of the soil makes it easy to dig canals and to sink wells. The deep clay in the sub-soil acts as reservoir for rain water which percolates through the porous alluvium. There is thus, a large quantity of ground water which is taken out for irrigation through wells and tube wells. The area is blessed with a large number of perennial rivers which provide water for irrigation throughout the year. However, the rate of flow of water fluctuates with the change of season. In the Peninsular plateau area, the rocks are hard and the surface relief is uneven. Therefore, it is difficult to have canals and wells and tanks are used for irrigation.

Types of Irrigation Projects

Irrigation Projects in India are classified into three categories *viz.* Major, Medium and Minor Irrigation. Projects which have a Cultivable Command Area (CCA) of more than 10,000 hector are termed as ***Major Projects***, those Irrigation Projects which have a CCA of less than 10,000 hector but more than 2,000 hector are termed as ***Medium projects*** and those Irrigation Projects which have a CCA of 2,000 hector or less are known as ***Minor projects***.

TYPES OF IRRIGATION TECHNIQUES

Various types of irrigation techniques differ in how the water obtained from the source is distributed within the field. In general, the goal is to supply the entire field uniformly with water, so that each plant has the amount of water it needs, neither too much nor too little. The various irrigation techniques are as under :

Surface Irrigation. In surface irrigation systems, water moves over and across the land by simple gravity flow in order to wet it and to infiltrate into the soil. Surface irrigation can be subdivided into furrow, border strip or basin irrigation. It is often called flood irrigation when the irrigation results in flooding or near flooding of the cultivated land.

Localized Irrigation. Localized irrigation is a system where water is distributed under low pressure through a piped network, in a pre-determined pattern, and applied as a small discharge to each plant or adjacent to it. Drip irrigation, spray or micro-sprinkler irrigation and bubbler irrigation belong to this category of irrigation methods.

Drip Irrigation. Drip irrigation, also known as ***trickle irrigation***, functions as its name suggests. Water is delivered at or near the root zone of plants, drop by drop. This method can be the most water-efficient method of irrigation, if managed properly, since evaporation and runoff are minimized. In modern agriculture, drip irrigation is often combined with plastic mulch, further reducing evaporation, and is also the means of delivery of fertilizer.

Sprinkler Irrigation. In sprinkler or overhead irrigation, water is piped to one or more central locations within the field and distributed by overhead high-pressure sprinklers or guns. A system utilizing sprinklers, sprays, or guns mounted overhead on permanently installed risers is often referred to as a solid-set irrigation system. Higher pressure sprinklers that rotate are called rotors and are driven by a ball drive, gear drive, or impact mechanism. Guns are used not only for irrigation, but also for industrial applications such as dust suppression and logging. Sprinklers can also be mounted on moving platforms connected to the water source by a hose. Automatically moving wheeled systems known as traveling sprinklers may irrigate areas such as small farms, sports fields, parks, pastures, and cemeteries unattended.

Sub-irrigation. Sub-irrigation also sometimes called seepage irrigation has been used for many years in field crops in areas with high water tables. It is a method of artificially raising the water table to allow the soil to be moistened from below the plants root zone. Often those systems are located on permanent grasslands in lowlands or river valleys and combined with drainage infrastructure. A system of pumping stations, canals, weirs and gates allows it to increase or decrease the water level in a network of ditches and thereby control the water table. Sub-irrigation is also used in commercial greenhouse production, usually for potted plants. Water is delivered from below, absorbed upwards, and the excess collected for recycling.

GROWTH AND UTILIZATION OF IRRIGATION

Irrigation has been practised in India since ancient times. The Hindu monarchs, the Mughal emperors and the British rulers exhibited great engineering feats to develop irrigation at different times in the history of India. In the pre-Independence period, the undivided India had some of the best irrigation systems in the world. Much of the canal irrigated area of the Satluj and the Indus system went to Pakistan after partition.

Sustained and systematic programme for development of irrigation facilities was taken up with the advent of Planned Development in 1951. A broad-assessment of the area that can be ultimately brought under irrigation, both by surface and ground water, made by the various States in sixties has indicated that ultimate irrigation potential of the country would be of the order of 113 m.ha (million hectare). However, the ultimate potential is 139 m.ha, the increase being primarily due to upward revision in assessed potential of minor ground water schemes and minor surface water schemes. Minor irrigation projects have both surface and ground water as their source, while Major and Medium projects mostly exploit surface water resources.

SOURCES OF IRRIGATION

Different sources of irrigation are used depending upon the topography, soils, rainfall, availability of surface or ground water, nature of rivers (whether perennial or non-perennial), requirements of crops, etc. The main sources of irrigation used in different parts of the country are (*i*) Canals; (*ii*) Wells and tube wells (*iii*) Tanks and (*iv*) Others (Dongs, Kuhls, springs, etc.)

Highlights of area under irrigation in India by sources

- Net area under irrigation by all sources of irrigation increased from 55.23 million hectares in 2000-01 to 63.25 million hectares in 2009-10, indicating 15% increase over the period.
- Net area under irrigation by Government canals increased from 15.81 million hectares in 2000-01 to 16.51 million hectares in 2009-10.
- Net area under irrigation by tube wells and other wells enhanced from 33.83 million hectares in 2000-01 to 39.04 million hectares in 2009-10.
- Net area under irrigation by tanks declined from 2.46 million hectares in 2000-01 to 1.64 million hectares in 2009-10.
- Net area under irrigation by other sources enhanced from 2.91 million hectares in 2000-01 to 5.88 million hectares in 2009-10.
- The total gross irrigated area enhanced from 76.19 million hectares in 2000-01 to 79.95 million hectares in 2009-10.
- The gross irrigated area under food grains increased from 53.61 million hectares in 2000-01 to 58.64 million hectares in 2009-10, the increase is due to increase of 4 million hectares in gross irrigated area under wheat during the period.

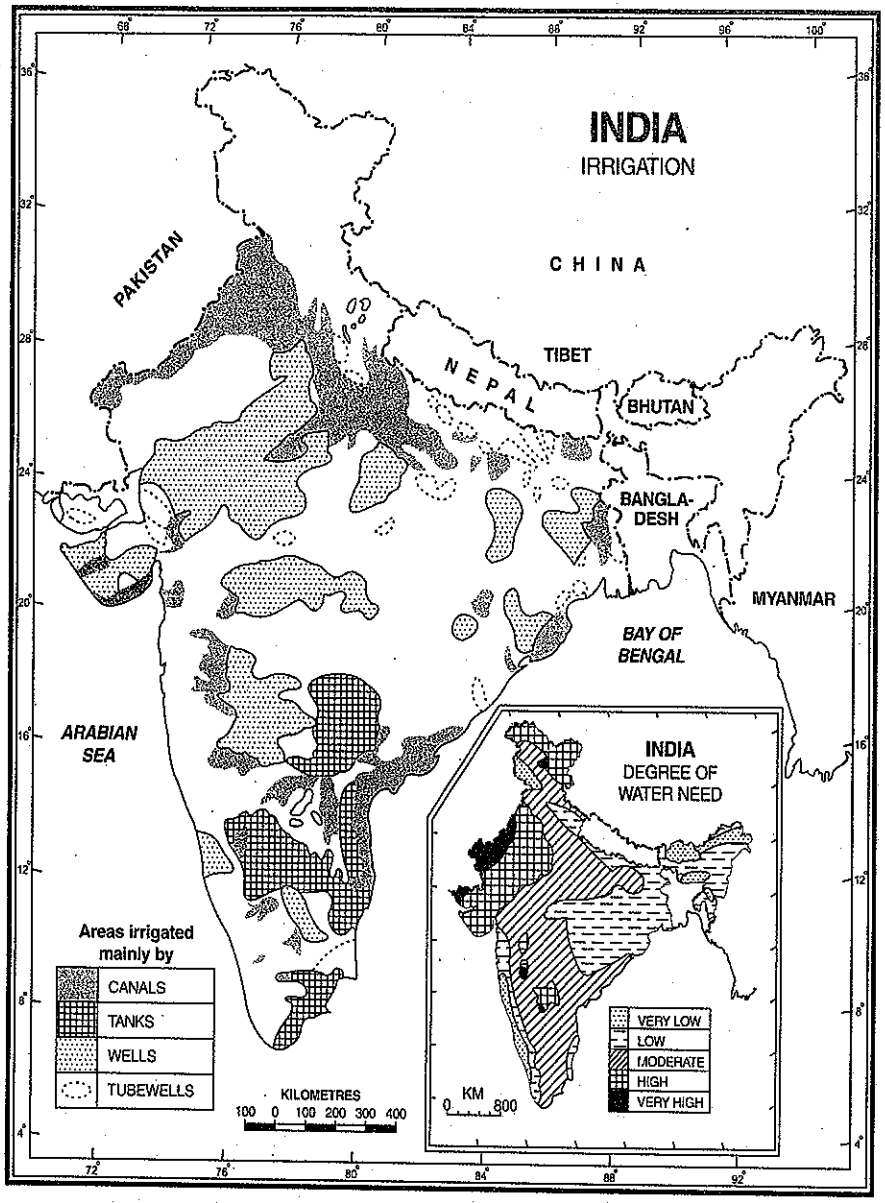


FIG. 16.1. India : Irrigation

TANK IRRIGATION

A tank consists of water storage which has been developed by constructing a small bund of earth or stones built across a stream. The water impounded by the bund is used for irrigation and for other purposes. Some tanks are built partly as dugouts and partly by enclosing bunds. Tanks are of varying size but most of the tanks are of small size and are built by individual farmers or groups of farmers. There are about 5 lakh big and 50 lakh small tanks irrigating nearly 1.64 million hectares of agricultural land. The ratio of tank irrigated land to the total irrigated area of the country has reduced from 14 per cent in the 1960-61 to about 3.0 per cent in 2009-10, primarily due to increase in well and tubewell irrigation and partly due to fall in the tank irrigation.

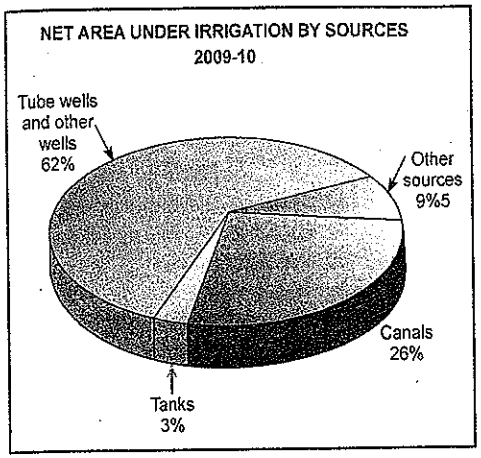


FIG. 16.2. Net areas irrigated in India by source
(Based on Statistical Year Book India, 2013, p. 12.3.

Tank irrigation is popular in the peninsular plateau area where Andhra Pradesh, Telangana and Tamil Nadu are the leading states. Andhra Pradesh and Telangana have 727 thousand hectares irrigated by tanks. These two states have about 28.8 per cent of tank irrigated area of India. About 16 per cent of the total irrigated area of the state is irrigated by tanks. The drainage areas of the Godavari and its tributaries have large number of tanks. Nellore and Warangal are the main districts of tank irrigation. Tamil Nadu has an area of 589 thousand hectares under tank irrigation. This is over 23 per cent of tank irrigated area of India and about one-fifth of the total irrigated area of the state. There are about 24,000 tanks in Tamil Nadu. Tanks comprise an important source of irrigation in the Karnataka Plateau, eastern Madhya Pradesh, Chhattisgarh, eastern Maharashtra, interior Odisha and Kerala. Outside the Peninsular plateau, West Bengal, Bihar, Bundelkhand area of Uttar Pradesh, Rajasthan and Gujarat have tank irrigation (Fig. 16.3). The tank irrigation is practised mainly in peninsular India due to the following reasons.

1. The undulating relief and hard rocks make it difficult to dig canals and wells.
2. There is little percolation of rain water due to hard rock structure and ground water is not available in large quantity.
3. Most of the rivers of this region are seasonal and dry up in summer season. Therefore, they cannot supply water to canals throughout the year.
4. There are several streams which become torrential during rainy season. The only way to make best use of this water is to impound it by constructing bunds and building tanks. Otherwise this water would go waste to the sea.
5. The scattered nature of population and agricultural fields also favours tank irrigation.

Merits of Tank Irrigation

Most of the tanks are natural and do not involve heavy cost for their construction. Even an individual farmer can have his own tank. Tanks are generally constructed on rocky bed and have longer life span. In many tanks, fishing is also carried on. This supplements both the food resources and income of the farmer.

Demerits of Tank Irrigation

Many tanks dry up during the dry season and fail to provide irrigation when it is needed the most. Silting of the tank bed is a serious problem and it requires desilting of the tank at regular intervals. Much water is evaporated from the large expanse of shallow water and is thus not available for irrigation. Tanks cover large areas of cultivable land. In many areas, other sources of irrigation have been adopted and the dry beds of tanks have been reclaimed for agriculture. Moreover, lifting of water from tanks and carrying it to the fields is a strenuous and costly exercise which discourages the use of tanks as a source of irrigation.

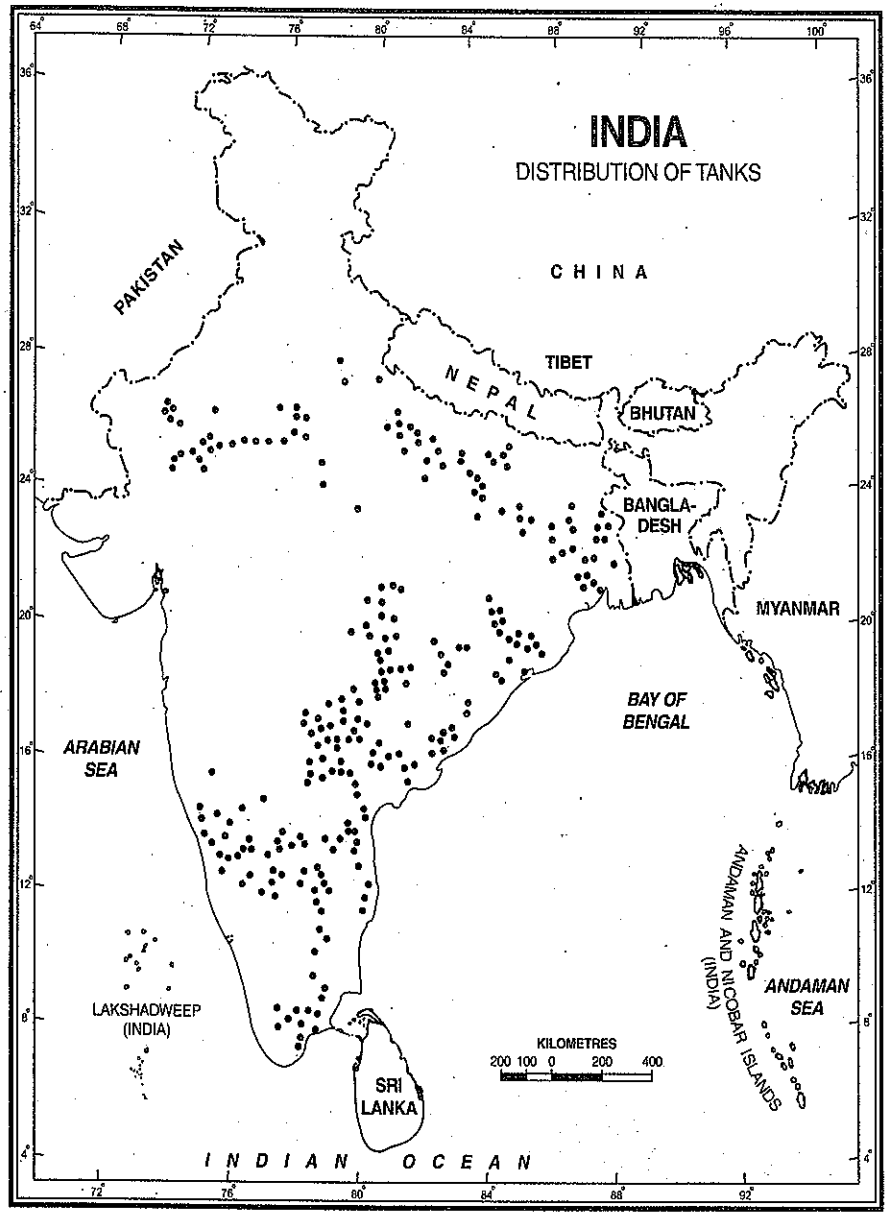


FIG. 16.3. India : Distribution of Tanks

WELLS AND TUBEWELLS

A well is a hole dug in the ground to obtain the subsoil water. An ordinary well is about 3-5 metres deep but deeper wells upto 15 metres and even more are also dug. This method of irrigation has been used in India from time immemorial. Various methods are used to lift the ground water from the well for irrigation, drinking, bathing and for other purposes.

Some of the widely used methods are the *persian wheel*, *reht*, *charas* or *mot*, and *dhinghly* (lever). Well irrigation is popular in areas where sufficient sweet ground water is available. These areas include a large part of the Great Northern Plain, the deltaic regions of the Mahanadi, the Godavari, the Krishna and the Cauvery, parts of the Narmada and the Tapi valleys and the weathered layers of the Deccan Trap and crystalline rocks and the sedimentary zones of the Peninsula. However, the greater part of the Penisnular India is not suitable for well irrigation due to rocky structure, uneven surface and lack of underground water. Large dry tracts of Rajasthan, the adjoining parts of Punjab, Haryana, and Gujarat and some parts of Uttar Pradesh have brackish ground water which is not fit for irrigation and human consumption and hence unsuitable for well irrigation.

There were about 5 million wells in 1950-51 and their number has now increased to about 12 million. Well irrigation accounts for about 62 per cent of the net irrigated area in the country against 26 per cent of canal and only 3 per cent of tank irrigation. It accounted 59.78 lakh hectares in 1950-51 which rose to about 390.4 lakh hectares in 2009-10 thereby registering more than six fold increase in well irrigation. Uttar Pradesh has the largest area lakh hectares under well irrigation and accounts for about 28.19 per cent of the well irrigated area of India. This is followed by Rajasthan (10.44%), Punjab (8.65%), Madhya Pradesh (7.97%), Gujarat (7.34%) Bihar (6.29%), Andhra Pradesh (5.87%), Maharashtra (5.75%), Haryana (4.41%), Tamil Nadu (4.35%), West Bengal (4.19%) and Karnataka (3.06%). In Gujarat, about 82.31 per cent of the net irrigated area is under well irrigation. The other states where well irrigation plays a significant role are Punjab (79.96%), Uttar Pradesh (73.22%), Rajasthan (70.78%), Maharashtra (64.62%), Madhya Pradesh (64.11%) and West Bengal (59.35%) (see Table 16.3). Uttar Pradesh, Rajasthan, Punjab, Madhya Pradesh, Gujarat, Bihar and Andhra Pradesh account for three-fourths of the total well irrigated area of India.

A *tubewell* is a deeper well (generally over 15 metres deep) from which water is lifted with the help of a pumping set operated by an electric motor or a diesel engine. Obviously, a tube well cannot be constructed everywhere and requires some geographical conditions favouring its installation. The main factors are :

(*i*) There should be sufficient quantity of ground water because a tube well can generally irrigate 2 hectares per day against 0.2 hectares per day irrigated by an ordinary well.

(*ii*) The water level should be nearly 15 metres. If the water table is more than 50 metres deep the cost of pumping out water from the tube well becomes uneconomic.

(*iii*) There should be regular supply of cheap electricity or diesel so that water from the tube well can be taken out at the hour of need.

(*iv*) The soil in the immediate neighbourhood of the tube-well should be fertile so that there is demand for irrigation and the cost involved in the construction and operation of the tube well can be recovered by the increased farm production.

The first tubewell of India was sunk in Uttar Pradesh in 1930. Till 1951 India had just 2,500 tube-wells. The central and the state governments are helping the farmers by distributing pumping sets, granting loans and giving subsidies. The number of electrical pumpsets/tubewells increased from 2 lakh in 1960 to over 4.5 million in 2009-10 while the dieselized pumpsets increased from 2.3 lakh to about 3.5 million during the same period. In several areas, the '*persian wheel*' earlier used for lifting water has been replaced by tubewells.

Merits of Well and Tubewell Irrigation

1. Well is the simplest and cheapest source of irrigation and the poor Indian farmer can easily afford it.

2. Well is an independent source of irrigation and can be used as and when the necessity arises. Canal irrigation, on the other hand, is controlled by other agencies and cannot be used at will.

3. Excessive irrigation by canal leads to the problem of *reh* which is not the case with well irrigation.

4. There is a limit to the extent of canal irrigation

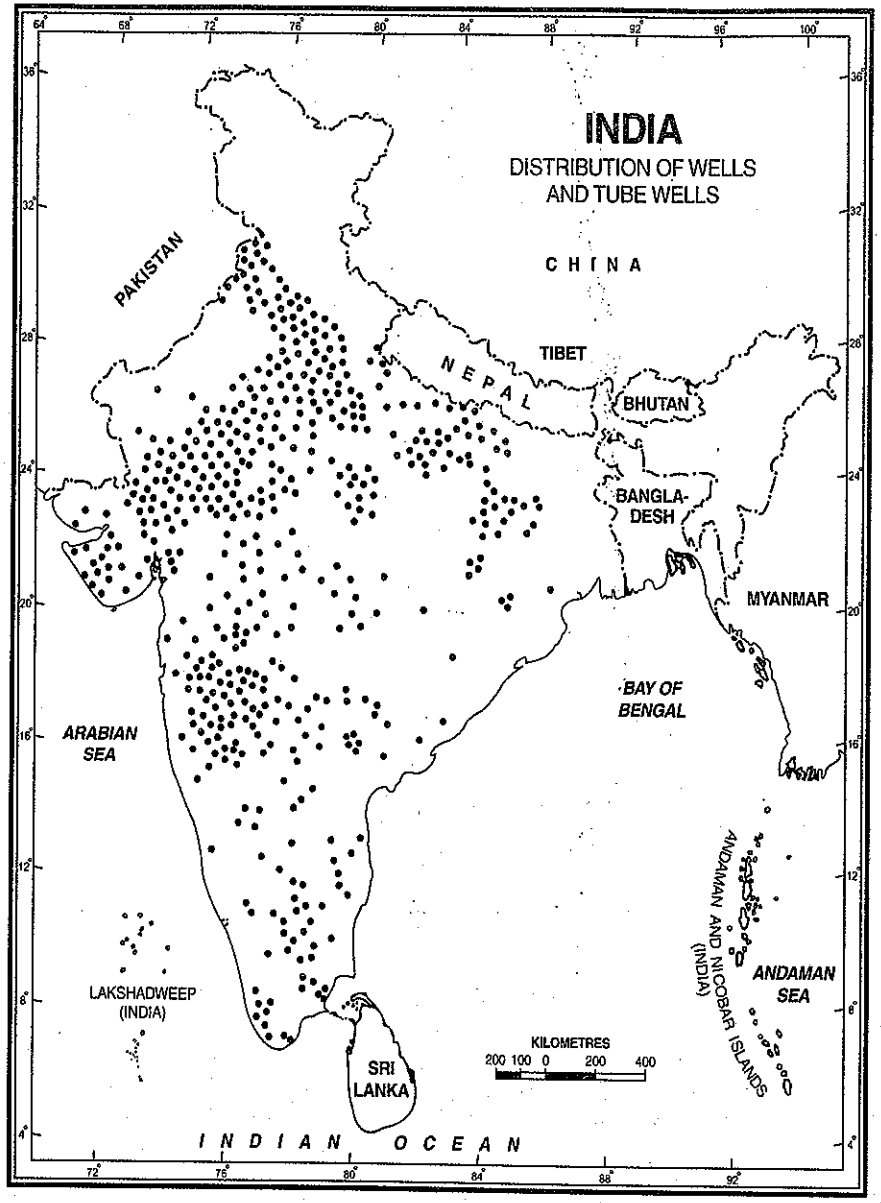


FIG. 16.4. India : Distribution of Wells and Tubewells

beyond the tail end of the canal while a well can be dug at any convenient place.

5. Several chemicals such as nitrate, chloride, sulphate, etc. are generally found mixed in well water. They add to the fertility of soil when they reach the agricultural field along with well water.

6. The farmer has to pay regularly for canal irrigation which is not the case with well irrigation.

Demerits of Well and Tubewell Irrigation

1. Only limited area can be irrigated. Normally, a well can irrigate 1 to 8 hectares of land.

2. The well may dry up and may be rendered useless for irrigation if excessive water is taken out of it.

3. In the event of a drought, the ground water level falls and enough water is not available in the well when it is needed the most.

4. Tubewells can draw a lot of groundwater from its neighbouring areas and make the ground dry and unfit for agriculture.

5. Well and tube well irrigation is not possible in areas of brackish groundwater.

CANALS

Canals used to be the most important source of irrigation upto 1960s, but in the 1970s they yielded first place to wells and tube wells and now constitute the second most important source of irrigation in India. The percentage of canal irrigation area to total irrigated area in the country has fallen from about 39.77 per cent in 1950-51 to 26 per cent in 2009-10.

Canals can be an effective source of irrigation in areas of low level relief, deep fertile soils, perrenial source of water and extensive command area. Therefore, the main concentration of canal irrigation is in the northern plain of India, especially the areas comprising Uttar Pradesh, Haryana and Punjab. The digging of canals in rocky and uneven areas is difficult and uneconomic. Thus the canals are practically absent from the Peninsular plateau area. However, the coastal and the delta regions in South India do have some canals for irrigation.

Broadly speaking, canals in India are of two types, *viz.* (*i*) *Inundation canals*, which are taken out from the rivers without any regulating system like weirs etc. at their head. Such canals provide irrigation mainly in the rainy season when the river is in flood and there is excess water. When the rainy season is over, the flood in the river subsides, the level of water falls below the level of the canal head and the canal dries up. Some canals taken off from the Satluj in Punjab were of this type. Since irrigation from this type of canals is uncertain, they have been converted in perennial canals. (*ii*) *Perennial canals* are those which are taken off from perennial rivers by constructing a barrage across the river. Most of the canals in India today are perennial.

The net area under government canal irrigation is about 16.52 million hectares. The main canal irrigated areas are in the northern plains of India where Uttar Pradesh, Punjab, Haryana, Rajasthan and Bihar account for about 60 per cent of the canal irrigated area of the country. In south and central India, Andhra Pradesh, Maharasthra, Karnataka, Madhya Pradesh, Chhattisgarh, Odisha and Tamil Nadu are important states of canal irrigation.

Uttar Pradesh

Canals constitute an important source of irrigation in Uttar Pradesh. The state is drained by perennial rivers originating in the snow covered Himalayan ranges and is blessed with fertile soils. But the amount of rainfall, especially in western parts of the state, is not sufficient for sustained agricultural growth. Therefore, a large number of canals have been constructed to provide regular supply of sufficient water to the crops. Uttar Pradesh has about one-third of the total canal irrigated area of the country. Over one-fourth of the net irrigated area of the state is irrigated by canals. Following are the main canals.

1. Upper Ganga Canal. This canal takes off from the Ganga at Kankhal (Hardwar). The construction of this canal commenced in 1842 and it was completed in 1854. The main canal is 342 km long while the length of its distributaries is about 6,200 km. During the first 32 km of its course, between Haridwar and Roorkee, it passes through a broken country so that at some places it is taken over the rivers and at others below the rivers. It irrigates about 7 lakh hectares of land in the upper part of the Ganga-Yamuna Doab. Districts of Saharanpur, Meerut, Ghaziabad, Bulandshahar, Aligarh, Mathura, Etah, Kanpur, Mainpuri, Farrukhabad and Fatehpur get benefit from this canal. Its main branches are Devbandh, Anupshahar, Motta and Hathras. It joins with the Lower Ganga Canal at Mainpuri and the water in this canal is considerably increased. Further beyond, these two canals flow separately.

2. Lower Ganga Canal. This canal was taken from the Ganga near Narora (Bulandshahar) in 1878. The length of the canal including its distributaries is

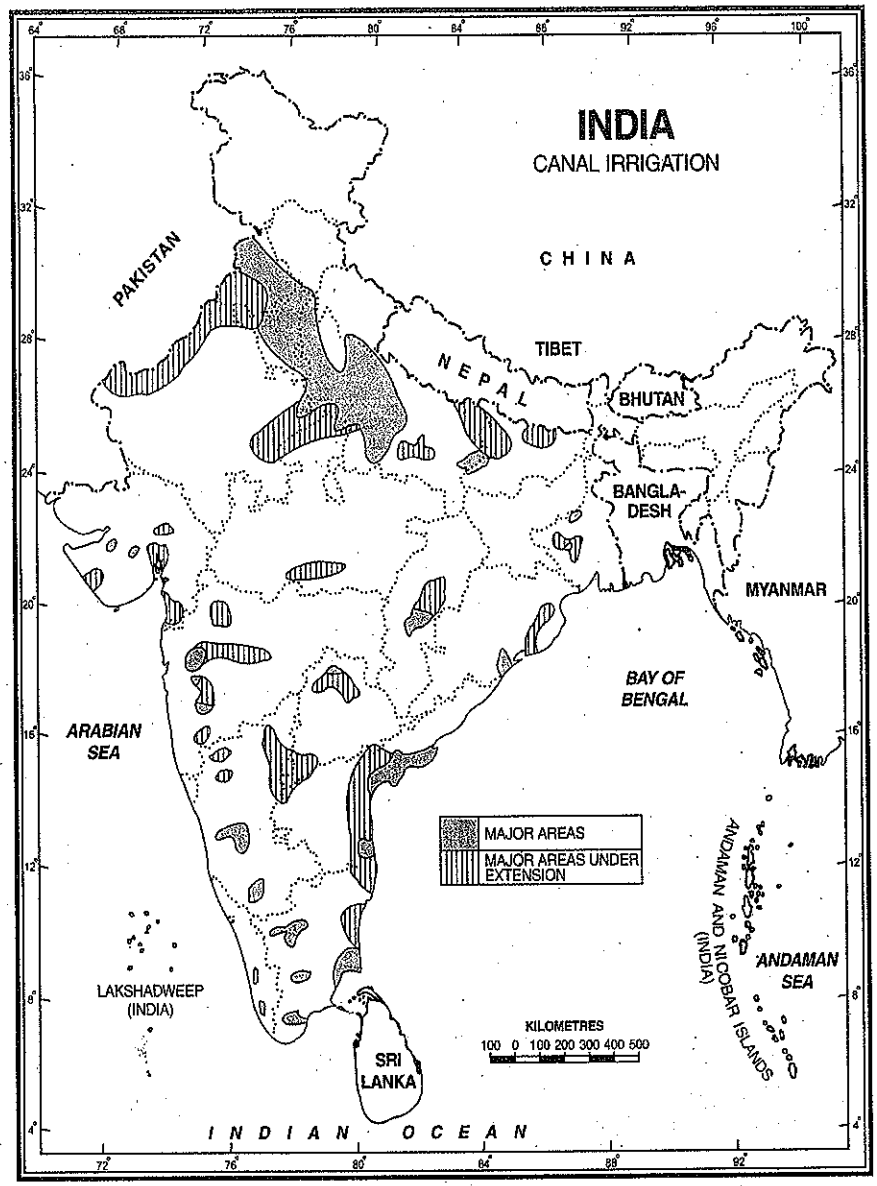


FIG. 16.5. India : Canal Irrigation

about 6000 km. Its main branches are Etawah, Kanpur and Fatehpur. It irrigates about 4.6 lakh hectares in the districts of Bulandshahar, Farrukhabad, Mainpuri, Aligarh, Etah, Etawah, Fatehpur, Kanpur and Allahabad.

3. Sharda Canal. As its name indicates, this canal is taken from the Sharda river at Banbasa near the Indo-Nepal border. The construction work on this canal was completed in 1928. The total length of the main canal and its distributaries is 13,624 km. It is

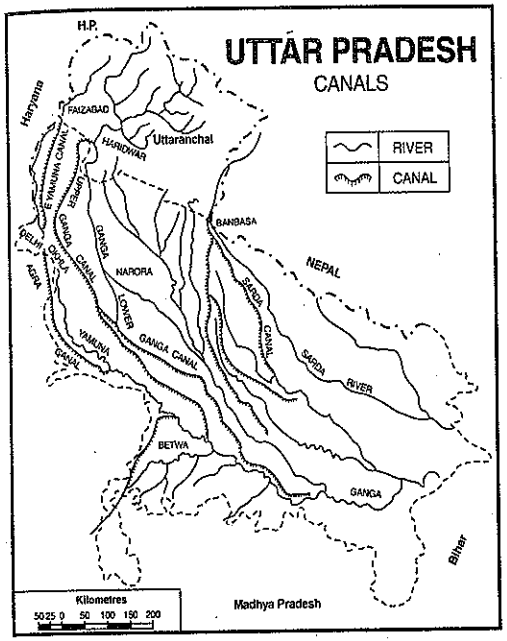


FIG. 16.6. Canals of Uttar Pradesh

thus one of the longest canal systems of the world. This canal system irrigates about eight lakh hectares of land mainly in Allahabad, Sultanpur, Pilibhit, Bareilly, Hardoi, Shahjahanpur, Sitapur, Lucknow, Barabanki, Rai Bareli, Unnao, Partapgarh and Kheri districts.

4. Eastern Yamuna Canal. It takes off from the river Yamuna at Faizabad. It was constructed in 1831. The main canal and its distributaries cover a distance of 1,450 km and irrigate about 2 lakh hectares of land in the districts of Saharanpur, Muzaffarnagar, Meerut and Ghaziabad. It again joins the Yamuna river at Delhi and irrigates a part of the union territory also.

5. Agra Canal. This canal is taken from the right bank of the Yamuna at Okhla (Delhi). It was built in 1874 and irrigates about 1.5 lakh hectares in Agra and Mathura in U.P., Faridabad and Palwal in Haryana, Bharatpur in Rajasthan and also parts of union territory of Delhi.

6. Betwa Canal. Built in the Third Five Year Plan, this canal takes off from the Betwa river about 56 km south-west of Jhansi. It irrigates about 1.2 lakh hectares in Jhansi, Jalaun and Hamirpur districts.

Apart from the above mentioned major canals, some other canals such as Ken, Chambal, Dhasan and Son canal also irrigate some areas in the southern part of Uttar Pradesh.

Punjab

In early days, canal irrigation accounted for about 39.14 per cent of the total irrigated area in Punjab but the share of canal irrigation fell down to less than 19 per cent in 2009-10. Following are some of the important canals of Punjab.

1. Upper Bari Doab Canal. This canal is taken from the Ravi river at Madhopur near Pathankot. Construction of this canal started in 1849 and completed in 1859. It irrigates about 3 lakh hectares in Gurdaspur and Amritsar districts.

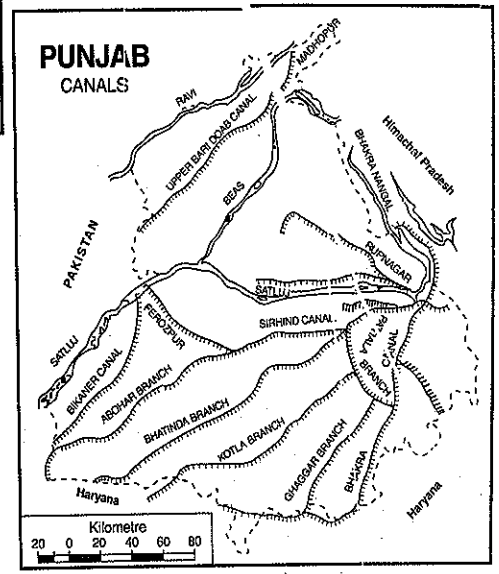


FIG. 16.7. Punjab : Canals

2. Sirhind Canal. This canal was taken from the Satluj river at Rupnagar (Ropar) in the year 1886-87. The total length of the canal along with its distributaries is 6,115 km. Its main branches are the Patiala, Abohar, Bhatinda, Kotla and Ghaggar. It irrigates about 7 lakh hectares in Patiala, Sangrur, Bhatinda, Ludhiana and Ferozepur districts. The Kotla and the Ghaggar branches provide irrigation to Hissar, Sirsa and Fatehabad districts of Haryana also.

In order to augment the supply of water, the *Sirhind Feeder Canal* was completed in 1960. It takes off from the Ferozepur Feeder at its 18th km at Malanwala. It is 242 km long and supplies water to Abohar branch of the Sirhind Canal. This water is drawn from the Satluj and Beas rivers which used to go unused to Pakistan. It also provides irrigation to Ferozepur, Faridkot and Muktsar districts in Punjab and to some parts of Rajasthan.

3. Bhakra Canal. It draws water from the Bhakra dam built across the Satluj river. It was completed in 1954. It irrigates a vast area of about 15 lakh hectares in Punjab, Haryana and Rajasthan. In Punjab, Ludhiana, Patiala, Sangrur, Jalandhar, and Ferozepur districts are benefited by this canal.

4. Bist Doab Canal. It is a part of the Bhakra-Nangal Project. The total length of this canal along with its distributaries is 1,090 km. It irrigates about 4 lakh hectares in Jalandhar and Hoshiarpur districts.

Bikaner and Beas are other projects which provide irrigation to parts of Punjab and the neighbouring states of Haryana and Rajasthan.

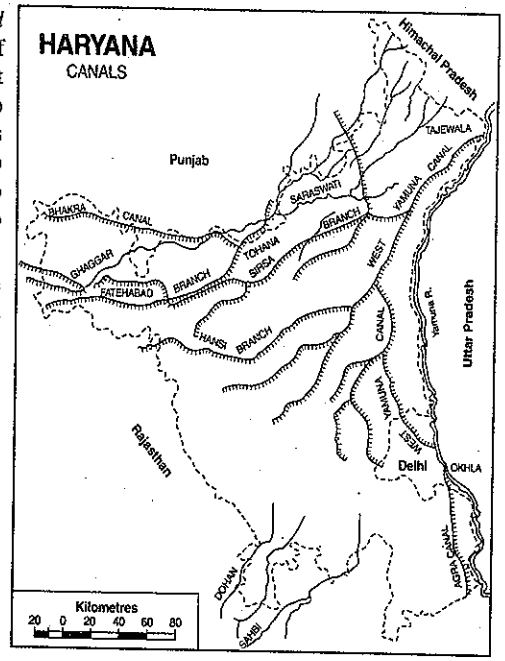


FIG. 16.8. Haryana : Canals

Haryana

Haryana depends upon canal irrigation for its agricultural prosperity to a great extent. About 49.89 per cent of the irrigated area in Haryana is irrigated by canals. Following are the main canals.

1. The Western Yamuna Canal. It takes off from the right bank of the Yamuna at Tajewala. It was built by Feroze Shah Tughlak. The total length of the canal along with its distributaries is 3,200 km and it irrigates about 4 lakh hectares in Ambala, Kurukshetra, Karnal, Panipat, Rohtak, Hissar, Sirsa, Fatehabad and Jind districts. Its important branches are, the Delhi, the Hansi and the Sirsa branch.

2. Bhakra Canal. After irrigating Punjab areas, the Bhakra canal enters Haryana near Tohana and irrigates large parts of Hisar, Fatehabad and Sirsa districts. Its main branches are the Fatehabad, the Ratia, the Rori, the Barwala and the Tohana branch.

3. Jui Canal. This is a lift irrigation scheme designed to irrigate the semi-desert region of Bhiwani and adjoining areas. This 169 km long canal irrigates about 32 thousand hectares.

4. Gurgaon Canal. It takes off from the Yamuna at Okhla in Delhi. Started in 1970, this canal irrigates 1.2 lakh hectares in Gurgaon and Faridabad districts.

Andhra Pradesh

With 10.31% of the total canal irrigated area of India, Andhra Pradesh is next only to Uttar Pradesh and tops in South India in so far as area under canal irrigation is concerned. Canal irrigation accounts for about 36.42 per cent of the net irrigated area of the state. The major canals of Andhra Pradesh are taken off from the Krishna, the Godavari and the Tungabhadra rivers and the major canal irrigated areas are in the deltas and the coastal regions.

The Godavari delta project comprises of two weirs — the Dowlaiswaram and the Ralli, which were completed in 1846. From these, right bank canal and the delta canal have been taken to irrigate about 4.5 lakh hectares. The *Krishna delta project* comprise Vijayawada anicut. Sunkesula anicut across the Krishna and the Tungabhadra irrigates about 4.5 lakh hectares. The *Kurnool-Cuddapah* canal was taken off from the Tungabhadra in 1816. It irrigates about 1.2 lakh hectares in Kurnool and Cuddappah districts.

The *Nagarjunasagar Project* consists of a dam across the Krishna River in Nalgonda district from where two canals have been taken off. The right bank canal is 204 km long and irrigates 6.7 lakh hectares in Guntur, Nalgonda (in Telangana), Kurnool and Krishna districts. The left bank canal is 171 km long and irrigates 3.56 lakh hectares in Khammam (in Telangana), Krishna and West Godavari districts.

Bihar

Rainfall in several parts of Bihar is inadequate, unreliable and uncertain leading to severe and frequent droughts. This has made canal irrigation an important part of agricultural practice in Bihar. Canal irrigation accounts for over 31 per cent of the total area of the state.

1. Sone Canals. The Eastern Sone Canal was taken from the Sone river at Varun in 1857. This 130 km long canal irrigates 2.5 lakh hectares in Patna and Gaya districts. The Western Sone Canal has been taken from this river at Dehri. It provides irrigation to Shahabad district.

2. Kosi Canals. Two canals known as the Eastern and the Western Kosi Canal have been taken from the eastern and the western banks of the river respectively by constructing a multipurpose dam near the Indo-Nepal border. These two canals have the irrigation potential of 4.5 and 3.5 lakh hectares respectively. Purnea, Muzaffarpur, Darbhanga, Champaran and Saran districts are benefited by this project. Besides, 4 lakh hectares are irrigated in Nepal.

3. Gandak Canals. A 743 metre long dam has been built across the Gandak at Balmiki Nagar from where two canals have been taken off. The eastern canal is called Tirhut. It is 250 km long and irrigates about 7 lakh hectares in Champaran, Darbhanga, and Muzaffarpur districts. The western canal is known as Saran Canal and irrigates 7.6 lakh hectares of Saran district of Bihar and Deoria and Gorakhpur districts of Uttar Pradesh. Another *Triveni Canal* has been taken from Triveni to irrigate about one lakh hectares of Champaran district.

West Bengal

Although most parts of West Bengal receive sufficient rainfall and do not require irrigation, still some parts of the state do feel the necessity of irrigation. More than one third of the net irrigated area is irrigated by canals. The *Mayurakshi* project was completed in 1951 at Tilpara. Two canals have been taken from this project to irrigate large areas in Bir Bhum, Murshidabad and Bardhaman districts. The main canal from the Kaugsabati completed in 1965 irrigates 1.2 lakh hectares in Bankura and Medinipur districts. The canals from the Damodar river built by Damdar Valley Corporation irrigate over five lakh hectares in West Bengal. The 520 km long *Medinipur Canal* has been taken off from the *Kosi* at Medinipur and irrigates about ten thousand hectares.

Rajasthan

Most of Rajasthan is a desert area and largely depends upon irrigation for successful growth of crops. Canals form an important source of irrigation and account for about 27.6 per cent of the net irrigated area of the state.

1. Indira Gandhi Canal. (See Chapter 14).

2. Chambal Project. This is a joint venture of Rajasthan and Madhya Pradesh. Under this project, *Gandhi Sagar Dam* has been constructed. Canals taken off from this dam irrigate about 5.15 lakh hectares in Rajasthan and Madhya Pradesh. In the second stage, *Rana Partap Dam* has been constructed which provides irrigation to 1.2 lakh hectares. In the third stage *Jawahar Sagar Dam* has been constructed.

3. The Gang or Bikaner Canal. It was taken off from the river Satluj at Husainwala in 1928. This canal is *a blood transfusion from the living Punjab into the moribund marusthal.* It provides irrigation to about 3.4 lakh hectares in Bikaner division. The total length of this canal system is 1,280 km.

The other canal irrigation projects of Rajasthan include Jawai project on the Jawai river, Parbati project near Dhaulpur, Gudha project in Bundi District, Ghaggar canal, Pichuna Canal, Banas Canal, Bharatpur Canal and Urmila Canal. The Bhakra Canal also irrigates about 2.3 lakh hectares in Rajasthan.

Madhya Pradesh

The unevern surface, rocky structure and limited fertile soil have not encouraged the construction of canals and canals irrigation is not much important,

keeping in view the size of this state. However, a few canal systems have come up. Consequently 19.49 per cent of the net irrigated area is irrigated by canals in Madhya Pradesh is under canal irrigation. Most of the canal irrigated area is in Gwalior, Bhind and Morena districts. The *Chambal project* provides irrigation to about 2.83 lakh hectares in these districts. The *Weinganga* canal takes off from the Weinganga river and irrigates 4,000 hectares of land in Balaghat and Seoni districts. Besides it provides irrigation to Bhandara district of Maharashtra. The *Barna* project involves the construction of a barrage across the Barna river (a tributary of the Narmada). The canal taken out from this barrage irrigates about 64,400 hectares of land in Raisen district. The *Tawa* project canals originate from the barrage constructed across the Tawa river, and irrigate about 3 lakh hectares of land in Hoshangabad district.

Chhattisgarh

The geographical conditions of Chhattisgarh are more or less similar to those prevailing in Madhya Pradesh which are not favourable for canal irrigation. Even then this state has some areas under canal irrigation. The *Mahanadi canal* takes off from Mahanadi river at Rudri in Raipur district. A subsidiary reservoir has been built at Maramsilli. The length of the main canal and distributaries is 215 km and 1,175 km respectively. It irrigates about 3 lakh hectares. The *Tandula canal* takes off from the confluence of the Tandula and Sukha rivers by building two separate earthen dams. It irrigates about 1.1 lakh hectares in Raipur and Durg districts.

Odisha

Canals irrigate about 878 thousand hectares of land which is nearly 25% of the net irrigated area of the state. Canals taken off from the *Hirakud dam* on the *Mahanadi*, form a major irrigation network and provide irrigation to about 2.4 lakh hectares in Bolangir and Sambalpur districts. The 3,650 km long canal system in the Mahanadi delta region provides irrigation to about 4 lakh hectares in Cuttack and Puri districts. Taldanda Canal irrigates 62 thousand hectares in Mahanadi catchment area.

Karnataka

Over 36.5 per cent of the net irrigated area in Karnataka is irrigated by canals. The *Ghatprabha* valley scheme developed on the Ghatprabha river is the most important irrigation project and irrigates about 3.2 lakh hectares in Belgaum and Bijapur districts. Canals of the *Tungbhadra project* irrigate about 2.7 lakh hectares in Bellary and Raichur districts. The canals of *Malprabha* project irrigate about one lakh hectares in Belgaum, Dharwar and Bijapur districts and those of *Bhadra Project* also irrigate one lakh hectares in Shimoga district. The *Visveswaraya Canal* taken off from the *Krishnaraja Sagar Dam* on the Cauvery irrigates about 50 thousand hectares in Mysore and Mandya districts.

Tamil Nadu

Tamil Nadu has about 29 per cent of its net irrigated area under canal irrigation. The most important canal system lies in the Cauvery delta where 6,400 km long canals irrigate about 4 lakh hectares in Thanjavur and Tiruchchirapalli districts. The *Mettur Canal system* of the Mettur dam on the Cauvery river irrigates about 1.2 lakh hectares in Salem and Tiruchchirapalli districts. The *Lower Bhawani Project* canal system irrigates about 79 thousand hectares in Coimbatore district. *Parambikulam Aliyar and Manimuthar* are other projects.

Maharashtra

Over 35 per cent of the net irrigated area in Maharashtra is irrigated by canals. Over 3,000 km long canals irrigate over 4 lakh hectares. The right bank and the left bank canals of the *Mutha Project* across Mutha river (a tributary of the Bhima river) at Khadakvasla irrigate about 45 thousand hectares in Pune district besides providing potable water to Pune and Kirkee. The canals of the Nira project irrigate over 66 thousand hectares in Pune, Satara and Solapur districts. Two canals taken out of the Godavari at *Darana dam* irrigate about 27 thousand hectares in Nashik and Ahmednagar districts. Canals taken out from *Gangapur dam* at Godavari irrigate 33 thousand hectares in Nashik district. The *Pravara* canals take

off from *Bhandardara masonary* dam at Pravara river. Both the left bank and the right bank canals irrigate about 34 thousand hectares in Ahmednagar. The Tapi canal system is a joint venture of Maharashtra and Gujarat and irrigates about 3 lakh hectares. The other irrigation canals are those of Mula, Vir, Purna, Girna, Jayakawadi, Warna, etc. Some other projects are at different stages of their completion.

Gujarat

Mahi project stage I and II is designed to irrigate over 2 lakh hectares in Kheda and Panchmahals districts. Canals of *Ukai* project on the *Tapi* river irrigate over one lakh hectares. The other important irrigation projects of Gujarat are *Rudramala*, *Ozat*, *Dantiwada*, *Panam* and *Kaprapara*.

Merits of Canal Irrigation

1. Most of the canals provide perennial irrigation. This saves the crops from drought conditions and helps in increasing the farm production.

2. Canals carry a lot of sediment brought down by the rivers. This sediment is deposited in the agricultural fields which adds to the fertility of soil.

3. Some of the canals are parts of multipurpose projects and, therefore, provide cheap source of irrigation.

4. Although the initial cost involved in canal irrigation is much higher, it is quite cheap in the long run.

Demerits of Canal Irrigation

1. The canal water soaks into the ground and leads to the problem of *water-logging* along the canal route.

2. Excessive flow of water in the fields raises the ground water level. Capillary action brings alkaline salts to the surface and makes large areas unfit for agriculture. Vast areas in Punjab, Haryana and Uttar Pradesh suffer from the problem of *'reh'* caused by canal irrigation. Similarly about 36,000 hectares have been rendered useless in Nira Valley of Maharasthra due to high concentration of salts in the soil resulting from canal irrigation.

3. The marshy areas near the canals act as breeding grounds of mosquitoes which result in widespread malaria.

4. Many canals overflow during rainy season and flood the surrounding areas.

5. Canal irrigation is suitable in plain areas only.

INTENSITY OF IRRIGATION

Intensity of irrigation is defined as *the percentage of net irrigated area to the net sown area*. Map in Fig. 16.9 shows that the regional variations in the intensity of irrigation are great and at once impressive. These variations are due to varied geographical conditions in different parts of the country. Rugged mountains, sandy deserts and rocky terrains without aquifers have very poor facilities of irrigation. On the other hand, fertile alluvial plains with perennial rivers and potable groundwater as well as areas of less than 125 cm of annual rainfall are by far, the areas of high percentage of irrigation. The highest intensity of irrigation exists in the Kashmir Valley, large parts of Punjab and Haryana, the Ganga-Yamuna Doab of Uttar Pradesh, Western part of the south Bihar Plain, Birbhum (West Bengal), Lakhimpur (Assam), the Godavari Krishna Deltas and Chengalpattu district (Tamil Nadu). The intensity of irrigation in these areas is invariably above 60 per cent and in some parts of Punjab it exceeds 75 per cent. Dry areas of Ladakh district in Jammu and Kashmir and Lahul and Spiti district in Himachal Pradesh cannot raise crops without irrigation. Although exact data are not available, these areas are believed to have 100 per cent intensity of irrigation. Large parts of the northern plain and east coastal plain have average intensity varying from 30-60 per cent. Parts of Brahmaputra Plain, the Chambal Valley and those of the Peninsular plateau have low intensity of irrigation varying from 15 to 30 per cent. The areas of low intensity are those which either do not need irrigation by virtue of high and dependable rainfall or they have not been able to develop irrigation facilities due to unfavourable geographical conditions such as rugged topography, hard rocks, infertile soils, lack of surface and ground water, etc. In this category are included large parts of Rajasthan to the west of the Aravali Range, parts of Bihar plain, central part of Peninsular plateau, the Maharasthra and Kerala coasts, Manipur, Mizoram and Tripura. Andaman and Nicobar Islands have zero per cent intensity of irrigation due to adequate rainfall throughout the year.

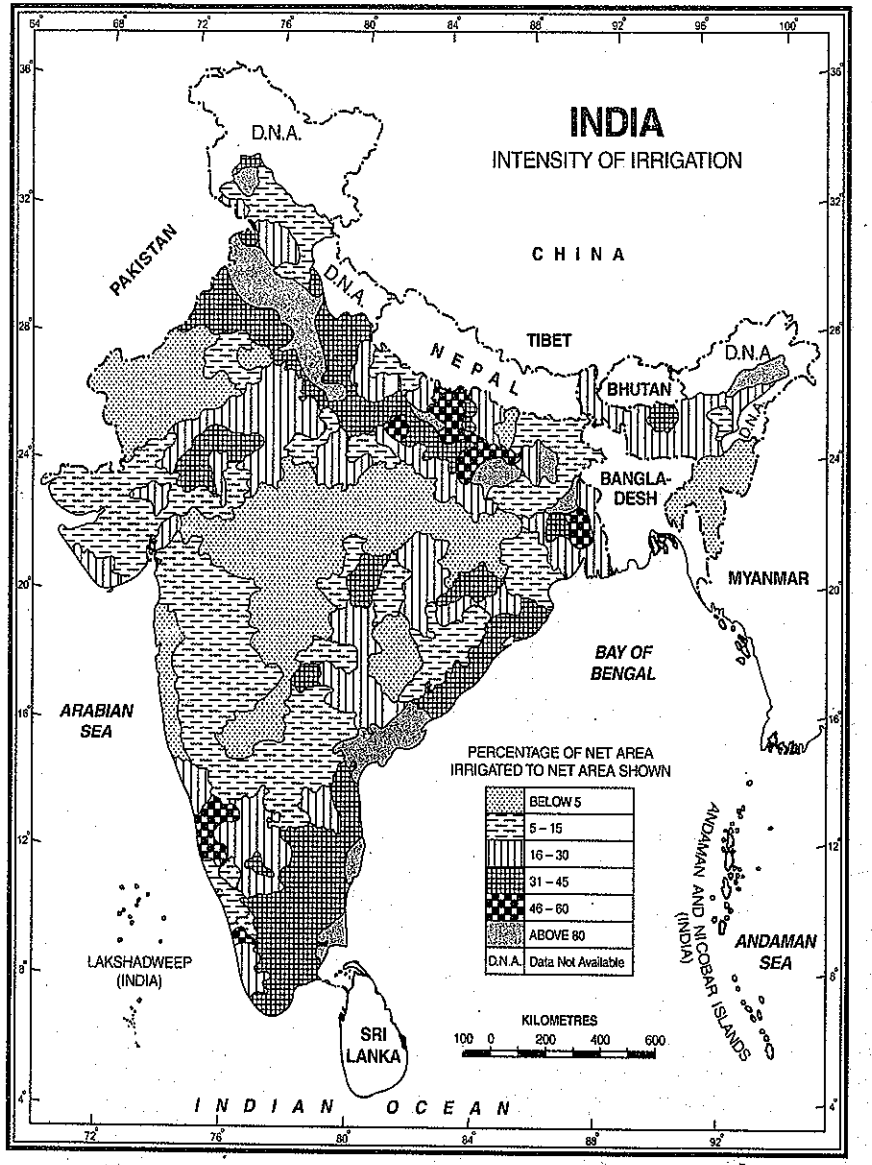


FIG. 16.9. Intensity of Irrigation

REFERENCES

Dhawan, B.D. (1990) : *Studies in Minor Irrigation with Special Reference to Ground Water.* Commonwealth Publishers, New Delhi.

Dikshit, G.S., G.R. Kupuswamy and S.K. Mohan (1993) : *Tank Irrigation in Karnataka : A Historical Study,* Gandhi Sahitya Sangh, Bangalore.

Govt. of India (1965) : *Development of Irrigation in India,* Central Board of Irrigation and Power.

Govt. of India (1970) : *Irrigation and Power Projects,* Ministry of Irrigation and Power, New Delhi.

Govt. of India (1971) : *Irrigation Atlas of India,* Ministry of Education and Scientific Research, New Delhi.

India (2014) : *A Reference Annual,* Ministry of Information and Broadcasting, New Delhi.

Jain, Bharatial H. (2004) : Irrigation—Tapping nature's bounty, The Hindu Survey of Indian Agriculture, 2004, Kasturi & Sons Ltd., Chennai, pp. 138-139.

NATMO (1990) : *Irrigation Atlas of India,* 2nd Ed. National Atlas & Thematic Mapping Organisation, Kolkata.

Report of the Irrigation Commission (1972) : Vol. I, Ministry of Irrigation and Power, New Delhi.

Sharma, T.C. (1987) : "Progress of Irrigation in Uttar Pradesh Plains : Inter-regional contrasts" *Agricultural Situation in India,* Vol. 42, No. 11, Feb. in Noor Mohammad (ed.), (1992), *New Dimensions in Agricultural Geography,* Vol. 5, Socio-Economic Dimensions of Agriculture, Concept, New Delhi.

Sivanappan, R.K. (2004) : Water Management Efficient Storage Method, The Hindu Survey of Indian Agriculture—2004; Kasturi & Sons Ltd., Chennai, pp. 135-137.

Statistical Year Book, India 2013. GOI, Ministry of Statistics and Programme Implementation.

CHAPTER 17

Multipurpose Projects

A multipurpose project is that which simultaneously serves several purposes. A dam built across a river often serves more than one purpose at a time and is termed as a multipurpose project. Flood control, irrigation, hydroelectric generation, navigation, fishing and tourism are some of the chief aims of a multipurpose project. The development of multipurpose projects in India since the beginning of planning era in 1951 has been the salient feature of the eoncomic growth of the country. Some of the important multipurpose projects are shown in Fig. 17.1.

1. BHAKRA NANGAL PROJECT

It is the largest and the most important multipurpose project named after the two dams built at Bhakra and Nangal on the Satluj river. It is a joint venture of the Punjab, Haryana and Rajasthan states designed to harness the precious water of the Satluj for the benefit of the concerned states. The project comprises of (*i*) Two dams at Bhakra and Nangal, (*ii*) Nangal Hydel Channel, (*iii*) Power houses with a combined installed capacity of 1,204 megawatt (M.W.) (*iv*) Electric transmission lines and (*v*) Bhakra canal system for irrigation.

The Bhakra Dam is one of the highest straight gravity dams in the world. It has been constructed on the Satluj river at the site of Bhakra gorge near Rupnagar (Ropar). The dam is 226 metres high and 518 metres long with its maximum width at the base as 362 metres. The dam has created a huge reservoir of water which is 88 km long and 8 km wide with a storage capacity of 986.8 crore cubic metres. This reservoir is named as Gobindsagar Lake after Guru Gobind Singh, the tenth guru of the Sikh community.

The Nangal Dam has been constructed at Nangal about 13 km downstream of the Bhakra dam. This 29 metre high, 305 metre long and 121 metre wide dam is an auxiliary dam which serves as a balancing reservoir for taking up daily fluctuations from the Bhakra Dam.

The Nangal Hydel Channel is 64.4 km long, 42.65 m wide and 6.28 m deep canal. It has been cemented throughout its length to avoid seepage. It is one of the longest cemented canals of the world. It takes off from the left bank of the river and flows through rugged topography of steep slope. There is a fall of 70 metres in elevation within a distance of 64 km. Its main function is to turn the turbines of power houses located below the Nangal Dam but it also supplies water to the Bhakra irrigation canals.

Power houses have been built to generate hydroelectricity from water of the Satluj river. One power house has been built at Ganguwal about 19 km downstream from Nangal. Another power house has been constructed at a distance of 29 km from the Nangal dam. This is known as the Kotla power house.

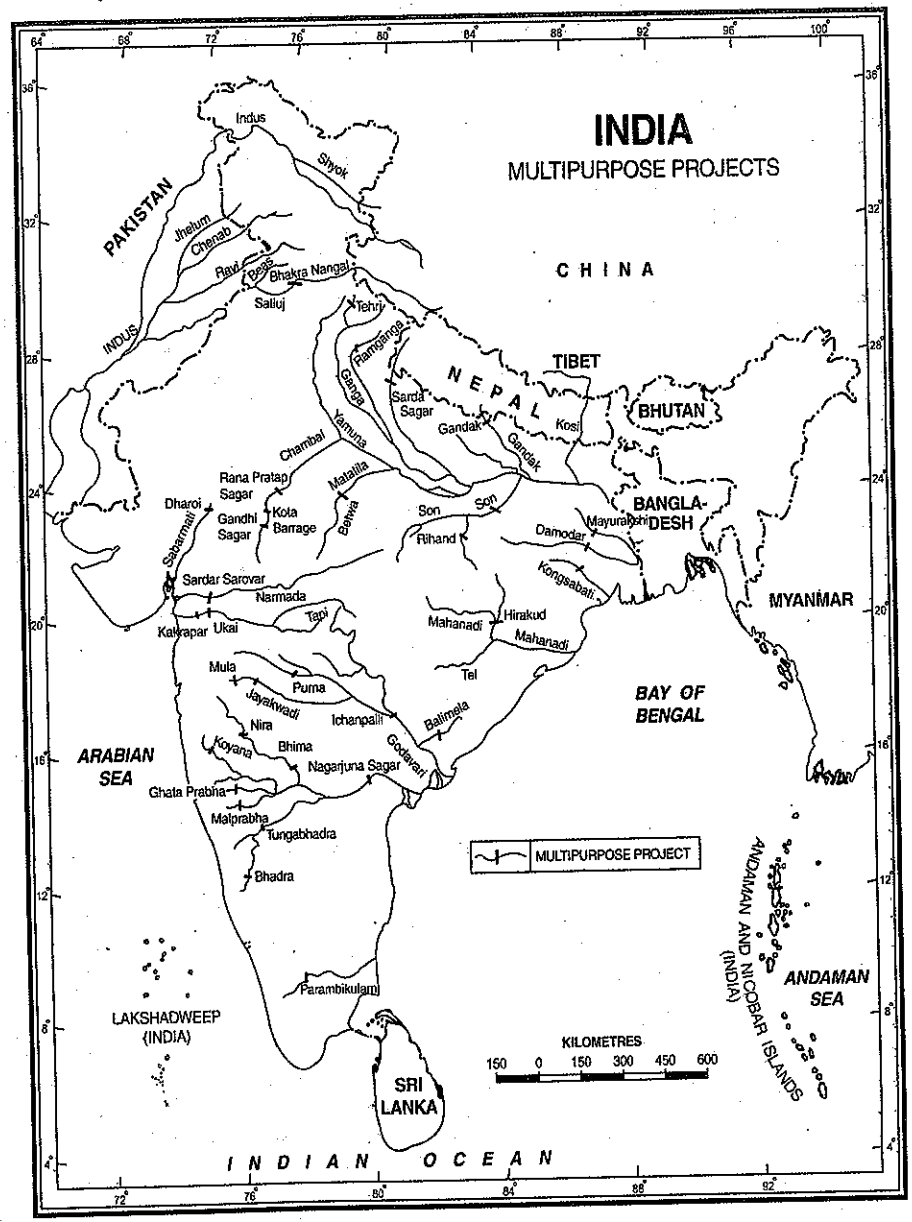


FIG. 17.1. India : Multipurpose Projects

The Ganguwal and the Kotla power houses have 2 units of 24 MW each and one unit of 29 MW. The third power house is at Rupnagar. Two power houses have been constructed at Bhakra dam, one of which is on the left and the other is on the right bank of the river. The installed capacity of these two power houses is 450 MW and 600 MW respectively.

The main Bhakra canal is 174 km long. The length of the canal system and that of the distributaries is 1,104 km and 3,360 km respectively. This canal system commands a gross area of about 27 lakh hectares and provides irrigation to about 15 lakh hectares. Of this 37.7 per cent is in Punjab, 46.7 per cent in Haryana and the remaining 15.6 per cent is in Rajasthan.

Transmission Lines have been laid to carry hydroelectricity to the consuming centres. A total of 3,680 km long transmission lines are used to supply power to Rupnagar, Ludhiana, Patiala, Rajpura, Nabha, Moga, Ferozepur, Fazilka, Faridkot, Muktsar, Jalandhar, Hoshiarpur, Kapurthala and Pathankot in Punjab; Ambala, Panipat, Hisar, Bhiwani, Rewari, Rohtak, Panchkula, Kalka, Gurgaon, Faridabad and Palwal in Haryana; Delhi; Kasauli, Kangra and Shimla in Himachal Pradesh and Rajgarh and Rattangarh in Rajasthan.

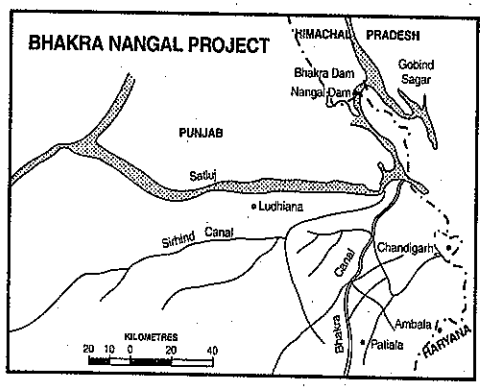


FIG. 17.2. Bhakra Nangal Project

"Bhakra Nangal Project is something tremendous, something stupendous, something which shakes you up when you see it. Bhakra today is the symbol of India's progress." —**Nehru**

Some Interesting facts about Bhakra-Nangal Project

1. About 14 million cubic metres of concrete and other building materials have been used for the completion of this project. This material is more than double the material used to build the *grand pyramids* of Egypt.

2. The number of tiles used in the main Bhakra canal is so large that if they are arranged in a straight line, the length of the line so formed will be seven times the length of the equator.

3. Seventy million man-days have been used to construct the canals of the Bhakra-Nangal project.

4. About 95.2 million cubic metres of earth has been excavated for constructing the canals of this project. This amount of soil is enough to construct a 6 metre wide road at 1 metre elevation from New Delhi to New York.

5. This project has helped in obtaining additional 1.3 million tonnes of foodgrains a year, 0.8 million tonnes of cotton, 0.5 million tonnes of sugarcane and 0.1 million tonnes of oilseeds. No other river valley project in the world has so much potential as this project.

However, Bhakra Nangal project like all other river valley projects, suffers from the problem of silting. Water coming from the higher reaches deposits its silt at the bed of the reservoir, thereby reducing its capacity to store water. The capacity of the reservoir was 6.03 million acre feet in 1963 which was reduced to 5.5 million acre feet in 1988, thereby causing a reduction of over half a million acre feet in a short span of only 25 years.

2. THE DAMODAR VALLEY PROJECT

(See Chapter 14)

3. THE HIRAKUD DAM PROJECT

It is an ambitious project of Odisha under the auspices of which a 61 metre high and 4,801 metre long dam has been built on the river Mahanadi at Hirakud about 14 km upstream off the city of Sambalpur. This is one of the longest dams in the world with a gross storage capacity of 8,100 million cubic metres over an area of 630 sq km. Two other dams have been constructed on the Mahanadi—one at Tikrapara and the other at Naraj, a few kilometres west of Cuttack. These three dams provide irrigation to 1 million hectares of land in Sambalpur, Bolangir, Puri and Cuttack districts, generate 3.5 lakh kW of electricity and also offer navigation facilities. The whole of the Mahanadi valley particularly Sambalpur district, Sonapur and the delta region are benefited by this project. The areas served by the Hirakud project are very rich in minerals like iron ore, bauxite, manganese, graphite, chromite, mica and several other useful minerals which require large supply of hydroelectricity for their exploitation. Hirakud project provides the required power to these areas and helps their economic growth. Besides, this project supplies power to a large number of industries and urban centres.

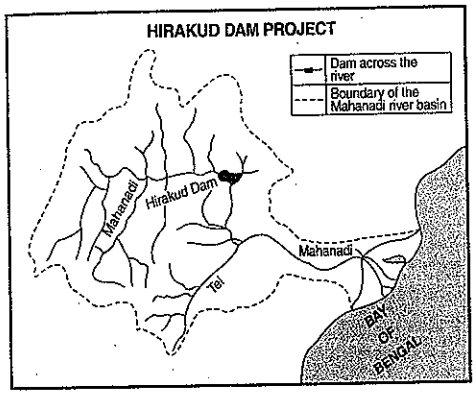


FIG. 17.3. Hirakud Dam Project

4. THE KOSI PROJECT

The Kosi river had earned the dubious name of *sorrow of Bihar* due to its devastating floods and frequent changes in its course. In order to tame the river and save precious lives and property from its annual fury, an agreement was signed with Nepal in 1954 (revised in 1961) and work on the project was started in 1955. Thus it is an international project. The entire plan has been executed by India but the benefits are being shared both by India and Nepal. The chief objectives of this project are irrigation, flood control, power generation, land reclamation, fishing and navigation.

The entire work on this project comprises three units *viz.*, a barrage near Hanumannagar in Nepal, flood embankments on both sides of the river and construction of irrigation canals.

The 1149 metre long and 72 metre high concrete barrage at Hanumannagar in Nepal was constructed in 1965. About 270 km long embankments on either side of the river were completed much earlier in 1959. The eastern and the western flood embankments were later extended by 25.76 km and 4.0 km respectively. This extension has provided protection to an area of 15,190 hectares of land in the lower reaches of the river from recurring submergence by floods.

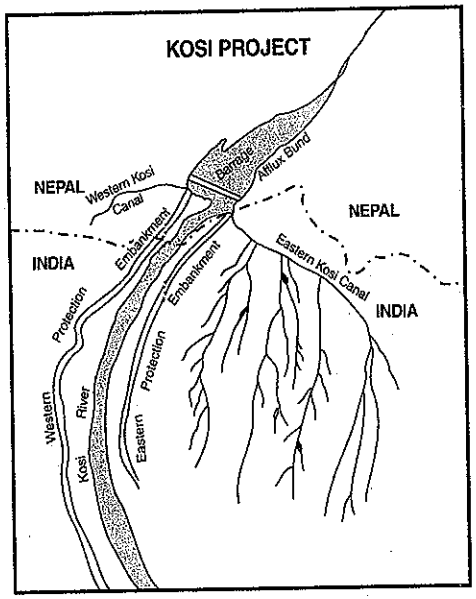


FIG. 17.4. Kosi Project

The *Eastern Kosi* canal is 43.5 km long and provides perennial irrigation to 5.19 lakh hectares in Purnea and Saharsa districts of Bihar. This canal has been extended to irrigate 1.6 lakh hectares of additional land in Saharsa and Munger districts. The 113 km *Western Kosi* Canal takes off from the right bank of the *Kosi barrage* and irrigates about 3.25 lakh hectares in Darbhanga district of Bihar and 12,120 hectares in Satpari district of Nepal. The length of the Rajpur Canal is 9.6 km only but it irrigates 1.6 lakh hectares in Saharsa and Munger districts. It takes off from the Eastern Kosi main canal. The power house at Eastern Kosi canal has an installed capacity of 20 M.W. Electricity generated by this power house is

shared on 50 per cent basis by India and Nepal. There is a plan to connect the power house of Kosi to the power houses of the Damodar Valley Project and set up a grid to supply electricity to larger areas.

5. THE RIHAND VALLEY PROJECT

This is by far the most important multipurpose project of Uttar Pradesh. It consists of 934 m long and 92 m high straight gravity concrete dam across the Rihand river (a tributary of the Son) near Pipri in Mirzapur district. The reservoir created by this dam has been named as Gobind Ballabh Pant Sagar. It spreads over an area of 466 sq km and is the largest man made reservoir in India. It has the capacity to hold 11.4 lakh hectare metres of water. Another dam about 25 km north of the Rihand Dam has been constructed at Obra. The power house near the Rihand dam has 6 units each with a 5 MW capacity. Besides, power house at Obra also has 6 units, each having a capacity of 50 M.W. This power is supplied to the eastern parts of Uttar Pradesh, western parts of Bihar and northern parts of Madhya Pradesh. The Son river valley, within a radius of 200 km from Pipri, is blessed with vast deposits of coal, iron ore, limestone, mica, bauxite, feldspar, etc. The hydroelectric power generated by the Rihand Valley Project goes a long way to help in exploiting these mineral resources and usher into a new era of economic prosperity.

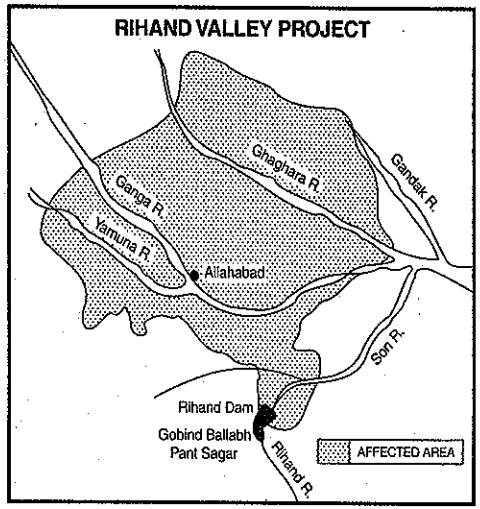


FIG. 17.5. The Rihand Valley Project

About 5,000 wells in Uttar Pradesh have been energised. Another 2.25 lakh hectares of land has been provided with tube-well irrigation in Bihar.

Flood control in Son valley, fishing in Gobind Ballabh Pant Sagar, tourism, prevention and control of soil erosion in Baghelkhand region are some of the other benefits from this project.

6. THE CHAMBAL VALLEY PROJECT

This is a joint venture of Rajasthan and Madhya Pradesh initiated in 1954 on the Chambal river (the main tributary of the Yamuna). The project aims at harnessing the Chambal river for irrigation, power generation and for prevention and control of soil erosion in the valley. The project has been executed in three successive stages.

The first stage consists of construction of the 64 m high and 514 m long Gandhisagar dam about 8 km downstream of the Chaurasigarh fort in Bhanupura tehsil at the border of M.P. and Rajasthan. Constructed in 1960, the dam has created the Gandhisagar reservoir which spreads over an area of

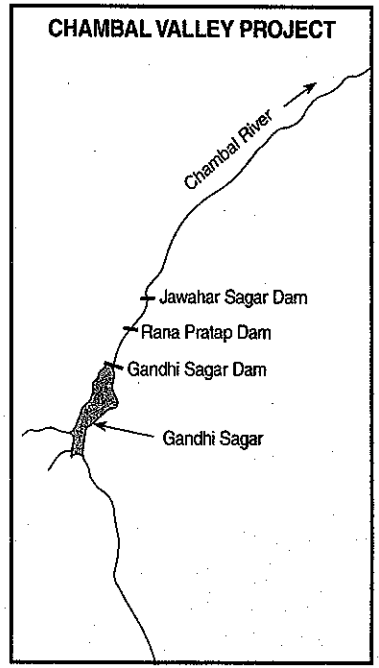


FIG. 17.6. The Chambal Valley Project

688 sq km. It has a capacity to hold 692 crore cubic metres of water which provides irrigation to 4.44 lakh hectares. Five units of 23,000 K.W. capacity each have been set up at the dam site.

The second stage includes the construction of the 54 m high and 1,143 m long *Rana Pratap masonry dam* at Rawatbhata about 56 km downstream of the Gandhisagar dam. It has a gross storage capacity of 290 crore cubic metres spreading over an area of 198 sq km. It provides irrigation to 1.2 lakh hectares of land. The Rana Pratap power station is located on the left bank just at the toe of the dam. Four generating units of 43,000 kW. each are installed here.

The third stage consists of the construction of a 45 m high and 548 m long gravity dam, known as the *Jawahar Sagar dam or Kota dam*, about 29 km upstream of Kota city. It was completed in 1971-72. The reservoir created by this dam has a potential of 68 million cubic metres. Three generating units of 33,000 K.W. each have been installed here.

Kota barrage was constructed in 1960, at a distance of less than 1 km from Kota. This is 36 m high and 600 m long earthen barrage. Irrigation canals taken from both sides of the barrage irrigate 4.4 lakh hectares in Rajasthan and M.P.

The areas benefited by this project include Kota, Bundi, Bharatpur, Jaipur, Sawai Madhopur, Tonk, Ajmer, Pali, Bhilwara, Sirohi and Udaipur districts of Rajasthan and Mandsaur, Indore, Ujjain, Gwalior and Ratlam districts of M.P.

7. TUNGBHADRA MULTIPURPOSE PROJECT

It is a joint undertaking of Andhra Pradesh and Karnataka. The project comprises a 2,441 metre long and 50 metre high straight gravity masonry dam across the Tungabhadra (a tributary of the Krishna River) at Mallapur in Bellary district of Karnataka, two irrigation canals and power houses on both sides of the dam.

The 349 km long *Right Bank Low Level* canal was completed in 1963. It irrigates 3.5 lakh hectares in Karnataka and Andhra Pradesh. Another 196 km long canal called the *Right Bank High Level Canal* has also been completed and irrigates 36 thousand hectares. The 227 km long *Left Bank Low Level Canal* was also completed in 1963. It irrigates 1.82 lakh hectares of land.

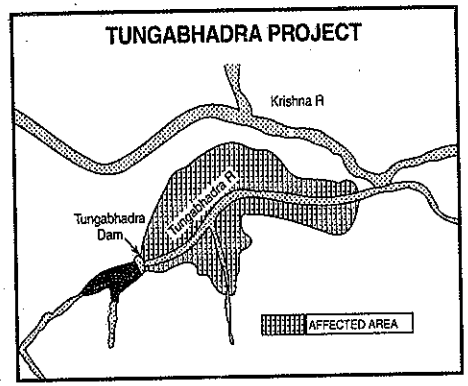


FIG. 17.7. Tungabhadra Project

Of the three power stations, two are situated at the foot of the dam (one on either side of the dam) and the third is at 15th km of the Right Bank Low Level Canal. All the three power stations have a potential of 126 M.W.

8. THE GANDAK PROJECT

This project is jointly executed by Bihar and Uttar Pradesh. Nepal also derives some benefit according to an agreement signed in 1959.

This project comprises a 747.37 metre long and 9.81 metre high barrage at Bhansoloten (Balmikinagar) in Bihar near the Nepal border below the Tribeni Canal Head Regulator (half of the barrage length is in Nepal), 4 canals, (2 each in India and Nepal) and a power house. The Project was completed in 1966-67. The 66 km long Main Western Canal irrigates 4.84 lakh hectares in Saran district of Bihar and about 1.88 lakh hectares in Gorakhpur and Deoria districts of Uttar Pradesh. A separate canal takes off from the western bank and irrigates about 16.4 thousand hectares in the Bhairwa area of Western Nepal. The Main Eastern Canal irrigates about 6.03 lakh hectares in Champaran, Muzaffarpur and Darbhanga districts of Bihar and 42 thousand hectares in Parasa, Bara and Rautuhat districts of Nepal. A power house with an installed capacity of 15 M.W. on the Main Western Canal has been commissioned and has been gifted to Nepal.

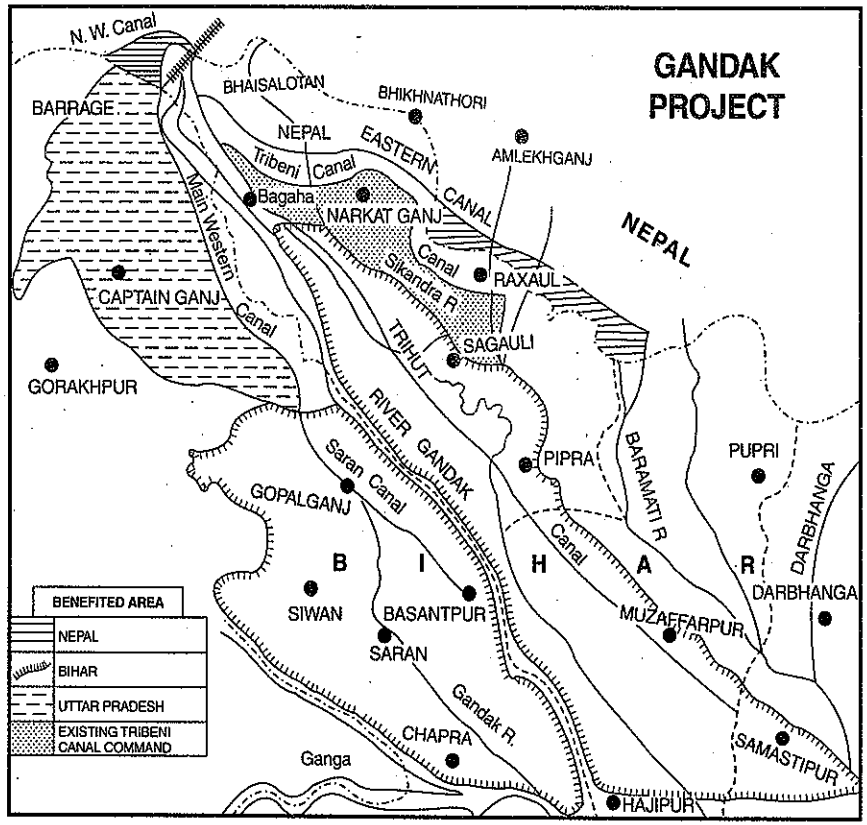


FIG. 17.8. The Gandak Project

9. THE NARMADA VALLEY PROJECT

Originating in the Amarkantak plateau of Madhya Pradesh, the Narmada is the fifth largest river of India and the largest among the west flowing rivers of the Peninsula. The volume of average annual flow of water is 40,700 million cubic metres, 90 per cent of which flows during the monsoon season. Only 5 per cent of this flow is utilized and 95 per cent flows unutilized to the Gulf of Khambhat. The Narmada Valley Project aims at harnessing this flow for the economic prosperity of the concerned areas. This is going to be one of the largest river valley projects of the world because the entire project includes the construction of 30 major, 135 medium and 3,000 minor dams on the river. Conceived in 1945-46 the project has been surrounded by controversies which have become very sharp after 1987 when the construction started and in the present day context this project is more controversial than any other river valley project of the world. There seems to be a tug of war between the environmentalists on one hand, and the protagonists of the project on the other. The environmetalists have predicted doom as, according to them, the project would lead to waterlogging, soil erosion, destruction of forests, cultivable land and wild life and also trigger health problems. They plead that the reservoirs created by two main dams *viz.* the *Sardar Sarovar dam and the Narmada Sagar Dam* will submerge 480 villages and displace 1.5 lakh persons and 8 lakh cattle heads. The Bargi Dam, a part of the giant *Narmada Sagar-Sardar Sarovar* scheme, has already dislocated about one lakh people in 162 villages in M.P. This dam was commissioned in 1968. Besides 50,000 hectares of reserve forests

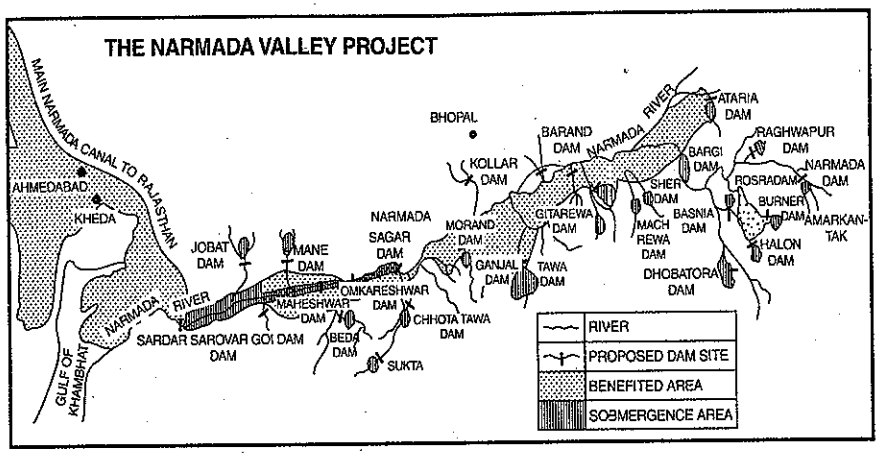


FIG. 17.9. The Narmada Valley Project

would also be destroyed. However, the document prepared by the *Ministry of Water Resources* in 1993 showed that a total of 245 villages in three states of Madhya Pradesh, Gujarat and Maharashtra would come under submergence of the river water. It would directly affect 38,044 families in the valley (31,080 in M.P., 4,500 in Gujarat and 2,464 in Maharashtra). The submergence would also render useless 11,279 hectares of cultivable land besides causing damage to forest spread over 10,719 hectares of land. There would also be immense loss of flora, fauna and marine life. There is also a pressing demand for the reduction of height of the *Sardar Sarovar Dam* from 455 ft to 436 ft. to save over 38,000 people from rehabilitation and 25,000 acres of land from getting submerged.

On the other hand, the protagonists of the project plead that this project would augur an impetus for a commendable economic development of the region. There is no denying the fact that the Narmada scheme is designed to benefit the people in not only Gujarat but also those in Madhya Pradesh and Maharashtra, with Rajasthan tagged as a marginal beneficiary to get more drinking water. The dams on the river are designed to produce about 3,000 M.W. of hydroelectricity. The canal system to be built in the integrated scheme is expected to provide irrigation facility to 17.92 lakh hectares of land in Gujarat, 1.40 lakh hectares in Madhya Pradesh and 73,000 hectares in Rajasthan. Although 87% of the Narmada flow is in M.P., 11.5% in Gujarat and 1.5% in Maharashtra, Gujarat is the main beneficiary state. This is the reason that the Narmada is called the *life line or Mother Narmada* in Gujarat. The increased irrigation potential is estimated to jack up the food grains production by 43 lakh tonnes a year. Further, Gujaratis claim a positive impact on the health scene. There would be substantial reduction in scabies and skin diseases in Saurashtra, Kuchchh and northern Gujarat due to the availability of potable water.

The Sardar Sarovar Project (SSP)

Construction of 1250 metres long and 121.92 metres tall dam completed upto Brim in December, 2006 in the Lower Narmada Valley in Gujarat (Fig. 17.10). It has create a reservoir having a potential of 77 lakh acre feet. It has provide irrigation to 18 lakh hectares in Gujarat which has helped in increasing the farm production by 82 lakh tonnes. About 10.6 lakh hectare metre water has been made available for domestic and industrial use to 131 cities and towns and to 8,720 villages. Two power stations produce 1,450 M.W. of hydroelectricity. An area of 4,650 hectares has been brought under forest to partly compensate for 10,713 hectares which has been submerged under the reservoir. It will provided employment to 4 lakh persons during the course of construction and to about 6 lakh persons after the completion due to increase in agriculture, animal husbandry, dairy, fertilizer industry and other allied occupations. The initial cost of the project was put at ₹ 5,793 crore which has now escalated to about ₹ 13,400 crore.

HIGHLIGHTS OF SARDAR SAROWAR PROJECT

- Generation of 1450 MW Hydro Power achieved.
- Beneficial to Gujarat, Rajasthan, Madhya Pradesh and Maharashtra.
- Irrigation facility in 18 lakh hectares in Gujarat and 2.50 lakh hectares in Rajasthan.
- Drinking water facility to 2 crores population of Gujarat and 15 lacs population of Rajasthan.
- Main Canal of 458 kms have been constructed and Branch Canals of 2,585 kms.
- 5,112 kms Distributory.
- 18,453 kms minor and 48,058 kms sub minor canals.
- Narmada Dam site is emerging as a favourite and pleasing Tourist Place, more than 12,00,000 Tourists visit the Narmada Dam site every year.
- Share of water after completion of the project will be by Madhya Pradesh (65.18%), Gujarat (32.14%), Rajasthan (1.79%) and Maharashtra (0.89%).
- States' share of 1,450 MW hydro power will be Madhya Pradesh (57%), Maharashtra (27%) and Gujarat (16%).

The Narmada Sagar Dam Project

The foundation stone of the Narmada Sagar Dam on the Narmada in Madhya Pradesh was laid on 3rd October, 1984. When completed, it will completely submerge 89 villages and 91 thousand hectares of land in East Nimar (Khandwa), Dewas and Hoshangabad districts. Besides, 105 villages will be partially submerged (**Fig. 17.9**). About 900 sq km of black soil fertile land and 40,000 hectares of forest land would also be submerged in water. On the positive side this project will usher into a new era in the form of added irrigation, water power generation, potable water and water for industrial purposes, fishing, tourism, etc.

On June 12, 2014, the Narmada Control Authority (NCA) permitted the Gujarat government to raise the height of the Narmada dam by about 17 metres from 121.92 metres to 138.68 metres which will also be the height of the reservoir in closed gates condition. With this increase in height the storage capacity of the reservoir will go up from the existing 1.27 million acre feet to 4.75 million acre feet.

10. THE NAGARJUNASAGAR PROJECT

Started in 1955-56, the Nagarjuna Sagar Project comprises the construction of a 124.7 metre high and 1450 metre long concrete dam on the Krishna river in Nalgonda district of Telangana about 114 km to the south-east of Hyderabad. The reservoir behind the dam spreads over an area of 118 sq km with a storage capacity of 1,156 crore cubic metre of water. Two canals have been taken, one each from either side of the dam. The 349 km long *Jawahar canal* on the right side of the dam has a capacity to irrigate about 4 lakh hectares in Guntur, Prakasam (Ongole) and Nellore districts. The 357 km long *Lal Bahadur canal* irrigates about 3 lakh hectares in Khammam, West Godavari and Krishna districts. A power house with two units of 50 M.W. each was set up at the toe of the dam in 1970. It supplies electricity to Nalgonda, Mahaboobnagar and Hyderabad districts for various purposes.

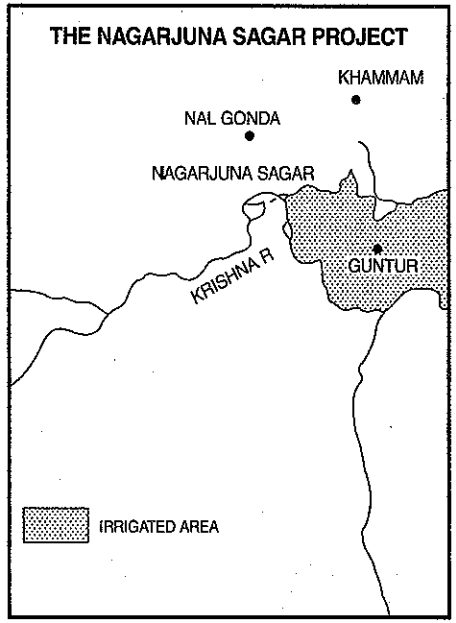


FIG. 17.10. Nagarjunasagar Dam Project

11. TEHRI DAM

This dam in Tehri Garhwal was conceived in 1949. Situated at the confluence of the Bhagirathi and the Bhilganga rivers in Garhwal district of Uttarakhand, this 2160.5 m long Tehri dam, said to be the highest in Asia, was commissioned in 1972, but work on it began only in 1978. And ever since,

MAJOR EVENTS CONCERNING TEHRI DAM

1949	Tehri dam on the Bhagirathi river conceived.
1961	Survey started for site selection.
1978	Construction starts for 600 M.W. power project.
1979	Installed capacity raised to 1,000 M.W.. Antidam protests starts and work on the project suspended for seven years.
1986	Union Cabinet approves Tehri as a joint project of Centre and Uttar Pradesh government. Assistance from erstwhile USSR sought. Writ petition filed in the Supreme Court against the project on ground's safety and environmental impact. Installed capacity raised to 2400 MW.
1988	Tehri Hydro Development Corporation formed.
1990	Experts conclude that Tehri dam is safe even in the event of a severe earthquake of 8 magnitude on the Richter scale.
1991	Foundation sheet of the dam raised to 15 metres above the river bed. Earthquake of 6.6 magnitude on Richter Scale rocks Uttarkashi on 20th October. No damage occurred to the dam.

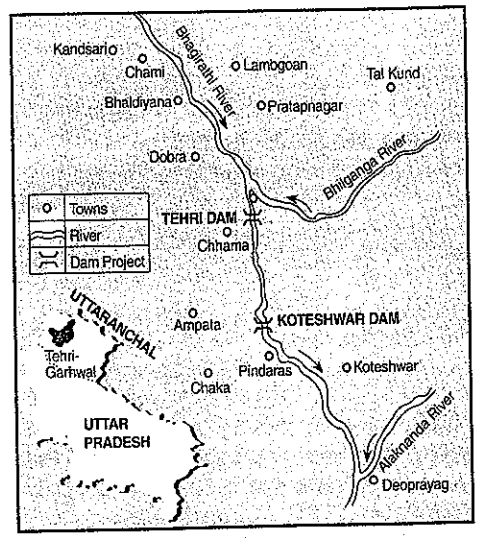


FIG. 17.11. Tehri Dam

environmental and safety aspects threatened the project. This rock-fill dam, generates 3,500 MW of electricity, irrigates 270,000 ha of arid land between the Ganga and Yamuna. A gigantic reservoir has been created over an area of 4,200 ha which feeds an underground power house with a racing torrent generating enough electricity. The initial project cost of ₹ 192 crore (in 1978), reached ₹ 6,000 crore in 1998.

The 2,400-MW dam has submerged town of Tehri, which was well known as a seat of Garhwali culture, and 23 villages in its vicinity. About 72 other villages along the river have also been partly submerged. People from 21 villages have already been displaced for constructing the New Tehri township, thus displacing about 70,000 people from their ancestral lands. The dam would also flood 1,000 ha of cultivated land, 1,000 ha of forest land and 2,000 ha of pasture land.

12. THE BEAS PROJECT

A joint venture of Punjab, Haryana and Rajasthan, the project consists of (*i*) Beas-Satluj link and (*ii*) Pong dam on the Beas. The Beas-Satluj link involves the construction of a 61 metre high diversion dam at Pandoh in Himachal Pradesh, about 27 km long water conductor system comprising two tunnels 12-13 km long each and an open hydel channel and a power plant at Dehar with an installed capacity of four units of 165 M.W. each. It has the capacity to provide irrigation to about 5.25 lakh hectares in Punjab and Haryana.

The second unit includes a 116 metre high dam at Pong in the Dhaoladhar range near Pong village. It is mainly an irrigation scheme which is intended to ensure extension of perennial irrigation to about 21 lakh hectares in Punjab, Haryana and Rajasthan. It also provides for a power plant of 240 M.W. capacity with provision of 2 future units of 60 M.W. each. The total installed capacity of the Beas complex is 1020 M.W. including one unit of 120 M.W. at Bhakra right bank power house.

Apart from the above major multipurpose projects, there are several other projects including the Mahi project, Mayurakshi, Rampadsagar, Ramganga, Machkund, and many more which have been taken up to boost the economy of the country.

REFERENCES

Agarwal, Anil; Narain, Sunita and Sen, Srabane (eds.) (1999) : Citizens' Fifth Report, State of India's Environment, Centre for Science and Environment, New Delhi, Chap. 4.

A Social and Economic Atlas of India (1987) : Oxford University Press, New Delhi.

Irrigation and Power Projects (1970) : Five Year Plans, Publications Division, New Delhi.

Johnson, B.L.C. (1979) : *India : Resources and Development*, New York.

Malik, Ashok : *Ma Narmada's Children*, The Hindustan Times, July 2, 1994.

Our River Valley Projects (1961) : Publication Division, Govt. of India, New Delhi.

Qureshy Ahtesham, *Human Aspect of Narmada Project.* The Hindustan Times, August 8, 1993.

Report of Irrigation Commission (1972) : Vol. III (Part I), New Delhi.

Biotic and Marine Resources

INTRODUCTION

Biotic resources consist of living creatures which include plants, animals (both wild and domestic), birds, animals living in water, and above all man himself. Considering the space constraint we will confine our attention to the description of domestic animals, poultry birds and animals living in water only (like fish, aquaculture).

LIVESTOCK

Livestock includes domestic animals such as cattle, buffaloes, sheep, goats, horses, ponies, donkeys, camels, pigs, etc. India's animal wealth is both large and varied. In most parts of India, killing of animals is taboo from religious point of view, as a result of which animals of various descriptions have outgrown in number.

In 2007, India had 199.1 million cattle, 105.3 million buffaloes, 71.6 million sheep, 140.6 million goats, and 148.7 million poultry birds. Thus India far exceeds any other country of the world insofar as the number of animals is concerned. India boasts of about half of the buffaloes, one fifth of the cattle and one sixth of the total goat population of the world. But this quantitative supremacy in no way speaks of the quality of our animals. Our animals are of poor quality in terms of stamina for draught and milk yield. Several factors are responsible for this sad state of affairs. Livestock rearing is a highly neglected industry in India and is always treated as an occupation subsidiary to crop production. Indian agricultural scene is primarily dominated by subsistence agriculture and commercial grazing is conspicuous by its absence. Every farmer has a few animals which are fed on straw and other farm-by-products. Only 3 per cent of our total area is termed as grassland which is too small to feed such a vast population of livestock. Animal husbandry accounts for nearly one-fourth of the total income from the agriculture sector and its contribution to the national income does not exceed 5 per cent. In the year 2008, livestock and fisheries sector contributed about 4.07

per cent the total GDP and nearly 29.7 per cent to the value of output from total agricultural and allied activities.

However animal husbandry sector provides large scale self-employment opportunities to the rural people and plays an important role in supplementing family income and generating gainful employment, particularly among the landless labourers, small and marginal farmers and women. It also provides cheap nutritional food to millions of Indians by producing meat, milk, eggs, etc. Livestock is a great source of raw material byproducts such as hides and skins, bones, blood, fat, etc. Livestock is the best insurance against the vagaries of nature like drought, famine and other natural calamities.

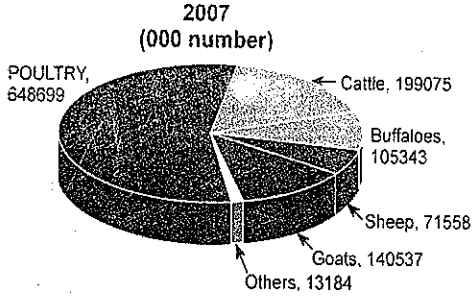


FIG. 18.1. India : Composition of Livestock

CATTLE

India has the largest number of cattle in the world. In 2007, India had 1,99,075 thousand cattle which account for about one fifth of the world's total number of cattle and about 37.6 per cent of the total livestock population of India. Thus the number of cattle possessed by India is simply amazing. Further the cattle have registered an increase of 28 per cent from 155.3 million in 1951 to 199.08 million in 2007. Uttar Pradesh has the highest number of 20 million cattle in India. Next in descending order are, Madhya Pradesh, Maharashtra, West Bengal, Bihar, Odisha, Rajasthan, Karnataka, Jharkhand and Andhra Pradesh. The other states with considerable number of cattle are Assam, Chhattisgarh, Gujarat and Tamil Nadu (**Fig. 18.2**).

The number of adult male cattle increased from 51.76 million in 2003 to 56.01 million in 2007. Out of total male cattle available in 2007, 4.68 per cent were used for breeding only, 79.66 per cent were used for 'agriculture and breeding', 9.08 per cent used for bullock cart and breeding and 6.58 per cent for other purposes. According to 2007 figures about 25 per cent of the adult male cattle were concentrated in two states of Madhya Pradesh and Maharashtra. Rajasthan and Bihar had 5 per cent and 3.7 per cent respectively of the total adult male cattle of India.

It has already been mentioned that Indian cattle are, by and large, of poor quality. The average yield of milk per cow is just one litre per day whereas this yield is 30-40 litres in some of the advanced countries like New Zealand, Denmark and Holland. This is the reason that Indian cow is often called *tea-cup-cow*.

Although majority of Indian cattle are of poor quality, there are 14 well defined excellent breeds of milch cattle and 12 well known draught and disease resisting breeds of cattle. Most of the good milch, draught or dual purpose breeds are found in dry northern, north-western and southern parts of the country. The humid regions generally do not support good breeds of cattle.

Milch Breeds. *Gir*, *Sindhi*, *Red Sindhi*, *Sahiwal*, *Tharparkar* and *Deoni* are some of the outstanding breeds of milch cattle. The ***Gir*** is a native of Saurashtra and is now found in several parts of Gujarat and adjoining Rajasthan. ***The Sindhi*** breed is mainly raised in Gujarat, Rajasthan and Maharashtra although it can be raised in several other parts of the country due to its disease resistant quality. The ***Red Sindhi*** breed has a distinct red colour and hails from Sind in Pakistan. The ***Sahiwal*** breed has its origin in the Montogomery district of Pakistan and is widely raised in Punjab, Haryana, Rajasthan, Uttar Pradesh and Delhi. ***The Deoni*** breed is widely raised in Telangana and Andhra Pradesh.

Draught Breeds. Among the important draught breeds are included the *Nagori*, *Bauchaur*, *Kenkatha*, *Malvi*, *Kherigarh*, *Hallikar*, *Khillari*, *Amritmahal*, *Kangayam*, *Ponwar*, *Bargur*, and *Siri*. The ***Nagori*** breed is a native of Jodhpur and is found in large parts of Rajasthan, Haryana, U.P. and M.P. ***The Bauchaur*** breed is mainly found in Bihar. The ***Malvi*** is largely concentrated in the dry western parts of Madhya Pradesh. ***The Kenkatha or Kenwariya*** breed hails from Banda district of Uttar Pradesh and neighbouring areas of Madhya Pradesh. Kheri district of Uttar Pradesh is the habitat of the ***Kherigarh***

breed. The ***Halikar*** and ***Amritmahal*** breeds are indigenous to Tumkur, Hassan and Mysore districts of Karnataka but are spread all over the Peninsular India. Solapur and Satara districts comprise the home of the ***Khillari*** breed. The ***Bargur*** and the ***Kangayam*** breeds are the natives of Coimbatore district of Tamil Nadu. The ***Siri*** breed flourishes well in the hilly areas of Darjeeling and Sikkim.

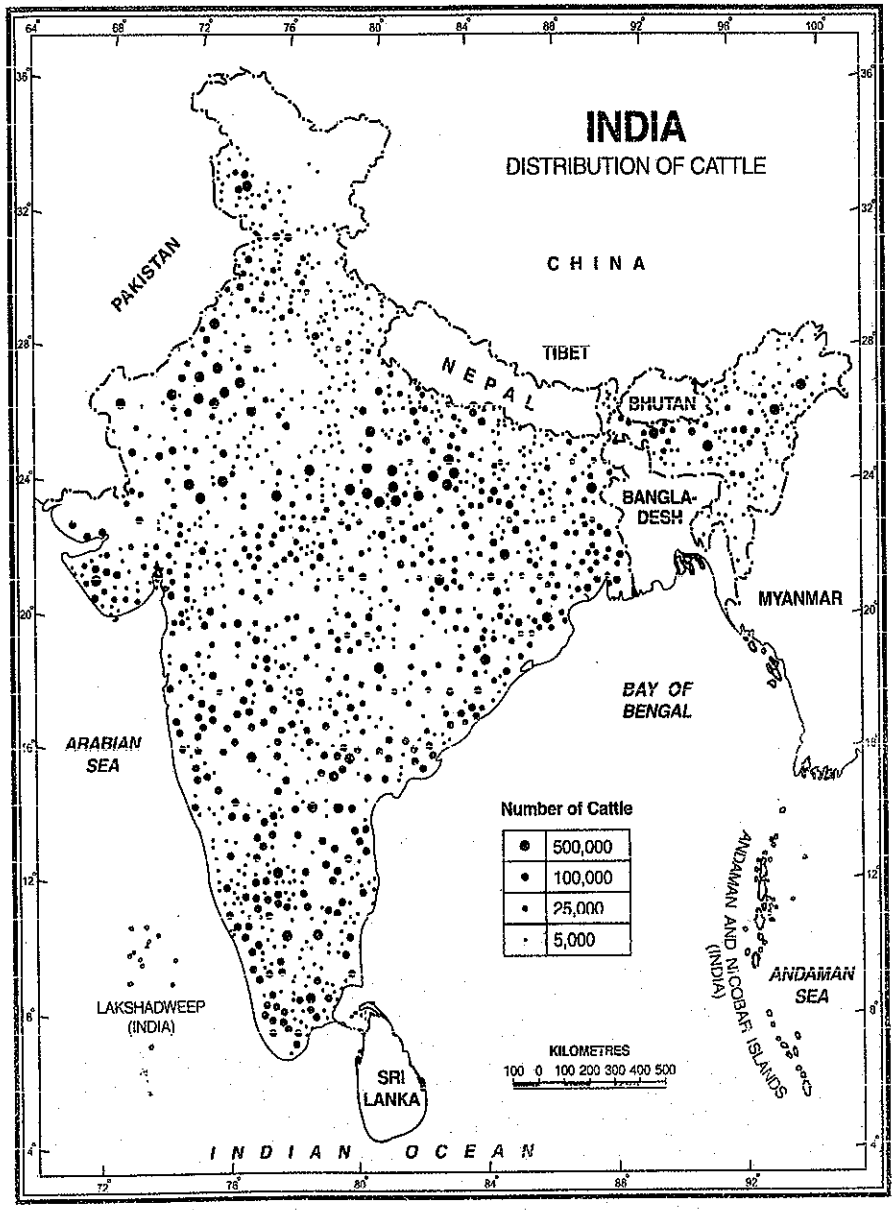


FIG. 18.2. India : Distribution of Cattle

Dual Purpose Breeds. Cattle of these breeds are used both for milk and for draught purposes. The cows are fairly good yielders of milk while bullocks are good for draught. *Tharparkar*, *Haryana*, *Mewati*, *Kankrej*, *Rath*, *Nimari*, *Dangi*, *Gaolao*, *Krishna Valley* and *Ongole* are important breeds of this category. ***The Tharparkar*** breed hails from the Sind province of Pakistan and is found in large parts of Gujarat and Rajasthan. As its name indicates, the ***Haryana breed*** is the much prized cattle of Haryana and is also found in the neighbouring parts of Delhi and Western Uttar Pradesh. ***The Mewati*** breed is found in Mathura district of Uttar Pradesh and Bharatpur and Alwar districts of Rajasthan. ***The Kankrej*** breed is indigenous to Gujarat plains. ***The Rath*** breed is a mixture of *Haryana*, *Nagori* and *Mewati* breeds and is found in the areas dominated by these breeds. The ***Nimari*** breed is largely found in the Narmada Valley in East and West Nimar districts of Madhya Pradesh. The ***Dangi*** breed is normally found in Kolaba, Thane, Nashik and Ahmednagar districts of Maharashtra. The ***Gaolao*** breed belongs to Chhindwara district of Madhya Pradesh and Wardha and Nagpur districts of Maharashtra. The ***Krishna valley*** breed is popular in upper Krishna Valley in Maharashtra and Karnataka. The ***Ongole*** breed hails from Nellore and Guntur districts of Andhra Pradesh.

Exotic Breeds. Some of the high milk yielding exotic breeds have been developed in India, especially in 20 military forms in hilly areas. Some foreign breeds have been crossed with Indian breeds and new breed called ***cross breed*** has been developed. The maximum yield of milk per lactation at the military farms is about 6,000 kgs while the average yield is 2,600 kg. Some of the important exotic breeds are Jersey, Holstein-Friesian, Swiss-Brown, Gurnsey, German Feleckvich, and Ayreshire.

BUFFALOES

India's buffaloes population was 105.3 million in 2007. This is about half the buffaloes population of the world and about 20 per cent of the total livestock of India. Buffaloes thrive best in areas of warm and humid climate. Buffaloes are reared mainly for milk but some buffaloes are used as draught animals in certain parts of the country. Uttar Pradesh has the largest number of over 27.4 million buffaloes which is over 26 per cent of the total buffaloes of India. The other major states with considerable buffaloes are Rajasthan (9.8 million), Andhra Pradesh (9.6 million), Madhya Pradesh (6.6 million), Gujarat (6.3 million), Punjab (6.2 million), Maharashtra (6.1 million), Bihar (5.9 million), Haryana (4.8 million) and Karnataka (4.4 million). The density of buffaloes is higher in the alluvial plains of North India where large quantity of fodder is available.

Buffaloes are the main source of milk in India and provide 46 per cent of total milk of India. Rest of the milk is obtained from other animals like cattle sheep, goats, camels, etc.

In addition to the fact that India has more buffaloes than any other country of the world; the Indian buffalo-breeds are some of the world's best. *The Murrah*, *Bhadawari*, *Jaffarabadi*, *Surti*, *Mehsana*, *Nagpuri* and *Nili Ravi* are among the important breeds. The **Murrah** breed is indigenous to Rohtak, Hisar and Gurgaon districts of Haryana and to the neighbouring areas of Delhi. Buffaloes of this breed yield 1,400 to 2,270 kg of milk per lactation with 7 per cent fat content against only 4.5 per cent in cow's milk. The Murrah male buffaloes are good draught animals. The **Bhadawari** breed belongs to Agra and Etawah districts of Uttar Pradesh and the neighbouring parts of Madhya Pradesh and Rajasthan. The **Jaffarabadi** breed hails from the Gir forest of Gujarat. The buffaloes of this breed are quite massive and yield about 2,500 kg of milk per lactation. The **Surti** breed comes from the Gujarat plains and gives about 1,655 kg of milk per lactation. The **Nagpuri** originates from Nagpur. The **Nili Ravi** breed belongs to Ferozepur district of Punjab and yields about 1,600 kg of milk in one lactation.

The number of adult male buffaloes increased from 5.21 million in 2003 to 6.44 million in 2007. Out of total male baffaloes available in 2007, 13.46 per cent were used for breeding only 58.22 were used for 'agriculture and breeding', 18.37 per cent used for bullock cart and breeding and only 9.95 per cent were used for other purposes.

Cattle and Buffalo Development Programmes

The important schemes initiated by the government for the development of cattle and buffaloes are Key Village Blocks (KVBs) and Intensive Cattle Development Projects (ICDPs). A major programme for genetic improvement called National Project for Cattle and Buffalo Breeding (NPCBB) was launched in October, 2000. Seven central cattle breeding farms at *Suratgarh* (Rajasthan), *Dhamrod* (Gujarat), *Alamadhi* (Tamil Nadu), *Chiplima* and *Suncheda* (Odisha), *Andeshnagar* (U.P.) and *Hessarghatta* (Karnataka) are engaged in scientific cattle breeding

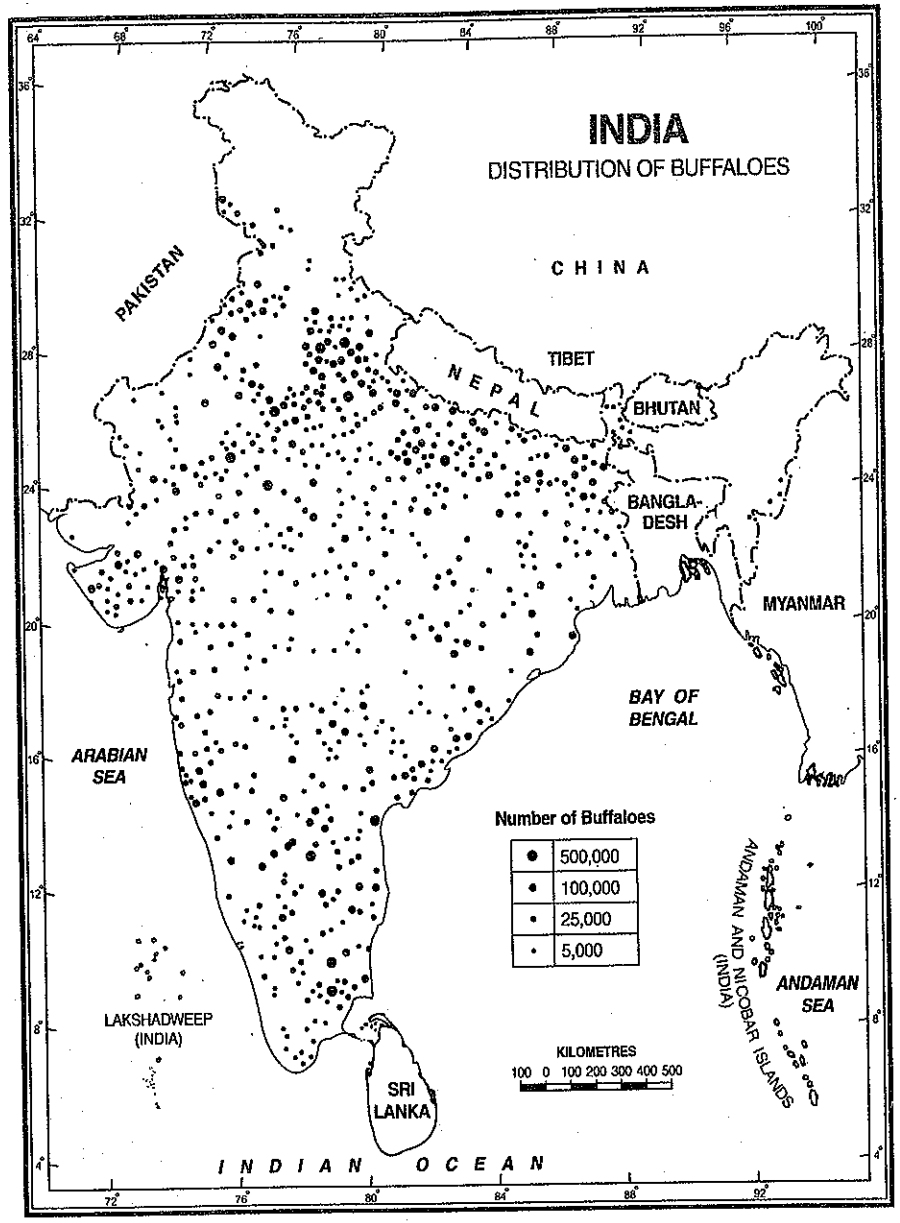


FIG. 18.3. India : Distribution of Buffaloes

programme and progeny testing of selected breeds of indigenous as well as exotic cattle and buffaloes. The embryo transfer technique is the latest technology for developing cattle and buffaloes and for increasing their productivity. Availability of good feed and fodder in sufficient quantity is the pre-requisite for proper development and growth of livestock. Seven regional stations in different agro-climatic zones have been set up to provide the latest fodder production technology. These are *Hisar* (Haryana), *Kalyani* (West Bengal), *Gandhinagar* (Gujarat), *Alamadi* (Tamil Nadu), *Hyderabad* (Telangana), *Suratgarh* (Rajasthan) and *Shehoma* (J&K). Central Frozen Semen Production and Training Institute located at Hessergatta in Karnataka is producing frozen semen of indigenous, exotic and crossbreed cattle and Murrah buffalo bulls for use in Artificial Insemination (A.I.) : Central Herd Registration Scheme (CHRS) is meant for registration of elite cow and buffalo, breeds of national importance and provides incentives for rearing of elite cows and male calves. It plays a significant role in sourcing indigenous germplasm required for the National Project for Cattle and Buffalo Breeding. Four CHRS units have been established at Rohtak (Haryana), Ahmedabad (Gujarat), Ajmer (Rajasthan) and Ongole (Andhra Pradesh).

Livestock Health

The governments of states and union territories have made provisions for better health facilities to the livestock by setting up Polyclinics/Veterinary Hospitals/Dispensaries/First Aid including Mobile Veterinary Dispensaries so that morbidity and mortality rate among the animals is minimised. One Central and five Regional Disease Diagnostic Laboratories are also functioning. For controlling major livestock and poultry diseases by way of prophylactic vaccination, the required quantity of vaccines are produced in the country at 27 veterinary vaccine units production units (20 in public sector and 7 in private sector).

Livestock Health and Disease Control

Centrally sponsored scheme 'Livestock Health and Disease Control' has been launched to help the state governments in controlling diseases among animals. Following are its major components :

(*a*) Assistance to States for Control of Animal Diseases (ASCAD)

(*b*) Professional Efficiency Development (PED)

(*c*) Naticnal Project on Rinderpest Eradication (NPRE)

(*d*) Foot and Mouth Disease Control Programme (FMD-CP)

(*e*) National Animal Disease Reporting System (NADRS)

(*f*) National Control Programme on Peste des petits ruminants (NCPPPR)

(*g*) National Control Programme on Brucellosis (NCPB)

(*h*) Establishment and strengthening of Veterinary Hospitals and Dispensaries (ESVHD)

Livestock Insurance

Centrally Sponsored Scheme (CSS) for providing assured protection to farmers and cattle rearers against eventual loss of animals due to death was launched on a pilot basis during 2005-06 and 2006-07 in 100 selected districts. A full fledged scheme on Livestock Insurance was implemented in 2008-09. The scheme benefits farmers (large, small, marginal) and cattle rearers having indigenous/crossbred milch cattle and buffaloes.

SHEEP

With 71.6 million sheep (2007), India stands sixth in sheep population in the world after Australia, Russia, China, Argentina and New Zealand. More than 4 per cent of the world's sheep are reared in India. *Most of the sheep are raised in regions which are too dry, too stony or too mountainous to be too good for agriculture or for cattle rearing*. Most of the Indian sheep are of poor quality yielding inferior wool in less quantity. Their yield of mutton is also very low. However, some of the good breeds are found in the northern temperate region. By virtue of their sheer number, sheep occupy an important place in our economy because they provide us with wool, mutton and skins. About five million households are engaged in the rearing of sheep and other allied activities. The largest number of 18.6 million sheep are found in Rajasthan which account for over one-fourth of the total sheep population of India. This is followed by

Andhra Pradesh including Telangana, Karnataka, Tamil Nadu, Maharashtra, Jammu and Kashmir, Uttarakhand, Himachal Pradesh, Gujarat, Bihar and Uttar Pradesh. The distribution of sheep may be properly studied by dividing the sheep areas into following regions :

1. The Temperate Himalayan Region. It comprises of Jammu and Kashmir, Himachal Pradesh and Uttarakhand. The entire region has temperate climate which is quite suitable for good quality sheep. Excellent pastures exist on the hill slopes. India's best quality sheep are reared in the Kulu, Kangra and Chamba districts of Himachal Pradesh and Kashmir Valley at altitudes varying from 2,000 to 3,000 metres. The shephards practise *seasonal transhumance*, going up in summer and moving down in winter. There are about 55 lakh sheep producing over 5,000 tonnes of superior qauality wool in this region.

2. The Dry North-Western Region. This region includes Rajasthan and neighbouring parts of Punjab, Haryana, western Uttar Pradesh, Gujarat and Madhya Pradesh. There are more than 13 million sheep contributing to about half of the total wool production of India. However, the wool is of comparatively inferior quality and the yield of wool per sheep is lower than that of the Himalayan region.

3. The Semi-arid Southern Region. This region comprising Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu and parts of Madhya Pradesh supports about 23.5 million sheep which is about one-third of the total number of sheep found in India. In spite of the largest number of sheep, this region produces only 11,000 tonnes of inferior quality rough wool. About 50 per cent of the sheep of this region are raised for mutton and produce no wool.

4. The Humid Eastern Region. This region, comprising Bihar, West Bengal, Assam and Odisha, has humid climate which is not favourable for sheep rearing. There are about 30 lakh sheep which are mainly reared for producing mutton. The per sheep wool and the total production of wool are lower than that of any other region.

Development of Sheep

Development of sheep is necessary to meet the growing demand for wool and mutton in the country and for a possible export of these commodities. This can be done by scientific breeding of the sheep. The breeding policy envisages selective breeding of important carpet wool breed and cross-breeding involving suitable exotic breeds with coarse carpet type. India is importing large number of exotic fine wool breed sheep in a phased manner. So far nearly 10 thousand fine wool sheep have been imported from the USA, Australia and Russia for increasing the production of quality wool. A central Sheep Breeding Farm with exotic breeds of sheep has been established at Hisar in Haryana. At present, it is having a breeding programme with pure exotic breed as well as cross breeding for production of superior rams. It has distributed over 12,000 exotic/cross breed rams to different states. During 2010-11 the form supplied 698 rams and 65 bucks.

GOATS

Goat is called the *poor man's cow* because it can be cheaply reared on meagre grass of poor quality. It is the major supplier of mutton along with milk, hair and skins. The number of goats increased sharply from 47.16 million in 1951 to 140.5 million in 2007. Goats are found in larger number as compared to sheep and are next only to cattle. About one-sixth of the world's goats are reared in India. Although goats are found in almost all parts of the country, their major concentration is in Bihar, Rajasthan, West Bengal, Uttar Pradesh, and Maharashtra. These states account for more than half the goats of India.

About 90 per cent of goats in the country are *desi* or non-descript, mostly found in the Deccan Plateau. But there are some outstanding breeds which are found in some specific areas. The Himalaya or *Angora* goat which is also known as the *Chamba*, *Gaddi*, *Chegu* or Kashmiri breed is reared in Kashmir and Himachal Pradesh. It produces soft warm hair. The *Pashmina* reared in Kashmir and Kulu valley is world renowned for its pashmina hair known as ***Mohair.*** The yield of hair per goat varies from 21 to 56 grams per year. The *Jamunapuri* is the breed found between the rivers Yamuna and the Chambal. It is a dual purpose breed providing meat and milk. The *Barabari* breed of western Uttar Pradesh and Haryana can yield upto 2.5 kg of milk per day. Among the other breeds are the *Beetal* of Punjab, the *Marwari*, *Mehsana*, *Kathiawar*, and *Zalwadi* of Rajasthan,

Gujarat and Madhya Pradesh and the *Barari*, *Surti* and *Deccani* of the Peninsular India. Several important foreign breeds such as *Alpine*, *Nubian*, *Saanen*, *Toggenberg* and *Angora* have been used for cross breeding with the local breeds.

PIGS

There are about 100 lakh pigs providing about 5 per cent of India's meat production in the form of pork. In a poor and thickly populated country like India, pig rearing is an important activity because pig provides rich meat at low cost. Pig farming plays an important role in improving the socio-economic status of sizeable section of weaker rural communities especially in north-eastern states where every rural family rears pigs for meat. Pig farms have been set up for improving the quality of pigs. At present, there are about 100 pig farm units in the country run by state governments maintaining about 29,000 pigs.

The Central Government has prepared a scheme to assist farmers/landless labourers/cooperatives and Tribals, particularly in the North-eastern States by rearing pigs under stall fed condition for quality pork production and organised pork marketing in rural and semi-urban areas. The main objectives of the scheme are :

(*a*) Encourage commercial rearing of pigs by adopting scientific methods and creation of infrastructure.

(*b*) Production and supply of improved germ plasm.

(*c*) Organising stakeholders to popularize scientific practices.

(*d*) Create supply chain for meat industry.

(*e*) Encourage the value addition for better income.

HORSES AND PONIES

There were 8.46 lakh horses and ponies in the country in 2007. They have lost much of their importance with the increasing use of automobiles for transport. But in remote hilly areas, horses and ponies are the only means of transport. About one-fourth of the total horses and ponies are found in Uttarakhand, Himachal Pradesh, Bihar, and Jammu and Kashmir. Some of the important indigenous breeds include *Marwari*, *Kathiawari*, *Manipuri*, *Bhutani*, *Spiti* and *Chummarti*. Some other breeds have been developed by cross-breeding the indigenous breeds with the Arabian and English breeds.

DONKEYS AND MULES

Donkeys and mules are used as beasts of burden, especially in those areas where modern modes of transportation cannot be used. Most of the donkeys are found in Rajasthan, Uttar Pradesh, Punjab, Gujarat and Tamil Nadu. Mules are derived from the cross-breeding of mares and donkeys. The largest concentration of mules is found in Uttar Pradesh and West Bengal.

CAMELS

Camel is an extremely useful animal for draught and transport purposes in the arid lands and is called ***ship of the desert***. There were about 140 lakh camels in the country in 2007, about two-thirds of which were concentrated in Rajasthan alone. The rest of the camels are found in the arid and semi-arid areas of Punjab, Haryana and Gujarat.

LIVESTOCK PRODUCTS

Livestock provide us with a large variety of products which are very useful in our everyday life. Animal products help in increasing the national income and in the upliftment of the rural masses. Livestock products play a significant role in the national economy of India. As mentioned earlier, the gross value of output from livestock sector (at current prices) is estimated to account for 25 per cent of the total value of output from agriculture sector. This excludes the contribution of animal draught power. Animal husbandry plays a significant role in rural economy by providing gainful employment particularly to small/marginal farmers and agricultural labourers and more so for people living in drought prone, hilly, tribal and other poorly developed areas, where crop production on its own may not sustain them fully. The major animal products include milk, meat, wool, hides and skins, dung, etc. Several industries mainly depend on the animal products. Over and above, animals render extremely useful service in different agricultural operations. Draught animals plough 100 million hectares of farmland forming 60 per cent of the cultivated area. They also

transport 25,000 million tonne kilometres of freight. Without animals, no cultivation would be possible, fields would remain unploughed, stores and bins stand empty and food and drink loose half their savour, for in a vegetarian country like India what can be worse than to have no milk, butter or *ghee*.

Milk

Milk is primarily obtained from buffaloes, cows and to some extent from goats and sheep. About two-thirds of buffaloes milk is produced in Uttar Pradesh, Punjab, Haryana, Andhra Pradesh, Telangana and Madhya Pradesh. Similarly, about two-thirds of cow milk is produced in Uttar Pradesh, Tamil Nadu, Madhya Pradesh, Maharashtra, Punjab, Kerala, Karnataka and Bihar.

White Revolution

The production of milk immediately after Independence was at a very low level and remained almost stagnant between 1947 and 1970 with animal growth rate of merely one per cent. As a result of concerted efforts by centre and state governments, the milk production increased rapidly. Milk production increased from a meager 17 million tonnes in 1951 to a staggering 132.43 million tonnes in 2012-13 thus registering a 7.8 times growth within a span of six decades. The per capita availability of milk also increased from 124 grams per day in 1951 to 290 grams per day in 2011-12 (**Table 18.1**). This phenomenal increase in milk production after 1970 has been named as ***White Revolution,*** similar to Green Revolution in agriculture. India is now the world's largest producer of milk. The dairy sector is the largest contributor in the agricultural sector to the nation's GDP.

Operation Flood

The phenomenal increase in milk production (**Table 18.1**) has also been termed as ***Operation Flood***. It started with the establishment of the National Dairy Development Board (NDDB) in 1965. This board was set up to promote, plan and organise dairy development through cooperatives. These cooperatives were envisaged as democratic institutions, owned and managed by rural producers and were sensitive to the producers' demands. The dairy development programme through cooperative societies was first established in the Anand District of Gujarat which was most successful. Consequently Anand model of dairy development was replicated in other parts of the country. The cooperative societies helped the milk produces by providing financial and technical assistance and in the sale of milk at remunerative prices.

The NDDB launched 'Operation Flood' in 1970 with commodity gifts from the European Economic Community. Those gifts included skimmed milk, milk powder and butter oil. The operational system of 'Operation Flood' consists of multi-tiered cooperative structure with Primary Village Cooperative Societies at the base. District Units at the district level, State Federations at the state level and the National Cooperative Dairy Federation of India as the apex body for milk cooperative societies. The cooperative societies have a well organised system of carrying milk from the producers to the consumers. After being collected at the village collecting centre, milk is

TABLE 18.1. Phenomenal Increase in Milk Production in India (1950-51 to 2011-12)

Year	Milk Production (in million tones)	Per Capital availability of milk in gram per day
1950-51	17.0	124
1960-61	20.0	126
1970-71	22.0	128
1980-81	31.6	128
1990-91	53.9	176
2000-01	80.6	217
2005-06	97.1	241
2006-07	102.6	251
2007-08	107.9	260
2008-09	112.2	266
2009-10	116.4	273
2010-11	121.8	281
2011-12	127.9	290
2012-13	132.4	—

Source : (*i*) Economic Survey, 2004-05, p. 175
(*ii*) Economic Survey, 2011-12, p. 192
(*iii*) Economic Survey, 2012-13, p. 185.
(*iv*) Economic Survey 2013-14, p. 149.

promptly transported to the dairy plant at the milk chilling centre. The timings of collecting milk are rigidly maintained by the village society, truck operators and milk is quickly transported to dairy plants. The chilling plants are managed by producers' cooperative unions which purchase milk directly from the producers, thus eliminating the middlemen. Before setting up of these societies, middlemen were indulging in maximum exploitation of the milk producers.

Today, 'Operation Flood' is considered to be the largest dairy development programme in the world.

Objectives

Following are the main objectives of 'Operation Flood' :

1. Forming cooperative societies.
2. Procurement transportation and storage of milk at the chilling plants.
3. Production of milk products and management of their marketing.
4. Provision of cattle feed.
5. Facilities for superior breeds of cows and buffaloes, health services, veterinary treatment and artificial insemination.
6. Provision of extension services.

Phases of the White Revolution

The White Revolution is usually examined under the following three phases :

Phase-I (1970-81). The objective of this phase was to set up dairy cooperatives in 18 milk sheds in 10 states to provide milk to four metropolitan cities *i.e.*, Mumbai, Kolkata, Delhi and Chennai. The important step in this phase was the setting up of 4 Mother Dairies in Mumbai, Kolkata, Delhi and Chennai. By the end of this phase, there were 13,000 village dairy cooperatives covering 15 lakh farmer families.

Phase II (1981-85). This phase coincided with the Sixth Five Year Plan and was designed to be built on the foundation of Phase-I. Dairy development programme was extended to three states of Karnataka, Rajasthan and Madhya Pradesh. The programme aimed at organising in 144 more cities, proper provision for fodder to feed the milch animals, control on animal diseases, improving the breeds and providing facilities to the milkmen. A new vaccine called 'Raksha' was developed by the Research Institute at Hyderabad to control cattle diseases. By the end of Phase II, there were 136 milk sheds and 34,500 village dairy cooperatives with a membership exceeding 36 lakhs.

Phase III. Started in 1985, this phase aimed at setting up 170 milk centres to benefit 250 districts in 22 states. The emphasis was on consolidating the gains of earlier two phases by improving productivity and efficiency of the cooperative dairy sector and its institutional base for sustainable development. By September 1996, about 73,300 dairy cooperative societies had been organised in 170 milksheds and the membership rose to ten million milkmen.

Achievements of White Revolution

1. India has become the largest producer of milk in the world.
2. There has been significant increase in the total production of milk and per capita availability of milk in the country.
3. The increase in milk and milk products has reduced the import of these products substantially and helped in saving the precious foreign exchange. In fact, India is now in a position to export some of the milk products to a number of countries.
4. The small and marginal farmers and landless labourers have been especially benefited from the White Revolution. About two-thirds of the milk supplies under "Operation Flood" come from the small and marginal farmers and landless labourers.
5. 'Operation Flood' has helped in increasing the income levels of small and marginal farmers as well as of the landless labourers. About 9 million small farmers in 70,000 village are earning jointly an incremental income of about ₹ 2,500 crore annually.
6. Dairy industry and infrastructure have been expanded and modernised. A Milk Grid has been activated to offset regional and seasonal imbalance in milk production. A stable structure has now been developed to safeguard against political instability.
7. To ensure success of 'Operation Flood' programme, research centres have been set up at Anand, Mehsana, Palampur (Banaskantha) all in Gujarat. Besides, three regional centres are working at Siliguri, Jalandhar and Erode.
8. A centrally sponsored scheme for livestock insurance was initiated in 2006-07 and is being implemented in all the states with twin objectives of providing protection mechanism to farmers and cattle rearers against any eventual loss of their animals due to death and to demonstrate the benefit of the insurance of livestock and popularize it with ultimate goal of attaining qualitative improvement in livestock and its products. The scheme benefits farmers and cattle rearers with indigenous/cross-breed milk cattle and buffaloes in 300 selected districts. During 2006-07 and 2010-11, about 29.10 lakh animals were insured.
9. Genetic improvement of milch cattle has been made possible by cross-breeding and this process has become very common in India.

Problems

White Revolution has several achievements to its credit and has increased the milk production to a great extent and has infused new life in producers and consumers alike. In spite of all its achievements, it has to face some problems as described below :

1. Collection of milk from remote and inaccessible areas is difficult, expensive, time consuming and economically unviable. Under these circumstances, the producers do not get remunerative price for their milk but the consumers have to buy milk at much higher cost.
2. In most villages, the cattle are kept under unhygienic conditions which results in lesser quantity of lower quality milk.
3. The existing marketing facilities are inadequate. In most villages, milk is converted into ***ghee*** which is not much remunerative. Therefore, there is need to improve the marketing infrastructure.
4. Although India possesses some of the best breeds of cattle in the world, yet most of the breeds are inferior which yield low production. There is great scope for improving the cattle breeds.
5. The extension service programme is not effective and needs improvement.

Prospects

Keeping in view the number of milch cattle and increasing demand for milk and milk products, it can be safely said that dairy development in India has great future. There are immense possibilities of capturing the international market with reference to liberalisation and global trade. Several corporate sector firms are taking advantage of the existing situation of liberalisation and globalisation. Such a situation can be encashed by strengthening the infrastructure and by increasing the production. India is capable of exporting milk products after meeting her domestic requirements by increasing quantity and improving quality of its products. The government has constituted Technology Mission for dairy development and Anand Model Cooperatives are being promoted to cover about 60 per cent of the total area of the country.

Intensive Dairy Development Programme (IDDP) was launched in 1993-94 for helping Non-Operation Flood, hilly and backward areas. Following are the main objectives of the IDDP :

(*i*) development of milch cattle

(*ii*) increasing milk production by providing technical input services

(*iii*) procurement, processing and marketing of milk in a cost effective manner

(*iv*) ensure remunerative prices to the milk producers

(*v*) generate additional employment opportunities

(*vi*) improve social, nutritional and economic status of residents of comparatively more disadvantaged areas.

The scheme was modified in March 2005 and also extended to some districts of Operation Flood Programme.

A comprehensive new scheme National Programme on Bovine Breeding and Dairy Development was launched with the objective of enhancing milk production and productivity in a sustainable manner. The National Dairy Plan Phase-I was launched in March 2012 with the objective of improving productivity of milch animals, strengthening and expanding village-level infrastructure for milk procurement and providing producers greater access to market in dairy sector continues. The number of milk animals increased from 62 million in 2000 to 83.15 million in 2012.

Production of Milk at the State Level. Table 18.2 shows that Uttar Pradesh is the largest producer accounting for more than 17 per cent of the total milk production of India. This is followed by Rajasthan (10.53%) and Andhra Pradesh (including Telangana) which produces more than 7 per cent of India's milk.

TABLE 18.2. Production of Milk in thousand tonnes (2012-13)

State	Production	Percentage of all India production
1. Uttar Pradesh	23,330	17.62
2. Rajasthan	13,946	10.53
3. Andhra Pradesh (including Telangana)	12,762	9.64
4. Gujarat	10,315	7.79
5. Punjab	9,724	7.34
6. Madhya Pradesh	8,838	6.67
7. Maharashtra	8,734	6.59
8. Haryana	7,040	5.32
9. Tamil Nadu	7,005	5.29
10. Bihar	6,845	5.17
Others	23,892	17.04
All India	**1,32,431**	**100.00**

Source : Data computed from Agricultural Statistics at a glance, 2013, p. 324.

Although Gujarat has the distinction of being the birth place of the "White Revolution" in India, this state produces only 7.79% of India's milk and has to content with fourth position among the major milk producing states of the country. The other important milk producing states of India are Punjab, Madhya Pradesh, Maharashtra, Haryana, Tamil Nadu and Bihar.

Meat

The annual meat production in the country is 5.9 million tonne of which 54 per cent is obtained from goats and sheep, 26 per cent from cattle, buffalo, and 7 per cent from pigs. The remaining 13 per cent comes from poultry birds. As about two-thirds of the Indian population is vegetarian and a large number of non-vegetarian people do not eat all types of meat due to religious sentiments, the production of meat is not much in spite of the fact that India has a very large livestock population. The annual per capita consumption of meat in India is less than 2 kg which is too small compared to over 100 kg in Australia, Argentina and New Zealand.

There are about 3,600 recognised slaughter houses in the country in which over five crore animals are slaughtered annually. Besides there are 32,000 illegal slaughter houses. Asia's biggest modern slaughter house is operating in Deonar, Mumbai while another abattoir of the Goa meat complex is functioning at Usgaon. There are 21 export-oriented modern abattoirs and 57 meat processing plans registered with Agriculture and Processed Food Products Export Development Authority exporting raw meat (chilled and frozen) to about 63 countries. In 1990-91 the country had exported meat worth ₹ 140 crore. The figure rose to ₹ 27,247 crore in 2013-14.

Table 18.3 shows that Uttar Pradesh is the largest meat producing state of India and produces over 19 per cent of the total meat production of the country. This is followed by Andhra Pradesh (including Telangana), West Bengal, Maharashtra, Tamil Nadu and Kerala.

Hides & Skins

India produces about 2 crore pieces of cattle hides and about 65 lakh pieces of buffalo hides

TABLE 18.3. Distribution of meat production in India (2012-13)

State	Production ('000 tonnes)	Percentage of all India production
1. Uttar Pradesh	1,137	19.11
2. Andhra Pradesh (including Telangana)	906	15.23
3. West Bengal	648	10.89
4. Maharashtra	591	9.94
5. Tamil Nadu	462	7.77
6. Kerala	401	6.74
Others	1,803	30.32
All India	**5,948**	**100.00**

Source : Data computed from Agricultural Statistics at a glance 2013, p. 325.

accounting for about 15 per cent of the world's hides. More than 50 per cent of Indian hides are produced in Uttar Pradesh, Madhya Pradesh, Gujarat, Maharashtra, Bihar, West Bengal, Telangana and Andhra Pradesh. India also produces about one crore pieces of goat skins and about two crore pieces of sheep skins every year. Indian skins are one of the best in the world and are much in demand in the international market. India exported leather and manufactures worth ₹ 34,517 crore in 2013-14.

Wool

There has been a modest increase in the production of wool from 41.2 million kgs in 1990-91 to about 42.99 million kg in 2010-11. This has been possible primarily due to proper sheep care and cross breeding of the high yielding fine quality exotic breeds with low yielding coarse indigenous breeds. However, the average yield of wool per sheep is still very low as compared to that obtained in Australia, New Zealand and in some other advanced countries. A Bikaneri sheep gives an average of 1 kg per clip while a fine Merino sheep gives 3 to 15 kg per clip. About 30 per cent of Indian wool is produced in Rajasthan. The other important producers are Karnataka (17.41%), Jammu and Kashmir (16.68%),

TABLE 18.4. Distribution of Wool Production in India in thousand kgs (2012-13)

State	Production	Percentage of all India production
1. Rajasthan	14,007	30.41
2. Karnataka	8,020	17.41
3. Jammu & Kashmir	7,681	16.68
4. Andhra Pradesh (including Telangana)	5,031	10.92
5. Gujarat	2,664	5.78
6. Himachal Pradesh	1,649	3.58
7. Maharashtra	1,503	3.28
8. Uttar Pradesh	1,456	3.16
Others	4,044	8.78
All India	**46,055**	**100.00**

Source : Data computed from Agricultural Statistics at a Glance 2013, p. 325.

Andhra Pradesh including Telangana (10.92%), Gujarat, Himachal Pradesh, Maharashtra and Uttar Pradesh.

The current wool production in India is 46 million kg against a total requirement of about 80 million kg per annum. Therefore, India has to import a large quantity of wool, especially the superior quality wool. India also exports raw wool in small quantity to the USA and UK.

Sericulture

Sericulture includes cultivation of mulberry tree and rearing of silk worms. Most of silk in India is obtained from silk worm which feeds on the mulberry leaves. On an average 1 kg of silk needs about 150 kg of mulberry leaves. As per current figures, about 4.5 lakh hectares of area is under mulberry cultivation. Silk production is mainly confined to areas between 15° and 34° N latitudes. The climate of the areas encompassed within this latitudinal zone is congened to the growth of mulberry trees and includes six major states of Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, West Bengal and Jammu and Kashmir. These six states collectively account for 97 per cent of

the total area under mulberry cultivation and 95 per cent of raw silk production in the country. Of late, sericulture has gained ground in some non-traditional areas also.

Sericulture is a labour-intensive agro-based cottage and industry which provides gainful employment to about 7,.25 million people in rural and semi-urban areas in India. Of these, a sizeable number of workers belong to schedule castes/scheduled tribes and economically weaker sections of society. There is substantial involvement of women in this industry.

The major fields of employment cover silk worm seed producers, farmers-cum-rearers, twisters, hand spinners of silk waste and traders. Mulberry plantation also requires high input of human labour. One hectare of mulberry plantation generates employment for a minimum of 13 persons annually.

Two types of silk are produced in India, *viz.* mulberry and non-mulberry. The distinction arises from the rearing of silk worms either upon mulberry leaves or on leaves of other plants. India produced 23,060 metric tons of silk in 2012 which was 13% more than produced in 2010-11. Of this mulberry silk accounts for 80.73%. The main producers of mulberry silk are Karnataka, West Bengal, Jammu and Kashmir, Tamil Nadu, Telangana and Andhra Pradesh although some other states have made some progress under their development plans. Karnataka and Andhra Pradesh are the leading producers of mulberry silk which account for 43 and 32 per cent respectively of the total mulberry silk production of India.

Vanya (non-mulberry) silk comprising Tasar, Eri and Muga are produced in Jharkhand, Chhattisgarh, Madhya Pradesh, Odisha, Bihar, West Bengal, Assam, Meghalaya, Manipur and Nagaland. In 2011-12 India produced 2,760 metric tons of Eri, 1,166 metric tons of Tasar and 122 metric tons of Muga silk. Different types of ***Vanya*** silk and spun silk and noil yarn are further defined as follows :

1. **Tasar Silk.** This silk is released from cocoons of silkworms belong to saturniidae family which are fed on leaves of oak, Asan, Arjuna trees. It is mainly produced in Jharkhand, Bihar, Chhattisgarh, Madhya Pradesh, Odisha, West Bengal and Andhra Pradesh.
2. **Eri Silk.** It is spun from cocoons of silkworms belonging to saturaiidae family which are fed on castor leaves. Eri silk is mainly produced in Assam, Bihar, Manipur, Meghalaya, Nagaland and West Bengal.
3. **Muga Silk.** This type of silk is produced only in Assam from cocoons of silkworms belonging to saturniidae family which are fed on Som and Soalu leaves.
4. **Spun Silk Yarn.** As the name indicates, spun yarn is composed of silk filaments of lengths varying from 1 to 20 cm produced by breeding, dressing and spinning the silk waste which is the by-product of the raw silk reeling industry.
5. **Noil Yarn.** It is a short, staple residue obtained during dressing operations in silk spinning from silk waste. It is a by-product of spun silk industry. This can be spun into Noil yarn of course counts.

Poultry Farming

The term 'poultry' refers to domestic fowls which are reared for their flesh, eggs and feathers and includes chickens, ducks, geese, turkeys, etc. Poultry farming has assumed much importance due to the growing demand of poultry products, especially in urban areas, because of their high food value. There has been a rapid increase in the number of poultry birds. Andhra Pradesh along with Telangana has the largest number of poultry birds accounting for about 18.2 per cent of the total poultry birds of India. This is followed by Tamil Nadu, Maharashtra, West Bengal and Karnataka.

Poultry sector has emerged from entirely unorganised farming practice to commercial production system with state-of-the-art technological innovations. It involves small capital investment; provides direct and indirect employment to the people and is a potent tool for subsidiary income generation for landless and marginal farmers.

TABLE 18.5. Production of eggs in India

Year	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
No. of eggs in millions	1,832	2,281	6,172	10,060	21,101	36,632	53,583	55,562	60,267	63,024	66,450	69,730

Source : Economic Survey, 2013-14, Statistical Appendix p. 21.

At present, India is among the top five chicken meat producing countries of the world. In the year 2011-12 India produced more than two million metric tonnes of poultry meat. The production of eggs increased from 1832 million 1950-51 to 69,730 million in 2012-13 (**Table 18.5**). Per capita availability of eggs was about 55 per year in 2011-12. According to the Agricultural and Processed Food Products Export Development Authority (APEDA), exports of poultry products were around ₹ 372 crore in 2009-10.

After the initial boost given by the Central Poultry Breeding Farms to promote poultry farming on commercial lines in the country, the poultry sector has flourished and now about 70 per cent of the production management and marketing is under highly organised sector. Four Central Poultry Development Organizations (CPDOs) are at Bengaluru (Southern Region), Bhubaneshwar (Eastern Region), Chandigarh (Northern Region) and Mumbai (Western Region) are functioning to provide necessary services including training the farmers to upgrade their skills. They are playing a pivotal role for implementing the policies of the Government with respect to poultry. The mandate of these organisations has specially been re-oriented to focus on improved indigenous birds, which lay on an average 180-200 eggs per annum and have vastly improved Feed Conversion ratio in terms of the feed consumption and weight gained. CPDO Bengaluru is also imparting training to in-service personnel from within the country as well as from overseas. Diversification with species other than chicken like ducks, turkey, guinea, fowl, Japanese squail and emu is also undertaken. The Central Poultry Performance Testing Centre (CPPTC) at Gurgaon is entrusted with responsibility of testing the performance of layer and broiler varieties. The "Poultry Development" scheme comprising three components, namely Assistance to State Poultry Farms, Rural Backyard Poultry Development, and Poultry Estates, is being implemented. Further, to encourage entrepreneurship skills of individuals, a central-sector 'Poultry Venture Capital Fund' scheme is also being implemented on capital subsidy mode since 1 April, 2011, covering various poultry activities.

TABLE 18.6. Distribution of Eggs in India (2012-13)

State	Number of eggs (lakhs)	Percentage of all India production
1. Andhra Pradesh (including Telangana)	2,22,974	31.98
2. Tamil Nadu	1,19,337	17.11
3. West Bengal	47,115	6.76
4. Maharashtra	45,661	6.55
5. Haryana	42,343	6.07
6. Punjab	37,911	5.44
7. Karnataka	36,773	5.27
8. Odisha	23,230	3.33
9. Kerala	22,375	3.21
Others	99,588	14.28
All India	**6,97,307**	**100.00**

Source : Data computed from Agricultural Statistics at a glance, 2013, p. 324.

Table 18.6 makes it clear that Andhra Pradesh along with Telangana is the largest producer of eggs. In the year 2012-13, these two states produced about one third of the total eggs produced in India. This was followed by Tamil Nadu (17.11%), West Bengal (6.76%), Maharashtra (6.55%) and Haryana (6.07%). The other major producers are Punjab, Karnataka, Odisha and Kerala.

FISHERIES

Introduction

Fishing is one of the oldest occupations of man. Man learnt fishing much before he could learn something about agriculture. Fishing has assumed much importance in view of the rapidly increasing population and depleting land resources. Fish provides protein rich food and is also a big source of vitamins A, B and D. There are about 30,000 species of fish in the world out of which about 18,000 are found in India. Fish forms an important part of diet of the people living in the coastal areas of Kerala, West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, Maharashtra, Karnataka, Goa and Gujarat. Inedible fish is also a rich source of animal protein for livestock feeding. Fish scales and fishery wastes are also a source of organic manure. The fish catch in India is of two types :

1. Sea or Marine Fisheries. It includes coastal, off-shore and deep sea fisheries mainly on the continental shelf upto a depth of 200 metres.

2. Inland or Fresh Water Fisheries. Rivers, lakes, canals, reservoirs, ponds, tanks, etc. contain fresh water and provide fresh water fisheries. Inland fisheries also include those obtained from estuaries, delta channels, back-waters, lagoons and coastal lakes.

Fish Production in India

India is the third largest producer of fish and second largest producer of inland fish in the world. The fisheries sector provides employment to over 14 million people engaged fully, partially or in subsidiary activities pertaining to the sector, with an equally impressive segment of the population engaged in ancillary activities and accounts for about one per cent of the total agricultural production in India. On an average a fisherman catches 2,000 to 2,500 kg of fish every year. Fish production has more than doubled in a span of about two decades from 3.8 million tonnes in 1990-91 to 9 million tonnes in 2012-13. The production of fish in selected years is shown in **Table 18.7**.

TABLE 18.7. Production of Fish in India ('000 tonnes)

Year	Marine	Inland	Total
1950-51	534	218	752
1960-61	880	280	1,160
1970-71	1,086	670	1,756
1980-81	1,555	887	2,442
1990-91	2,300	1,531	3,836
2000-01	2,811	2,845	5,656
2005-06	2,816	3,756	6,572
2006-07	3,024	3,845	6,869
2007-08	2,920	4,207	7,127
2008-09	2,978	4,638	7,616
2009-10	3,104	4,894	7,998
2010-11	3,250	4,981	8,231
2011-12	3,372	5,294	8,666
2012-13(P)	3,275	5,744	9,019

P = Provisional
Source : Agricultural Statistics at a Glance, 2013, p. 326.

Marine Fisheries

India has a coastline of over 7,517 km including that of Andaman and Nicobar Islands and Lakshadweep Islands and its continental shelf spreads over 3,11,680 sq km. This entire area is suitable for marine fisheries. It is estimated that about 75 per cent of the marine fish landings are on the West coast and only 25 per cent is contributed by East coast.

There is a vast scope of increasing the marine fish in India. It is worth mentioning here that Indian Ocean is the least exploited of all the oceans of the world so far as fishing is concerned. The important fish caught along the coast are *shark*, *sardine*, *herring*, *anchovies*, *Mumbai duck*, *fly fish*, *ribbon fish*, *mackerel* and *Indian salmon*. Mackerel accounts for about one-third of the total catch while herring and prawn account for 15 per cent and 9 per cent respectively. Kerala, Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh, Odisha, West Bengal and Gujarat are the main producers of marine fish.

India's offshore and deep sea fish catch is very poor considering the marine potential of 20-25 million tonnes annually. Only 10-12 per cent is caught at present. Only 11 per cent of the potential fishing grounds are more than 200 metres deep, even then we are not able to make proper use of the natural advantage. Following are the main reasons for this sad state of affairs.

(*i*) India has tropical climate in which fish cannot be preserved for a long time and spoils very quickly. Heavy expenditure on refrigeration and deep freezing increases the market price of the fish.

(*ii*) Indian coast does not have many gulfs, bays, estuaries and backwaters as is the case with Norway. As such, it lacks good fishing grounds.

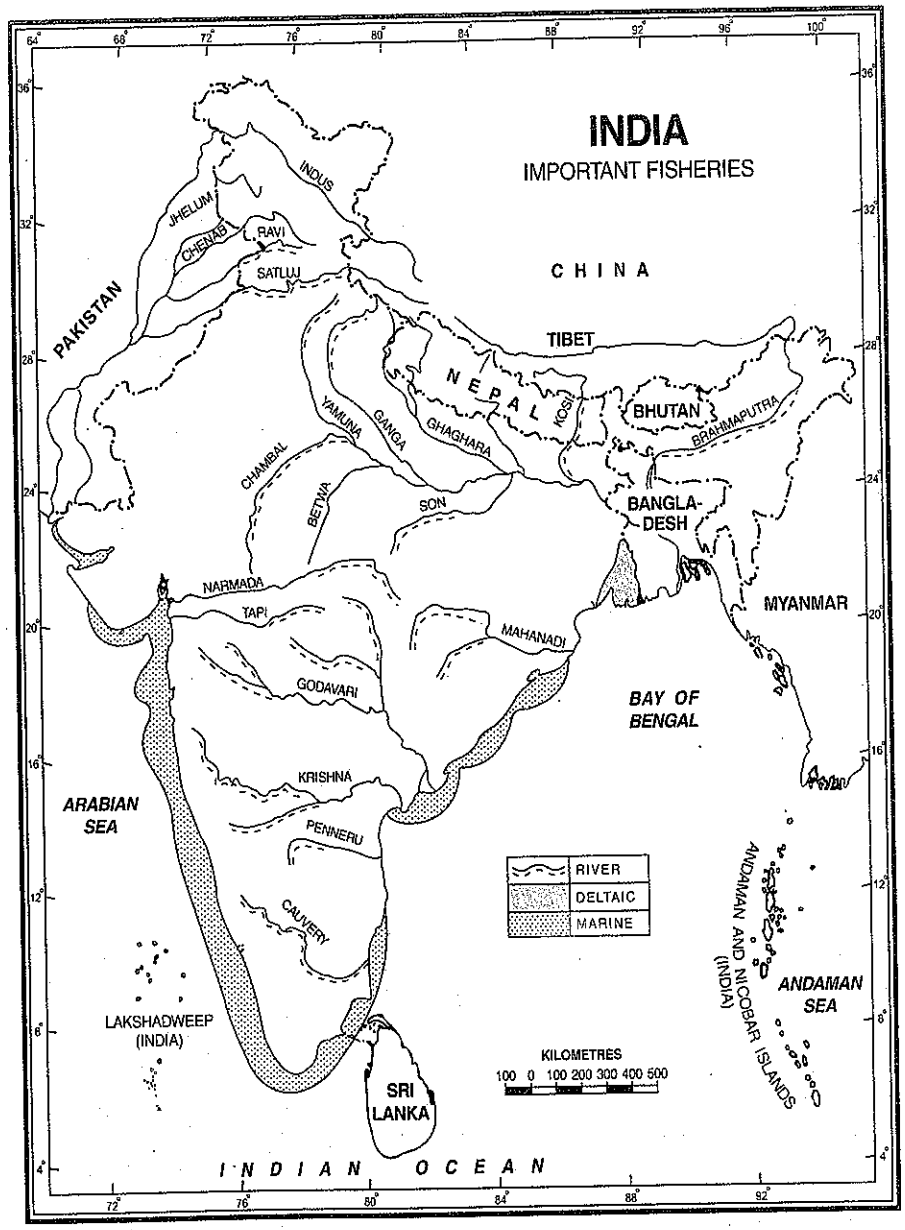


FIG. 18.4. India : Major Fisheries

(*iii*) Marine fishing in India is a seasonal phenomena. Strong winds during the monsoon season accompanied by tropical cyclones often hinder fishing operations.

(*iv*) Majority of Indians are vegetarians and do not eat fish.

(*v*) About 60 per cent of the fishermen still use small non-mechanised boats. They normally do not venture beyond 10 km from the coast and in waters more than 18 metres deep. They have to come back to the coast at night.

(*vi*) Lack of landing, freezing, canning, transport and organised markets are other handicaps faced by fishing in India.

Fresh Water or Inland Fisheries

India's inland fishery resources are one of the richest in the world. Rivers, irrigation canals, reservoirs, lakes, tanks, ponds, delta channels, backwaters, lagoons, estuaries, etc. provide the foundation for inland fisheries. The inland fish production has increased at a much faster rate as compared to marine fish. In the year 1950-51, the inland fish caught was only 218 thousand tonnes which was less than 29 per cent of the total fish caught in the country. After half a century *i.e.* in 2000-01 the inland fish was more than the marine fish which happened for the first time. After that, the inland fish production increased rapidly whereas marine fish production almost stagnated. In 2012-13, the inland fish accounted for 5,744 thousand tonnes which was about two-thirds of the total fish caught, thereby recording over four times increase in a span of 23 years. India's riverine fishery resources comprise the major river systems of the Ganga, the Brahmaputra, the Indus, the Mahanadi, the Narmada, the Tapi, the Godavari and the Krishna. The total length of the fishable rivers, along with their tributaries is 27,359 km. The length of irrigation channels is 1,12,654 km. The dam reservoirs and small lakes cover an area of 29 lakh hectares. Another 26 lakh hectares of land is covered by brackish water in the form of coastal lakes and lagoons. About 16 lakh hectares are covered by tanks and ponds out of which 6 lakh hectares are used for pisciculture.

Distribution

Although fishing is carried on in almost all parts of the country, about 97 per cent of India's marine fish and about three fourth of the country's inland fish are caught in the littoral states like Andhra Pradesh, West Bengal, Gujarat, Kerala, Tamil Nadu, Maharashtra .

TABLE 18.8. State-wise Production of Fish (2012-13) (in tonnes)

State	Marine	Inland	Total
Andhra Pradesh	4,14,349	13,93,728	18,08,077
West Bengal	1,52,352	13,37,664	14,90,016
Gujarat	6,93,500	92,586	7,86,086
Kerala	4,84,392	1,49,098	6,33,490
Tamil Nadu	4,28,441	1,91,956	6,20,397
Maharashtra	4,33,684	1,45,110	5,78,794
Karnataka	3,73,167	2,02,216	5,75,383
Odisha	1,18,311	29,183	4,10,143
Others	1,76,895	21,42,466	22,06,762
All India	**32,75,091**	**57,44,057**	**91,69,148**

Source : Data computed from Agricultural Statistics at a glance 2013, pp. 327-28.

1. Andhra Pradesh. Andhra Pradesh is the largest fishing state on the eastern coast of the Peninsular India producing about 20 per cent of the total fish of India. Its 960 km long coast is dotted by villages of fishermen in addition to the major fishing centres like, Vishakhapatnam, Machilipatnam and Kakinada. About 84 thousand fishermen use 580 mechanized and over 36,000 non-mechanized boats for fishing. There are 1,169 primary cooperatives to handle the processing of fish. *Oil sardine*, *mackerel*, *silver bellies*, *ribbon fish*, *catfish* and *soles* are important varieties of fish caught here. A large quantity of fish is sent to West Bengal where there is a great demand for fish.

2. West Bengal. West Bengal is the second larget producer of fish in India. More than 6 per cent of India's total fish is caught in West Bengal. Here the inland fish far exceeds the marine fish. West Bengal also is the second largest producer of fresh water fish accounting for nearly 23 per cent of India's fresh water fish. The Ganga Delta is inhabited by about one lakh fishermen who are engaged in fresh water fishing. Bengalis are fond of fresh water fish. The state can meet only 20 per cent of its demand and the rest is obtained from other states.

3. Gujarat. With 1,000 km long coast and over 65,000 sq km fishing ground, Gujarat is the third most important producer of fish in the northern part of western coast and accounts for over 8 per cent of the total fish of India. There are 52 big and small fishing ports on the Gujarat coast. Kandla, Porbandar, Navabandar, Dwarka, Umbergaon and Jaffarabad are important centres. Besides several small towns and a large number of villages also contribute to fishing. About 1.5 lakh fishermen are engaged in catching about 7 lakh tonnes of fish every year. *Mumbai duck*, *pomfret*, *jew fish*, *Indian salmon*, *tunnies*, *grey mullet*, *mackerel*, *eel*, *shark*, etc. are important fish varieties caught here. Local consumption being very low, about 97 per cent of the fish is transported to big markets like Mumbai, Kolkata and Delhi. Some fish is exported to Sri Lanka, Myanmar, Mauritius and Singapore.

4. Kerala. Kerala is the fourth largest fish producing state of India and accounts for about 7 per cent of the total fish production of the country. The 590 km long Kerala coast is indented and is dotted by a large number of lakes and lagoons. In fact Kerala coast is the most intensely fished area of India. There are about 1.35 lakh fishermen in Kerala. They use over 3 thousand mechanised boats and about 27 thousand country craft to catch fish. The mechanised production is 32 tonnes per boat as against about 10 tonnes by country craft. About 60 per cent of the total fish caught is consumed within the state, 22 per cent sold to other states and the remaining 18 per cent is exported. Kerala has about 85 per cent of India's total processing facilities such as freezing, ice making, cold storage, canning, etc. and processes the largest amount of fish in the country. *Oil sardines*, *prawns*, *horse mackerel*, *soles*, *lactarius* and *shark* are the most important marine fisheries. Inland fisheries include *prawns*, *barbus*, *clarius*, *mallet*, *etroplus*, and *murrels*. Thiruvananthapuram, Kozhikode, Kochi, Kollam, Azhikode, Ponnani, Kannur, Baliapatnam, Baypore, Vizhinjam, etc. are the leading centres of fish production.

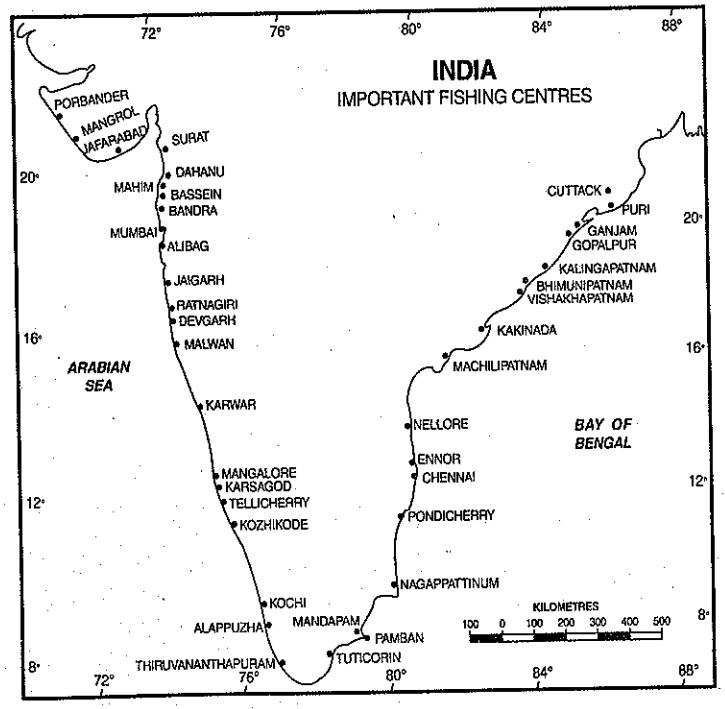


FIG. 18.5. India : Important Fishing Centres

5. Tamil Nadu. Tamil Nadu produces about 6.8 per cent of India's fish. The 1,000 km long coast of Tamil Nadu is not much indented which hinders fishing to some extent and encourages the use of mechanized boats. Presently, 96,500 persons are engaged in fishing along the Tamil Nadu coast using 2,757 mechanized boats and 43,343 country craft. *Mackerel*, *ribbon fish*, *catfish* and *soles* are the main varieties of marine fish caught here. Chennai is the largest centre. Other important centres are Tuticorin, Ennore, Cuddalore, Mandapam and Nagpattinam. The Tamil Nadu coast is dotted by about 300 villages of fishermen who solely depend upon fishing for their livelihood. Fish processing is done in 46 freezing, 60 cold storage, 3 canning and 6 fish meal units.

6. Maharashtra. Mahrashtra accounts for 6.4 per cent of the total fish catch of India. This state has 750 km long indented coast, as a result of which marine fish is more important than inland fish. There are about 250 villages along the Maharashtra coast inhabited by about 2.6 lakh fishermen. These fishermen operate on 4,718 mechanized boats and 5,662 traditional crafts. There are 530 primary fishing cooperatives, 41 freezing units, 6 cold storage units, 3 canning units and 6 fish meal units. The sea along the Maharashtra coast remains calm for about 7 months in a year which is quite convenient for fishing operations. *Mumbai duck, white pomfret, black pomfret, jew fish, Indian salmon, tunnies, grey mullet, mackerel, eel,* and *shark* are the chief varieties of marine fish here. Estuarine fisheries have been developed in Mahim and other creeks. Mumbai, Kolaba, Ratnagiri, Alibag and Bassein are the leading centres of fish production.

7. Karnataka. Karnataka produces nearly 6.3 per cent of India's fish. Mangalore, Karwar, Ankola, Kumta, Honawar, Bhatkal, Majali, Bingi, Chendia, Gangolli, Malpe, Udiayawar and Bokapatnam are the main centres. About 20,000 fishermen using 6,500 boats are engaged in fishing. *Sardine*, *mackerel*, *shark*, and *seer*, are the principal varieties caught here. The creeks of Netravati, Sharavati and Kali rivers are the most intensively used areas for inland fishing. Besides there are 30,000 minor tanks, 2,700 major tanks, 17 reservoirs and 6,885 km long stretch of rivers used for fishing.

8. Odisha. Both marine fish and inland fish are equally important in Odisha. Odisha's 720 km long coast provides about 410 thousand tonnes of fish every year which is about 4.5 per cent of the total fish catch of India. Cuttack, Puri, Sambalpur and Balasore are important fishing centres. Chilka lake is the most intensively fished area for inland fisheries. The fish from Chilika lakes is of superior quality and is in great demand.

Bihar (3.93%), Uttar Pradesh (3.68%), Assam (2.8%), Goa, Madhya Pradesh, Punjab, Haryana, Tripura and Punducherry are other producers.

Trade. India exports about 8 per cent of the total fish production mainly to Sri Lanka, Myanmar, Mauritius and Singapore. Sri Lanka alone purchases 80 per cent of our fish and fish products. There has been a spectacular increase in export of marine products in the recent years. Marine products have been identified as a major thrust area for exports during the Eighth Plan and it continues till now.

PROGRAMME FOR DEVELOPMENT OF FISHERIES

Central Institute of Fisheries Nautical and Engineering Training (CIFNET) was established at Kochi for organising suitable fisheries training system at the national level. Subsequently two units were set up at Chennai and Vishakhapatnam. The main objective is to make available sufficient number of trained operatives for fishing vessels and technicians for shore establishments.

The Fishery Survey of India (FSI) is the nodal agency for survey and assessment marine fishery resources in the Indian Exclusive Economic Zone (EEZ). With its headquarters at Mumbai, it has seven operational bases at Porbandar, Mumbai, Marmagoa, Kochi, Chennai, Vishakhapatnam and Port Blair.

National Fisheries Development Board (NFDB) was set up on 9th September, 2006 with its headquarters at Hyderabad. The main objective was to increase the fish production to a level of 10.3 million tonnes, to achieve double the exports from ₹7,000 crores to ₹14,000 crore and direct employment to an extent of 3.15 million.

Development of Fishing Harbours. The Government has been implementing a scheme for providing infrastructure facilities for safe landing and berthing to the fishing vessels. Since the inception of the scheme, six major fishing harbours *viz.* Kochi, Chennai, Vishakhapatnam, Roychowk, Paradeep and Season dock (Mumbai), 62 minor fishing harbours and 194 landing centres have been taken up for construction in various coastal states and union territories.

Fish Mapping. Fish species distribution maps for rivers Ganga, Yamuna, Chambal, Betwa, East Banas, Ken, Rupnarayan, Ajay, Subarnarekha, Kangshbati, Tapi, Narmada, Mahanadi, Godawari, Krishna, Kaveri, Tava, Tungabhadra, Hemavati and Pennar were declineated.

Development of Freshwater Aquiculture. This programme is being implement through Fish Farmers Development Agencies (FFDAs). A network of 429 FFDAs covering all potential districts in the country are in operation. During 2010-11, about 1,05,060 hectares of water area was brought under fish culture.

Marine Fishing Policy 2004

A comprehensive Marine Policy was launched in November 2004 to facilitate sustainable deep sea fishing. In the inland sector, the potential for fishery development in East and North-Eastern States is immense. Development of fisheries can go a long way to tackle the problem of food as well as unemployment in these states.

Following are the main features of Marine Fishing Policy 2004 :

The policy objectives are : (1) to augment marine fish production of the country up to the sustainable level in a responsible manner so as to boost export of sea food from the country and also to increase per capita fish protein intake of the masses, (2) to ensure socio-economic security of the artisan fishermen whose livelihood solely depends on this vocation, (3) to ensure sustainable development of marine fisheries with due concern for ecological integrity and bio-diversity.

Blue Revolution. The term 'blue revolution' is used to describe the phenomenal increase in fish production from a meager 0.7 million tonnes in 1950-51 to a staggering 9 million tonnes in 2012-13 by adopting a package of methods. It was coined and started in 1970 after the success of the Green Revolution in agriculture when the Central Government sponsored the Fish Farmers Development Agency (FFDA).

The fisheries industry has witnessed a massive transformation form the traditional subsistence type of enterprise to a multi-crore business industry with improved modern infrastructure. Motorised boats have replaced the traditional hand driven inefficient boats and big trawlers are a common site in the Indian seas. In fact Blue Revolution has brought a conspicuous improvement in fishing industry by adopting new techniques of fish breeding, fish rearing fish marketing and fish export. Refrigeration and fast transport system have opened up new vistas for exploring the untapped markets and have made fish a profitably marketable commodity.

AQUACULTURE

Also known as **aquafarming**, aquaculture refers to the production of aquatic animals and plans under controlled conditions. According to Food and Agriculture Organisation (FAO) "acquaculture is understood to mean the farming of aquatic organisms including fish, crustaceans, molluscs and aquatic plants." Although aquaculture has a long history and has been practised in China since, 2500 BC, it is a recent phenomenon in India. Aquaculture can be classified into two major categories *viz.* ***freshwater aquaculture*** and ***coastal aquaculture.*** Coastal aquaculture can be further subdivided into two categories; namely ***sea farming*** and ***brackish water acquaculture.*** Sea farming is concerned with the culture of organisms in open coastal waters and bays. Brackish water aquaculture, on the other hand, refers to land based farming systems using salt water from creeks, estuaries as well as from the coastal seas.

To encourage research and development in aquaculture, the Indian Council of Agricultural Research (ICAR), New Delhi, reorganised the fisheries research institute in 1987 and three different institutes were established. These are : (*i*) Central Institute of Freshwater Aquaculture (CIFA) at Bhubaneshwar (Odisha), (*ii*) the Central Institute of Brackish water Aquaculture (CIBA) at Chennai (Tamil Nadu) and (*iii*) the National Research Centre for Cold Water Fisheries (NRCCWF) at Bhimtal (Nainital, Uttarakhand).

Types of Aquaculture

1. Freshwater Aquaculture. The Central Institute of Freshwater Aquaculture (CIFA) has contributed a lot for breeding and rearing the air-breaching cat-fish (popularly known as magur) in vast areas of the country. This institute has adopted biotechnological approach and the fish are implanted with hormonal pellets to advance maturity. Freshwater shark has also been bred and reared by this institution. This is a very popular fish in the north-eastern part of India particularly in Manipur. Freshwater prawn or shrimp is an important form of aquaculture and prawn is raised for human consumption.

The initial step for freshwater aquaculture in India was taken with the setting up of Pond Culture Division at Cuttack in 1949 under the name of the Centre of Central Inland Fishers Research Institute (CIFRI). This type of aquaculture is popular particularly in the eastern states of West Bengal, Odisha and Andhra Pradesh. However, Punjab, Haryana, Assam and Tripura are also taking up this culture in a big way.

2. Brackish water Farming. This type of aquaculture has a long history. It is confined mainly to coastal wetlands impounded by human, locally known as ***bheries*** in West Bengal. It is also practised in salt resistant deepwater paddy fields in the coastal areas of Kerala, locally known as ***pokkali.*** These systems have sustained high production level although there has not been much additional input. This type of aquaculture got its due recognition after the initiation of an All India Coordinated Research Project (AICRP) in 'Brackish water Fish Farming' by the Indian Council of Agricultural Research (ICAR) in 1973. This project is credited for developing several technologies concerning fish and shrimp farming.

3. Shrimp Farming. Shrimp farming is a type of aquaculture in which marine shrimps are produced for human consumption. There has been phenomenal increase in area under shrimp farming due to development of more commercial hatcheries. The formation of Brackishwater. Fish Farmers' Development Authority (BFDA) in marine states supplemented by various government programmes proved to be a great help to shrimp farming. Subsidies from the Marine Products Export Development Authority (MPEDA), loans from commercial banks gave financial support to this farming. Demonstration of semi-intensive farming technology provided the required technical support. The Central Marine Fisheries Research Institute (CMFRI) initiated studies on maturation in early 1970s. In late 1980s Marine Products Export Development Authority (MPEDA) established the Andhra Pradesh Shrimp Seed Production and Research Centre and the Odisha Shrimp Seed Production and Research Centre to facilitate shrimp farming in these two states and to benefit other states also. Obviously Andhra Pradesh, Odisha and Tamil Nadu have developed shrimp farming in a big way. Nellore district of Andhra Pradesh is such a prolific producer of shrimp that it has earned the distinct name of ***Shrimp Capital of India.*** A number of farm holdings are located in Kerala and West Bengal.

4. Mariculture. Mariculture is that branch of aquaculture which is concerned with the cultivation of marine organisms for food and other products in the open ocean, enclosed seas or a section of ocean, tanks, ponds or raceways filled with seawater. Fish, prawns and oysters are the main food products. Non-food products include fish-meat, nutrient agar, jewelleries (cultured pearls) and cosmetics. Mandapam (in Tamil Nadu) centre of Central Marine Fishers Research Institute made the earliest attempt at mariculture in 1958-59 with the culture of milkfish. This institute has developed different types of technologies for a number of species including oysters, mussels and clams among sedentary species, as well as for shrimps and finfish.

5. Algaculture. This type of aquaculture involves farming of varied species of algae. Majority of algae that are cultivated belong to the category of micro algae also referred to as phytoplankton, microphytes, or planktonoic algae.

6. Integrated Multi-Trophic Aquaculture (IMTA). In this type of aquaculture, by-products (wastes) from one species are recycled as inputs for another. Fed aquaculture (*e.g.* fish, shrimp) is combined with inorganic extractive (*e.g.* seaweed) and organic extractive (*e.g.* shellfish) aquaculture to create balanced systems for environmental and economic sustainability as well as for social acceptability.

7. Fish Farming. Fish farming involves raising of fish in tanks or other water enclosures on a commercial scale. Products of fish farming are primarily used as food items. Salmon, catfish, cod, carp, trout, tilapia etc. are the chief species of fish reared under fish farming.

8. Seaweed culture. Marine algae are better known as seaweeds. Like other photosynthetic plants, seaweeds need sunlight. Little sunlight penetrates depths greater than 15 metres, so most of the seaweeds grow in shallow waters around shores or reefs. They are divided into three groups according to colour, brown, green and red. They provide food to tiny creatures, most of which filter dead particles from water. At present seaweed accounts for about 30 per cent of world aquaculture production. The Indian Ocean abounds in seaweeds, one-third of which occurs along the Indian coast. Seaweed has a wide range of application in the fields of food, textile, cosmetic, pharmaceutical, fodder, fertilisers etc. due to which its demand has increased tremendously in the recent past. Seaweed are rich in vitamins, minerals, trace elements and bioactive substances and have became an important ingredient of human food. There is vast scope for developing seaweed food in India.

9. Sewage-fed fish culture. Sewage-fed fish culture is an old practice in ***bheries*** in West Bengal. This is a culture in which fish are reared in sewage water. It involves multiple stocking and multiple harvesting approaches.

10. Paddy-cum-fish culture. In many parts of the country, fish are reared in paddy fields which are flooded with water for paddy sowing. It is practised in medium to semi-deep water paddy fields in low land areas. Strong dykes or field boundaries are constructed to prevent the escape of cultivated fish during floods. Although the system largely depends upon natural stocking, modern farming techniques are also practised. These techniques involve major and minor carps stocked at the densities of 5,000 to 10,000 per hectare are practised in several parts of the country. Fresh water prawns are also cultivated along with paddy-cum-fish.

Apiculture (Beekeeping)

The term apiculture has been derived from Latin *apis* which means a bee. Thus apiculture is the practice of developing and maintaining bee colonies by man. Beekeeping is practised mainly for honey, beeswax and for pollinating crops. Honey bees have tendency to live in colonies and as such they are kept in hives. Various types of hives are used depending on the local conditions and choice of the beekeepers. Fixed frame hives, movable frame hives and top bar hives are some of the popular types of hives used in the present day world. Usually there are three classes of bee in a colony : (*i*) a queen which is normally the only breeding female, (*ii*) about 30 to 50 thousand female workers which serve the queen and build hives and (*iii*) large number of male drones which may run into thousands in spring to a very few due to death in cold season. Beekeepers are generally categorised in following three classes :

(*i*) Commercial beekeepers, *i.e.*, beekeeping as primary source of income as in Himachal Pradesh.

(*ii*) Sideliners who keep bee as a secondary source of income; in different parts of the country.

(*iii*) Migratory beekeepers as of Kanniyakumari.

Beekeeping has become a reasonably important occupation which has great capacity to supplement the income of the farmers. It provides employment to rural workers and helps in improving the quality and quantity of crops. Honey bees are used to increase the production of plantation crops,. Cross-pollination by bees is very useful for crops. In addition to the significant role played by bees in crop production, they are a greater source of honey and wax. Currently beekeeping is carried on over a cultivated area of about 50 million hectares for growing vegetables, fruits, oilseeds, pulses, etc. and 3-4 colonies of honey bees are required per hectare of cultivated land.

Honey is the most important product of beekeeping. It contains vitamins and a large number of nutritions elements. Each 100 grams contains 138 mg potassium, 17 mg sodium, 13 mg calcium, 5 mg phosphorous and 1.5 mg iron. Further, it is estimated that 100 gm of honey gives 320 calories of energy. Traditionally honey is known to increase body resistance to diseases and help in weight management when taken regularly.

According to Food and Agriculture Organisation of the United Nations, India produced 52.23 thousand

metric tons of honey in 2005 out of which about 45.0 thousand metric tonnes of honey was consumed within the country. On an average, one hive yields about 5 kg of honey which varies from 1.8 to 2.3 kg in south India to 5.5 to 6.8 kg in north India. It has been estimated that as much as 50 kg of honey can be obtained from one hive in one year by using modern technology. Only 30 per cent honey is collected by Khadi Gramodyog and commercial beekeepers and the remaining 70 per cent is collected by the tribal people. Most of the honey is collected in Himachal Pradesh, Maharashtra and Uttar Pradesh. Tamil Nadu, Karnataka, Kerala, Andhra Pradesh, Telangana, West Bengal, Chhattisgarh, Madhya Pradesh etc. are some other honey producing states.

There are vast potentialities for increasing the production of honey in India and for exporting it to European countries, USA and Japan. Indian honey is in great demand in the international market due to its high quality and low cost.

Species of Honey Bees. A large number of species of honey bees are found in India because of diversity in topography, climate and flora in this vast country. Some of the important species are briefly described as under :

Apis cerana are found in large areas especially in high Himalayan region where beekeepers log hives in their houses. In the South India, *Apis cerana* beekeeping is undertaken under the supervision of the Bee Research and Training Institute of Pune and Khadi and Village Industries Commission at Mumbai. This type of beekeeping is also practised in Mahabaleshwar hills of Maharashtra, parts of West Bengal, north-eastern states of Arunachal Pradesh and Sikkim, as well as in large parts of Karnataka, Kerala and Tamil Nadu.

Apis dorsata is found in higher reaches of the Himalayas, in the Terai region of Uttar Pradesh and Himachal Pradesh in North India. In the central part of India, thick forests provide congenial conditions for *Apis dorsata* where this breed of honey bees is kept mainly by the tribals. Mangrove forests of Sundarbans in West Bengal and Eastern Ghats in Andhra Pradesh provide ideal conditions for *Apis dorsata*.

Apis mellifera are steadily increasing in Himachal Pradesh, Punjab, Bihar and Madhya Pradesh. Breeding of this dorsata has also been introduced in West Bengal. In Himachal Pradesh, farmers keeping *Apis dorsata* practise **transhumance**. They move to higher reaches of the mountains in summer with thick loads of bee colonies for pollination of apple orchards and come down to plains in winter for placing the bee hives amongst eucalyptus trees and sunflower plants.

REFERENCES

Agricultural Statistics at a glance, 2013, Govt. of India, Ministry of Agriculture.

Ayyappan, S and Krishna, M (2007) : Inland Fishers—Changing Consumption Patterns, The Hindu Survey of Indian Agriculture, 2007, Kasturi and Sons Ltd. Chennai, pp. 101-102.

Ayyappan, S. and Biradar, R.S. (2004) : Inland Fisheries—Enhancing Global Competition, *The Hindu Survey of Indian Agriculture,* 2004, Kasturi and Sons Ltd., Chennai, pp. 91-95.

Balram, N. (2007) : *Livestock—Need to boost export share,* The Hindu Survey of Indian Agriculture, Kasturi and Sons Ltd., Chennai, pp. 94-97.

Dayal, P. (1984) : *Distribution of Cattle and Problem of Fodder Supply in Bihar,* in A. Ramesh (ed.), *Resource Geography,* Heritage Publishers, New Delhi.

Desai, Anuradha (2004) : Poultry—Problems and Prospects, *The Hindu Survey of Indian Agriculture,* 2004, Kasturi & Sons Ltd., Chennai, pp. 94-95.

Economic Survey, 2011-12, 2012-13 and 2013-14, Oxford University Press, GOI, New Delhi.

India (2012, 13 and 14) : *A Reference Annual,* Publication Division, Ministry of I&B, Govt. of India.

Jana, R.K. and Sena R.K. (2004) : Aquaculture—Overwhelming Growth, *The Hindu Survey of Indian Agriculture,* 2004, Kasturi and Sons Ltd., Chennai, pp. 101-103.

Kadirvel, R. (2004) : Livestock—Towards Open Economy, *The Hindu Survey of Indian Agriculture,* 2004, Kasturi & Sons Ltd., Chennai, pp. 110-113.

Kaura, R.L. (1952) : *Indian Breeds of Livestock Including Pakistan,* Prem Publishers, Lucknow.

Muthiah, S. *et al.* (eds.) : *A Social and Economic Atlas of India,* Oxford University Press, New Delhi.

Narhari, D. (1996) : *Commercial Broiler Production,* Emkay Publications, Delhi.

Panikkar, N. Kesava (1984) : *Development of Indian Marine Fisheries, in* A. Ramesh *(ed.), Resource Geography,* Heritage Publishers, New Delhi.

Patel, Amrita (2004) : Dairying—Improving Milk Quality, *The Hindu Survey of Indian Agriculture,* 2004, Kasturi & Sons Ltd., Chennai, pp. 107-109.

Raghava, Kurup C.G. (1967) : (ed.) *Handbook of Animal Husbandry,* I.C.A.R., New Delhi.

Randhawa, M.S. (1958) : *Agriculture and Animal Husbandry,* I.C.A.R., New Delhi.

Sharma, Nagendra and Kumar, Shalender (2004) : Sheep and Goat—Yawning Productivity Gap, *The Hindu Survey of Indian Agriculture,* 2004, Kasturi & Sons Ltd., Chennai, pp. 115-117.

Singh, Harbans. (1966) : *Domestic Animals— India,* National Book Trust, New Delhi.

Singhal, N.C. (1992) : Marine Fisheries : Joint Efforts for Big Catch, *The Hindu Survey of Indian Agriculture,* 1992, Kasturi and Sons Ltd., Chennai, pp. 171-176.

Srivastava, U.K. and Dharma, M. (ed.) (1985) : *Fisheries Development in India: Some Aspects of Policy Management,* Concept Publishing Co., New Delhi.

Statistical Year Book India, (2013) Govt. of India, New Delhi.

Sundararajan, B. (2007) : *Poultry—Logistics Plays Vital Role,* The Hindu Survey of Indian Agriculture, 2007, Kasturi and Sons Ltd. Chennai, pp. 92-93.

Yadava, Y.S. (2004) : Marine Fisheries—Exploiting deep sea-avenue, *The Hindu Survey of Indian Agriculture,* 2004, Kasturi and Sons Ltd., Chennai, pp. 91-95.

Yadava, Y.S. (2007) : *Marine Fishers—Signs of Growth Visible,* The Hindu Survey of India Agriculture (2007), Kasturi and Sons Ltd., Chennai, pp. 98-100.

Land Utilization

INTRODUCTION

As in all other countries, land in India is put to various uses. The utilization of land depends upon physical factors like topography, soil and climate as well as upon human factors such as the density of population, duration of occupation of the area, land tenure and technical levels of the people. There are spatial and temporal differences in land utilization due to the continued interplay of physical and human factors. India has total geographical area of about 328.73 million hectares but statistics pertaining to land utilization were available for about 305.90 million hectares in 2010-11.

1. Net sown area

Cropped area in the year under consideration is called ***net sown area***. This area has a special significance in an agricultural country like India because agricultural production largely depends upon this type of land. There is an urgent need to increase the net area sown for meeting the food and other requirements of rapidly increasing population in India; although there is not much scope for increasing area under this category due to natural limitations such as topography, soils, climate, etc. Unfortunately the net sown area remained as 141.58 million hectures in 2010-11 as it was in 2000-01.

Net sown area accounted for about 46.05 per cent of the total reporting area of India (in 2010-11) against the world average of about 32 per cent. This is much higher than 40 per cent in the USA, 25 per cent in Russia, 16 per cent in Brazil and only 6 per cent in Canada. But the per capita cultivated land has gone down drastically from 0.53 hectares in 1951 to 0.11 hectares in 2011-12. This is a serious trend and can be checked only by population control.

Rajasthan has the largest net sown area of 18.35 million hectares which is about 12.96 per cent of the total reporting net sown area of India. This is followed by Maharashtra (17.41 million hectares).

It may be noted that agricultural prosperity does not depend as much as on the total net sown area as it does on the percentage of net sown area to the total reporting area. There are large variations in the proportion of net sown area to total reporting area from one state to another. Punjab and Haryana had some of the highest proportions of 82.6 and 80.5 per cent respectively while Arunachal Pradesh had 3 per

TABLE 19.1. Pattern of Land Utilization in India

('000 hectares)

Year	Total reported area (according to village papers)	Net area sown	Area sown more than once	Total cropped area	Forests	Not available for cultivation	Permanent pastures and other grazing lands	Land under Miscellaneous tree crops and groves (not included in net sown area)	Culturable waste	Fallow lands other than current fallows	Current fallows
1950-51	284.32	118.75	13.15	131.89	40.48	47.52	6.68	19.83	22.94	17.45	10.68
1960-61	298.46	133.20	19.57	152.77	54.05	50.75	13.97	4.46	19.21	11.18	11.64
1970-71	303.75	140.86	24.93	165.79	63.83	44.61	13.26	4.37	17.50	8.73	10.60
1980-81	304-16	140.29	34.63	172.63	67.46	39.55	11.99	3.58	16.74	9.72	14.83
1990-91	304.86	143.00	42.74	185.75	67.81	40.48	11.40	3.82	15.00	9.66	13.70
2000-01	305.19	141.34	44.00	185.34	69.84	41.23	10.66	3.44	13.63	10.27	14.76
2005-06	305.45	141.16	51.57	192.73	69.99	42.32	10.44	3.39	13.22	10.70	14.21
2006-07	305.65	139.82	52.56	192.38	70.03	42.73	10.42	3.35	13.27	10.52	15.51
2007-08	305.67	141.02	54.21	195.23	69.96	42.90	10.36	3.40	13.04	10.33	14.65
2008-09	305.84	141.90	53.41	195.31	69.98	43.06	10.34	3.34	12.73	10.29	14.19
2009-10	305.83	139.18	49.81	188.99	69.99	43.32	10.34	3.21	12.95	10.83	16.01
2010-11	305.90	141.58	57.39	198.97	70.01	43.56	10.30	3.21	12.66	10.32	14.27

Source : Agricultural Statistics at a Glance, 2013, pp. 257-58.

cent only in 2010-11. Large parts of the Satluj, Ganga plains, Gujarat plains, Kathiawar plateau, Maharashtra plateau and West Bengal basin have high proportion of cultivated area. This is largely due to gentle slope of the land, fertile alluvial and black soils, favourable climate, excellent irrigation facilities and high density of population. In contrast, mountainous and hilly areas in the Himalayan region and some of the drier tracts are not much suited to farming because of rugged topography, unfavourable climate and infertile soils.

2. Area sown more than once

As the name indicates, this area is used to grow more than one crop in a year. According to **Table 19.1,** the total cropted area has increased from 185.34 million hectares in 2000-01 to 198.97 hectares in 2010-11. This means that the area sown more than once has increased from 44.00 million hectares in 2000-01 to 57.39 million hectares in 2010-11. Thus there is a net increase of over 13 million hectares in 'area sown more than once' in a short span of ten years. This is healthy trend and this pace of increasing area sown more than once should be kept if we really want to be self-sufficient in food grains and succeed in our mission of food security in view of the rapidly increasing population. This type of area comprises of land with rich fertile soils and regular water supply. It is clear that the percentage of area sown more than once is rather low in India as a whole. This is attributed to infertile soils, deficiency of moisture and insufficient use of manures and fertilizers. This type of land is of special significance. Since almost all the arable land has already been brought under plough, the only course left to increase the agricultural production is to increase the intensity of cropping which can be done by increasing the area sown more than once. Large tracts of the Indo-Ganga plain in

Punjab, Haryana, Uttar Pradesh and Bihar and in coastal regions have large percentage of area sown more than once.

3. Forest Area

This area includes all land classified either as forest under any legal enactment, or administered as forest whether state owned or private and whether wooded or maintained as potential forest land. The area of crops grown in the forest and grazing lands or areas open for grazing within the forests remain included under the forest area. Forests cover about 23 per cent of the reported area which is a definite improvement against 14 per cent in 1950-51. However, 23 per cent of forest land to the total reporting area is not sufficient for a tropical country like India where about 33 per cent of the total land should be under forests. This will require massive tree plantations and vigorous restrictions on the reckless felling of trees. According to the expert committee recommendations, much of the area reclaimed from the forest for agriculture should be retired from cultivation and brought back under forests to save the land from the adverse effects of deforestation.

4. Land not available for cultivation

This class consists of two types of land *viz.* (*i*) land put to non agricultural uses and (*ii*) barren and unculturable waste. The area put to non-agricultural uses includes land occupied by villages, towns, roads, railways or under water *i.e.* rivers, lakes, canals, tanks, ponds, etc. The barren land covers all barren and uncultivated lands in mountains and hill slopes, deserts and rocky areas. These areas cannot be brought under plough except at high input cost with possible low returns. The amount of this land has been variable right from 1950-51 to 2010-11, the data for which are available. Land not available for cultivation increased from 41.48 million hectares in 2000-01 to 43.56 million hectares in 2010-11 and accounted for 14 per cent of the total reported area in 2010-11. The largest amount of land in this category is in Andhra Pradesh followed by Rajasthan, Himachal Pradesh, Maharashtra, Madhya Pradesh, Gujarat, Uttar Pradesh and Bihar.

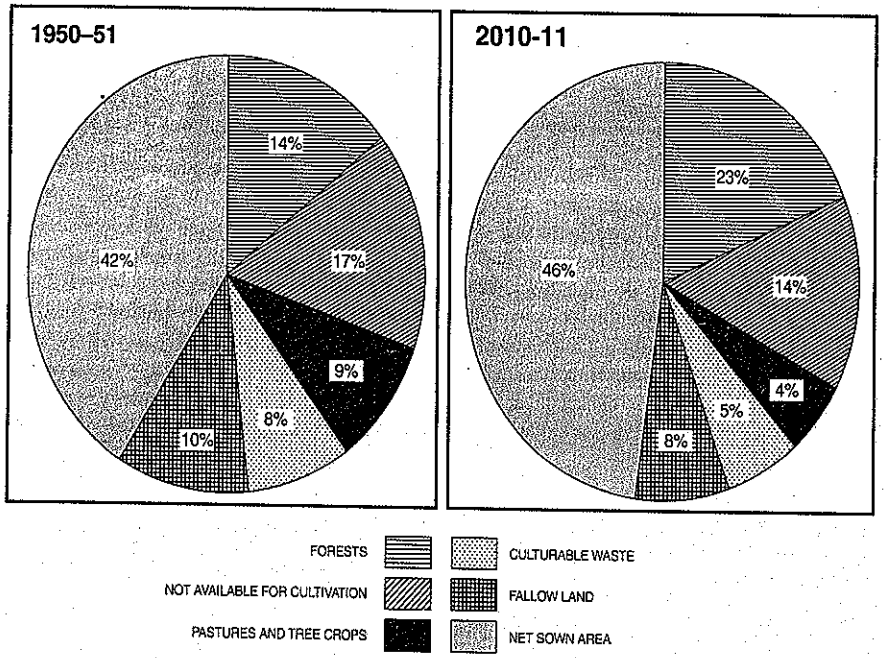


FIG. 19.1. India : Land use 1950-51 and 2010-11

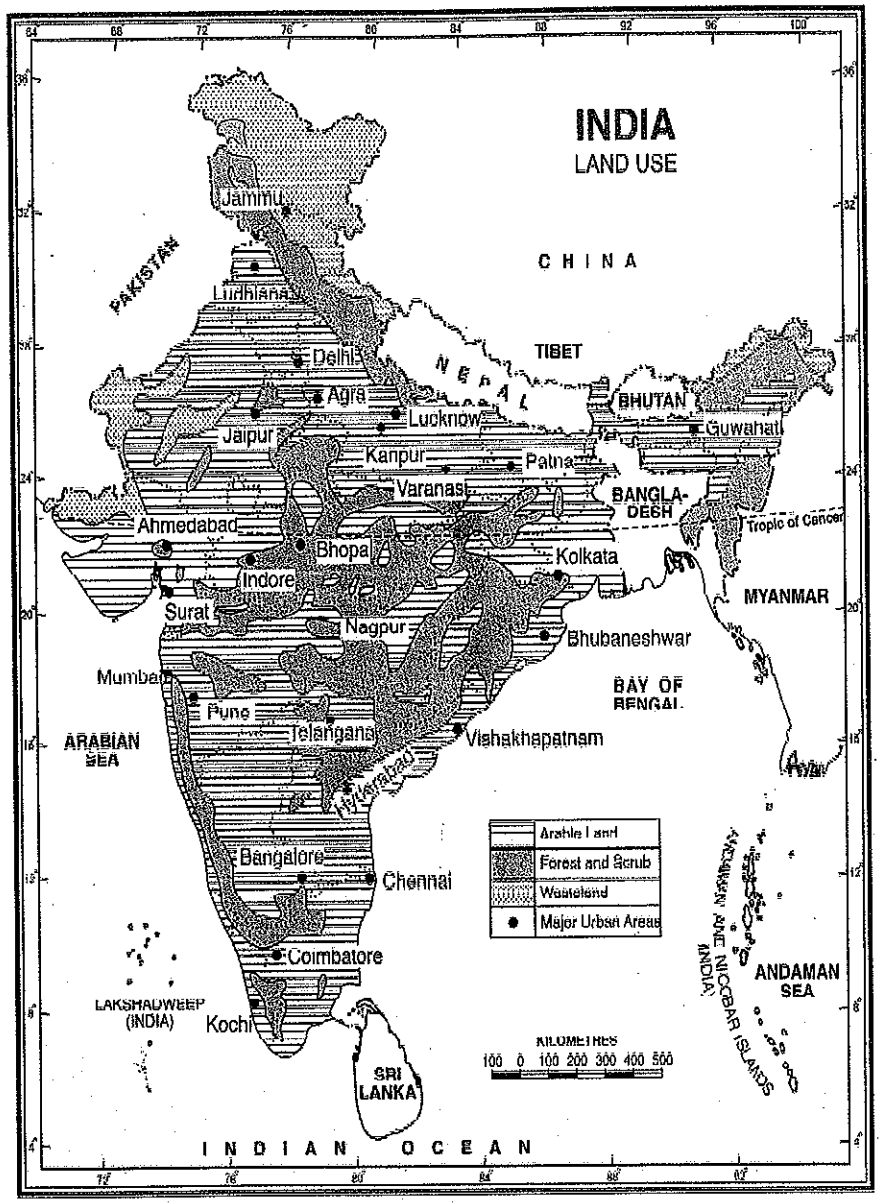


FIG. 19.2. India : Land use

5. Permanent pastures and other grazing lands

A total area of 10.3 million hectares is devoted to permanent pastures and other grazing lands. This amounts to about 4 per cent of the total reporting area of the country. Grazing takes place mostly in forests and other uncultivated land wherever pasturage is available. The area presently under pastures and other

TABLE 19.2. Pattern of Land Utilisation in India (1999-2000) *('000 hectares)*

State/Union Territory	Reporting area for land utilisation statistics	Forests	Not available for cultivation	Permanent pastures and other grazing lands	Land under Miscellaneous tree crops and groves (not included in net sown area)	Cultureable waste land	Fallow lands other than current fallows	Current fallows	Net area sown	Area sown more than once	Total cropped area
States											
Andhra Pradesh	27,505	6,230	4,890	554	290	626	1,490	2,229	11,186	3,326	14,512
Arunachal Pradesh	5,661	5,154	64	18	37	64	70	40	213	65	278
Assam	7,850	1,853	2,626	160	196	77	50	79	2,811	1,349	4,160
Bihar	9,360	622	2,131	16	245	45	122	920	5,259	1,935	7,194
Chhattisgarh	13,790	6,336	1,019	855	1	355	275	253	4,697	—	5,671
Goa	361	125	37	1	1	53	—	13	131	29	160
Gujarat	19,069	1,834	3,723	851	4	1,960	16	379	10,302	1,945	12,247
Haryana	4,370	39	624	27	11	27	3	122	3,518	2,987	6,505
Himachal Pradesh	4,550	1,103	1,122	1,503	68	135	20	59	539	410	949
Jammu & Kashmir	3,781	2,023	678	119	66	135	26	101	732	408	1140
Jharkhand	7,970	2,239	1,372	110	93	336	1,045	1,729	1,085	—	1,249
Karnataka	19,050	3,072	2,217	912	286	414	426	1,199	10,523	2,539	13,062
Kerala	3,886	1,082	510	0	4	92	96	76	2,072	575	2,647
Madhya Pradesh	30,756	8,697	3,424	1,328	28	1,088	568	503	15,119	6,927	22,046
Maharashtra	30,758	5,216	3,179	1,242	250	919	1,179	1,366	17,406	6,663	24,069
Manipur	2,125	1,742	27	1	0	8	0	0	348	0	348
Meghalaya	2,235	946	238	—	163	392	155	58	284	54	338
Mizoram	2,109	1,585	95	5	37	7	182	67	130	3	133
Nagaland	1,625	863	89	—	103	52	100	55	155	107	362
Odisha	15,472	5,814	2,279	513	220	520	567	877	4,682	747	5,429
Punjab	5,033	294	533	4	4	4	4	33	4,158	3,725	7,883
Rajasthan	34,270	2,473	4,268	1,694	21	4,233	1,726	1,235	18,349	7,216	25,565
Sikkim	693	584	11	—	4	4	5	9	77	75	152
Tamil Nadu	13,033	2,125	2,666	110	252	331	1,580	1,015	4,954	799	5,753
Tripura	1,049	629	141	2	14	4	2	2	256	94	350
Uttar Pradesh	24,170	1,658	3,321	66	354	426	538	1,215	16,593	8,790	25,383
Uttarakhand	5,673	3,485	442	199	386	310	84	43	723	—	1,170
West Bengal	8,684	1,174	1,840	5	53	29	18	574	4,991	4,035	9,563
Union Territory											
A. & N. Islands	757	717	9	4	4	3	3	3	15	4	19
Chandigarh	7	0	5	—	0	—	0	0	1	1	2
D. & N. Haveli	49	20	4	1	—	0	4	2	17	5	22
Daman & Diu	4	—	0	0	0	0	0	0	3	0	3
Delhi	147	—	1	93	0	1	10	8	12	8	20
Lakshadweep	3	0	—	—	—	—	—	—	3	4	7
Pondicherry	49	19	—	1	5	2	3	6	19	12	31

Source : Agricultural Statistics at a Glance. 2013, pp. 264-69.

grazing lands is not sufficient keeping in view the large population of livestock in the country. About one-third of the reporting area in Himachal Pradesh is under pastures. The proportion varies from 4 to 10 per cent in Madhya Pradesh, Karnataka, Gujarat, Rajasthan, Maharashtra and Odisha. It is less than 3 per cent in the remaining parts of the country.

6. Land under miscellaneous tree crops and groves

Land under miscellaneous tree crops and groves includes all cultivable land which is not included under net area sown, but is put to some agricultural use. Land under casuarina trees, thatching grass, bamboo, bushes, other groves for fuel, etc. which are not included under orchard are classed under this category. Land under this category declined sharply from 19.8 million hectares in 1950-51 to only 4.46 million hectares in 1960-61 and further to 4.29 million hectares in 1970-71. Thus the percentage of this land fell from 6.97 per cent in 1950-51 to a mere 1.49 per cent in 1960-61 and further to 1.41 per cent in 1970-71. After that juncture the area under miscellaneous tree crops and groves has shown varying trends and stood at 3.21 million hectares or 1 per cent of the total reporting area in 2010-11. Odisha has the largest area in this category followed by Uttar Pradesh, Bihar, Karnataka, Andhra Pradesh Assam and Tamil Nadu.

7. Culturable waste

The "wasteland survey and reclamation committee" defines "culturable waste" as *the land available for cultivation but not used for cultivation for one reason or the other*. This land was used in the past but has been abandoned for some reason. It is not being used at present due to such constraints as lack of water, salinity or alkalinity of soil, soil erosion, waterlogging, an unfavourable physiographic position, or human neglect. Reh, bhur, usar, and khola tracts of Uttar Pradesh, Punjab and Haryana as well as in several other parts of the country were used for agriculture in the past but had to be abandoned due to some deficiencies in the soil resulting from faulty agricultural practices. The land under this category has declined considerably from about 22.9 million hectare in 1950-51 to 13.8 million hectare in 1999-2000. In 2010-11, the culturable waste and was estimated to be about 5 per cent of the total area about which statistics were available. This decline in the wasteland is due to some land reclamation schemes launched in India after Independence. About one-sixth of the total reporting area in Goa is termed as culturable waste. Rajasthan has 4.3 lakh hectare of cultivable waste land which is about 36 per cent of the total waste land of India. The other states with considerable culturable waste land are Gujarat (13.6%), Madhya Pradesh (10.2%), Uttar Pradesh (6.93%) and Maharashtra (6.83%). The cultivable waste, if brought under cultivation can be an important factor in augmenting the country's agricultural production. However, in the interest of long term conservation and maintenance of ecobalance, this land should be put under afforestation and not under crop farming. National Remote Sensing Agency (NRSA), Hyderabad is making valuable contribution in mapping the wastelands in India through satellite imageries.

8. Fallow lands

This category includes all that land which was used for cultivation but is temporarily out of cultivation. Fallow land is of two types *viz., current fallow* and *fallow other than current fallow*. Fallow of one year is called ***'current fallow'*** while that of 2 to 5 years is classified as 'fallow other than current fallow'. Fallow land is left uncultivated from 1 to 5 years to help soil recoup its fertility in the natural way depending upon the nature of soil and the nature of farming. There have been varying trends in the extent of current fallow and it amounted to 5 per cent of the reported area in 2010-11. But there had been a sharp decline in fallow lands other than current fallow. In the year 2010-11 about 3 per cent of the reported areas was found to be 'follow land other than current fallow'. The largest area of over 1.7 million hectare of 'fallow land other than current fallow' is in Rajasthan followed by 1.5 million hectares in Andhra Pradesh and over one million hectares in Maharashtra. The distribution of the curent fallow on the other hand presents a slightly different picture. Andhra Pradesh with about 2.2 million hectares has the largest area as current fallow. This is followed by over 1.3 million hectares in Maharashtra, 1.2 million hectares in Rajasthan, 1.2 million hectares in Uttar Pradesh, 1.2 million in Karnataka, 1.01 million hectares in Tamil Nadu and over one million hectares in Uttar Pradesh.

There is need to reduce the extent and frequency of fallow land in order to increase agricultural production. This can be done by proper dose of fertilizers, providing irrigation facilities, crop rotation and combination and several other similar farm techniques.

REFERENCES

Agricultural Statistics at a glance, 2013. Govt. of India, Ministry of Agriculture.

Banerjee, Bireswar (1992) : *Strategies for Restoration of Wastelands in India,* in Mehdi Raza (ed.) *Development and Ecology,* Rawat Publications, Jaipur.

Bhumbla, D.R. and Khare, A. (1994) : *Estimate of Wastelands in India,* Society for promotion of Wastelands Development, New Delhi.

Classification of area and irrigated area (1966-67) : Directorate of Economics and Statistics, Ministry of Food and Agriculture, New Delhi.

Gautam, N.C. and Narayan, L.R.A. (1988) : *Wastelands in India,* Pink, Mathura.

Indian Agriculture in Brief (1986) : Directorate of Economics and Statistics, Ministry of Agriculture, New Delhi.

Negi, B.S. : *Rural Geography,* Kedar Nath Ram Nath, Meerut.

Singh, Abha Laxmi. (1985) : *The Problem of Wastelands in India,* B.R. Publishing Corporation, Delhi.

Singh, H.S. (1988) : *Land use in relation to Agro-climatic Zones in India in Proc. National Symp.* Remote Sensing in Rural Development, H.A.U., Hisar.

Singh, Jagdish (1991) : *Optimum Land use in Eco-Development Perspective* in Jaymala Diddee, *Emerging Trends in Indian Geography,* Rawat Publications, Jaipur.

Statistical Year Book of India : 2013, Govt. of India.

Study and Survey and Reclamation of Ravines in India (1955) : Planning Commission, New Delhi.

Study of Wastelands Including Saline, Alkaline and Water-logged Lands and their Reclamation Measures (1962) : Planning Commission, New Delhi.

Yadav, H.R. (1990) : *Reclaiming Wastelands,* Concept Publishing Co., New Delhi.

Agriculture

INTRODUCTION

Agriculture includes raising of crops from the land, animal husbandry, agroforestry and pisciculture. India is pre-eminently an agricultural country. Agriculture has been practised in India since time immemorial. It plays a vital role in the economy of India. Till 1971, about 80 per cent of India's population lived in rural areas and depended directly or indirectly on agriculture. It contributed about 45 per cent of Gross Domestic Production (GDP) at that time. The relative importance of agriculture has reduced considerably since then due to rapid development of other occupations such as mining, manufacturing, transport, trade and services. Today, agriculture and allied sectors contribute nearly 14.4 per cent of GDP, while about 55 per cent of the population is dependent on agriculture for their livelihood, and it still forms the hub of India's economy. In addition to providing food and fodder to large population of human beings and livestock respectively, agriculture is the main source of raw materials for several key industries. Sugarcane, cotton, jute and oil seeds are some of the outstanding agricultural raw materials used in industries.

India is a unique country from agricultural point of view. Its enormous expanse of level plains, rich soils, high percentage of culturable land, wide climatic variety with adequate aggregate rainfall combined with sufficient temperature, ample sunshine and long growing season provide solid base to agriculture.

A healthy and advanced agriculture creates demand for several industrial products like tractors, harvestors, threshers, chemical fertilizers, pesticides, etc. Moreover, income generated in the agricultural sector creates ready market for various manufactured goods. Thus agriculture has double relation with industry. It acts as a supplier of raw materials to the industries and as consumer of industrial products. It goes without saying that the prosperity of industrial sector largely depends upon the agricultural prosperity. In fact, prosperity of the entire nation depends upon the prosperity of agriculture.

Agricultural sector also contributes a lot to the export trade of India. Bulk of India's export trade consists of agricultural products and agro-processed products. The major agricultural commodities of export are tea, coffee, cashew kernels, raw cotton, oil cakes, tobacco, spices, fruits and vegetables. There is great need to increase agricultural production so that sufficient exportable surplus commodities are available after meeting our domestic requirements.

From the above discussion, it can be concluded that agriculture furnishes the central sinew of Indian economy. A prosperous farmer means a prosperous nation.

SALIENT FEATURES OF INDIAN AGRICULTURE

Indian agriculture has its own peculiarities. Some of the outstanding features of Indian agriculture are mentioned as follows.

1. Subsistence agriculture. Most parts of India have subsistence agriculture. The farmer owns a small piece of land, grows crops with the help of his family members and consumes almost the entire farm produce with little surplus to sell in the market. This type of agriculture has been practised in India for the last several hundreds of years and still prevails in spite of the large scale changes in agricultural practices after Independence.

2. Pressure of population on agriculture. The population in India is increasing at a rapid pace and exerts heavy pressure on agriculture. Agriculture has to provide employment to a large section of work force and has to feed the teeming millions. While looking into the present need of food grains, we require an additional 12-15 million hectares of land to cope with the increasing demands. Moreover, there is rising trend in urbanization. As much as 31.16 per cent of the Indian population lived in urban areas in 2011 and it is estimated that over half of the total population of India would be living in urban areas by 2025 A.D. This requires more land for urban settlements which will ultimately encroach upon agricultural land. It is now estimated that about 4 lakh hectares of farm land is now being diverted to non-agricultural uses each year.

3. Importance of animals. Animal force has always played a significant role in agricultural operations such as ploughing, irrigation, threshing and transporting the agricultural produces. Complete mechanisation of Indian agriculture is still a distant goal and animals will continue to dominate the agricultural scene in India for several years to come.

4. Dependent upon monsoon. Indian agricluture is mainly dependent upon monsoon which is uncertain, unreliable and irregular. In spite of the large scale expansion of irrigation facilities since Independence, less than one-third of the total cropped area is provided by perennial irrigation and the remaining two-third of the cropped area has to bear the brunt of the vagaries of the monsoons.

5. Variety of crops. India is a vast country with varied types of relief, climate and soil conditions. Therefore, there is a large variety of crops grown in India. Both the tropical and temperate crops are successfully grown in India. Very few countries in the world have a variety of crops comparable to that produced in India.

6. Predominance of food crops. Since Indian agriculture has to feed a large population, production of food crops is the first priority of the farmers almost everywhere in the country. More than two-thirds of the total cropped area is devoted to the cultivation of food crops. Area under foodgrains increased from 121.05 million hectare in 2000-01 to 126.77 million hectares in 2010-11 and there is not much scope for further increase in area under foodgrains because more than 85 per cent of the net sown area is already under foodgrains.

7. Insignificant place to given fodder crops. Although India has the largest population of livestock in the world, fodder crops are given a very insignificant place in our cropping pattern. Only four per cent of the reporting area is devoted to permanent pastures and other grazing lands. This is due to pressing demand of land for food crops. The result is that the domestic animals are not properly fed and their productivity is very low compared to international standards.

8. Seasonal pattern. India has three major crop seasons.

(*i*) ***Kharif*** season starts with the onset of monsoons and continues till the beginning of winter. Major crops of this season are rice, maize, jowar, bajra, cotton, sesamum, groundnut and pulses such as *moong*, *urad*, etc.

(*ii*) ***Rabi*** season starts at the beginning of winter and continues till the end of winter or beginning of summer. Major crops of this season are wheat, barley, jowar, gram and oil seeds such as linseed, rape and mustard.

(*iii*) ***Zaid*** is summer cropping season in which crops like rice, maize, groundnut, vegetables and fruits are grown. Now some varieties of pulses have been evolved which can be successfully grown in summer.

9. Mixed Cropping. Mixed cropping is one of the chief characteristics of Indian agriculture particularly in the rain-fed areas. Sometimes four to five crops are grown simultaneously in the same field and in areas Jhuming (shifting agriculture) ten to fifteen area mixed in one field. The popular crops are millets, maize and pulses in the *kharif* season and wheat, gram and barley in the *rabi* season. This is done to ensure good agricultural production keeping in view the vagaries of the monsoon rainfall and uncertain weather conditions. If the amount of rainfall is good, rice crop will give better output and if there is failure of the moonsoon rains, then less water requiring crops such as maize, millets and pulses will give better yields. Mixed cropping is a characteristic of subsistent agriculture and this practice reduces the overall agricultural output and per hectare yield.

10. High percentage of reporting area under cultivation. In the year 2010-11, 141.58 million hectares was the net sown area out of total reporting area of 305.57 million hectares. Thus nearly 46 per cent of the total reporting area is under cultivation. This is a very high percentage when compared to some of the advanced countries like 16.3% in U.S.A., 14.9% in Japan, 11.8% in China, and only 4.3% in Canada.

11. Labour intensive. In large parts of India, agriculture is labour intensive as most of agricultural operations like ploughing, levelling, sowing, weeding, pruning, sprinkling, spraying, harvesting, thrashing, etc. are done by the farmers and their animals. Mechanisation of farming is prevalent in Punjab, Haryana, and western part of Uttar Pradesh and in these area too, it is the privilege of the rich farmers only. Farm mechanism in packing up in Uttarakhand, Gujarat and Maharashtra also where limited areas use farm machinery.

PROBLEMS OF INDIAN AGRICULTURE AND THEIR SOLUTIONS

Indian agriculture is plagued by several problems; some of them are natural and some others are man-made. Some of the major problems and their possible solutions have been discussed as follows.

1. Small and fragmented land-holdings. The seemingly abundance of net sown area of 141.58 million hectares and total cropped area of 198.97 million hectares (2010-11) pales into insignificance when we see that it is divided into economically unviable small and scattered holdings. The average size of holdings was 2.28 hectares in 1970-71 which was reduced 1.16 hectares in 2010-11. The size of the holdings will further decrease with the infinite sub-division of the land holdings. The problem of small and fragmented holdings is more serious in densely populated and intensively cultivated states like Kerala, West Bengal, Bihar and eastern part of Uttar Pradesh where the average size of land holdings is less than one hectare and in certain parts it is less than even 0.5 hectare. It has been estimated that over two-thirds of the landholdings are less than one hectare and only 0.7 per cent are over 10.0 hectares in size.

The main reason for this sad state of affairs is our inheritance laws. The land belonging to the father is equally distributed among his sons. According to new inheritance law, even daughters are entitled to share the father's property. This distribution of land does not entail a collection or consolidated one, but its nature is fragmented. Different tracts have different levels of fertility and are to be distributed accordingly. If there are four tracts which are to be distributed between two sons, both the sons will get smaller plots of each land tract. In this way the holdings become smaller and more fragmented with each passing generation.

Sub-division and fregmentation of the holdings is one of the main causes of our low agricultural productivity and backward state of our agriculture. A lot of time and labour is wasted in moving seeds, manure, implements and cattle from one piece of land to another. Irrigation becomes difficult on such small and fragmented fields. Further, a lot of fertile agricultural land is wasted in providing boundaries. Under such circumstances, the farmer cannot concentrate on improvement.

The only answer to this ticklish problem is the *consolidation of holdings* which means the reallocation of holdings which are fragmented, the creation of farms which comprise only one or a few parcels in place of multitude of patches formerly in the possession of each peasant. But unfortuantely, this plan has not succeeded much. Although legislation

for consolidation of holdings has been enacted by almost all the states, it has been implemented only in Punjab, Haryana and in some parts of Uttar Pradesh.

2. Seeds. Seed is a critical and basic input for attaining higher crop yields and sustained growth in agricultural production. Distribution of assured quality seed is as critical as the production of such seeds. Unfortunately, good quality seeds are out of reach of the majority of farmers, especially small and marginal farmers mainly because of exorbitant prices of better seeds. In order to solve this problem, the Government of India has taken several steps so that quality seeds are made available to farmers in sufficient quantity at reasonable prices. But the benefit of schemes launched by the government still remain out of reach of the small and marginal farmers.

3. Manures, Fertilizers and Biocides. Indian soils have been used for growing crops over thousands of years without caring much for replenishing. This has led to depletion and exhaustion of soils resulting in their low productivity. The average yields of almost all the crops are among the lowest in the world. This is a serious problem which can be solved by using more manures and fertilizers. Manures and fertilizers play the same role in relation to soils as good food in relation to body. Just as a well-nourished body is capable of doing any good job, a well nourished soil is capable of giving good yields. It has been estimated that about 70 per cent of growth in agricultural production can be attributed to increased fertilizer application. Thus increase in the consumption of fertilizers is a barometer of agricultural prosperity. However, there are practical difficulties in providing sufficient manures and fertilizers in all parts of a country of India's dimensions inhabited by poor peasants. Cow dung provides the best manure to the soils. But its use as such is limited because much of cow dung is used as kitchen fuel in the shape of dung cakes. Reduction in the supply of fire wood and increasing demand for fuel in the rural areas due to increase in population has further complicated the problem. Chemical fertilizers are costly and are often beyond the reach of the poor farmers. The fertilizer problem is, therefore, both acute and complex.

It has been felt that organic manures are essential for keeping the soil in good health. The country has a potential of 650 million tonnes of rural and 160 lakh tonnes of urban compost which is not fully utilized at present. The utilization of this potential will solve the twin problem of disposal of waste and providing manure to the soil.

The government has given high incentive especially in the form of heavy subsidy for using chemical fertilizers. There was practically no use of chemical fertilizers at the time of Independence. As a result of initiative by the government and due to change in the attitude of some progressive farmers, the consumption of fertilizers increased tremendously.

Pests, germs and weeds cause heavy loss to crops which amounted to about one-third of the total field produce at the time of Independence. Biocides (pesticides, herbicides and weedicides) are used to save the crops and to avoid losses. The increased use of these inputs has saved a lot of crops, especially the food crops from unnecessary wastage. But indiscriminate use of biocides has resulted in wide spread environmental pollution which takes its own toll.

4. Irrigation. Although India is the second largest irrigated country of the world after China, only one-third of the total cropped area is under irrigation. Irrigation is the most important agricultural input in a tropical monsoon country like India where rainfall is uncertain, unreliable and erratic. India cannot achieve sustained progress in agriculture unless and until more than half of the cropped area is brought under assured irrigation. This is testified by the success story of agricultural progress in Punjab, Haryana and western part of Uttar Pradesh where over half of the cropped area is under irrigation. Large tracts still await irrigation to boost the agricultural output. However, care must be taken to safeguard against ill effects of over irrigation especially in areas irrigated by canals. Large tracts in Punjab and Haryana have been rendered useless (areas affected by salinity, alkalinity and waterlogging), due to faulty irrigation. In the Indira Gandhi Canal command area also intensive irrigation has led to sharp rise in sub-soil water level, leading to waterlogging, soil salinity and alkalinity.

5. Lack of mechanisation. In spite of the large scale mechanisation of agriculture in some parts of the country, most of the agricultural operations in larger parts are carried on by human hand using

simple and conventional tools and implements like wooden plough, sickle, etc. Little or no use of machines is made in ploughing, sowing, irrigating, thinning and pruning, weeding, harvesting, threshing and transporting the crops. This is specially the case with small and marginal farmers. It results in huge wastage of human labour and in low yields per capita labour force.

There is urgent need to mechanise the agricultural operations so that wastage of labour force is avoided and farming is made convenient and efficient. Agricultural implements and machinery are a crucial input for efficient and timely agricultural operations, facilitating multiple cropping and thereby increasing production.

Some progress has been made for mechanising agriculture in India after Independence. Need for mechanisation was specially felt with the advent of Green Revolution in 1960s. Strategies and programmes have been directed towards replacement of traditional and inefficient implements by improved ones, enabling the farmer to own tractors, power tillers, harvesters and other machines. A large industrial base for manufacturing of the agricultural mechines has also been developed. Power availability for carrying out various agricultural operations has been increased. This increase was the result of increasing use of tractors, power tillers and combine harvesters, irrigation pumps and other power operated machines. Strenuous efforts are being made to encourage the farmers to adopt technically advanced agricultural equipments in order to carry farm operations timely and precisely, and to economise the agricultural production process.

6. Agricultural Marketing. Agricultural marketing still continues to be in a bad shape in rural India. In the absence of sound marketing facilities, the farmers have to depend upon local traders and middlemen for the disposal of their farm produce which is sold at throw-away price. In most cases, these farmers are forced, under socio-economic conditions, to carry on distress sale of their produce. In most of small villages, the farmers sell their produce to the money lender from whom they usually borrow money. According to an estimate 85 per cent of wheat and 75 per cent of oil seeds in Uttar Pradesh, 90 per cent of jute in West Bengal, 70 per cent of oilseeds and 35 per cent of cotton in Punjab is sold by farmers in the village itself. Such a situation arises due to the inability of the poor farmers to wait for long after harvesting their crops. In order to meet his commitments and pay his debt, the poor farmer is forced to sell the produce at whatever price is offered to him. The Rural Credit Survey Report rightly remarked that the producers in general sell their produce at an unfavourable place and at an unfavourable time and usually they get unfavourable terms. In the absence of an organised marketing structure, private traders and middlemen dominate the marketing and trading of agricultural produce. The remuneration of the services provided by the middlemen increases the load on the consumer, although the producer does not derive similar benefit. Many market surveys have revealed that middlemen take away about 48 per cent of the price of rice, 52 per cent of the price of grounduts and 60 per cent of the price of potatoes offered by consumers.

In order to save the farmer from the clutches of the money lenders and the middle men, the government has come out with regulated markets. These markets generally introduce a system of competitive buying, help in eradicating malpractices, ensure the use of standardised weights and measures and evolve a suitable machinery for settlement of disputes thereby ensuring that the producers are not subjected to exploitation and receive remunerative prices.

7. Inadequate storage facilities. Storage facilities in the rural areas are either totally absent or grossly inadequate. Under such conditions the farmers are compelled to sell their produce immediately after the harvest at the prevailing market prices which are bound to be low. Such distress sale deprives the farmers of their legitimate income.

The Parse Committee estimated the post-harvest losses at 9.3 per cent of which nearly 6.6 per cent occurred due to poor storage conditions alone. Scientific storage is, therefore, very essential to avoid losses and to benefit the farmers and the consumers alike. At present there are number of agencies engaged in warehousing and storage activities. *The Food Corporation of India* (F.C.I.), the *Central Warehousing Corporation* (C.W.C.) and *State Warehousing Corporation* are among the principal agencies engaged in this task. These agencies help in building up buffer stock, which can be used in the

hour of need. The Central Government is also implementing the scheme for establishment of national *Grid of Rural Godowns* since 1979-80. This scheme provides storage facilities to the farmers near their fields and in particular to the small and marginal farmers. The Working Group on additional storage facilities in rural areas has recommended a scheme of establishing a network of *Rural Storage Centres* to serve the economic interests of the farming community.

8. Inadequate transport. One of the main handicaps with Indian agriculture is the lack of cheap and efficient means of transportation. Even at present there are lakhs of villages which are not well connected with main roads or with market centres. Most roads in the rural areas are *Kutcha* (bullock-cart roads) and become useless in the rainy season. Under these circumstances the farmers cannot carry their produce to the main market and are forced to sell it in the local market at low price. Linking each village by metalled road is a gigantic task and it needs huge sums of money to complete this task.

9. Scarcity of capital. Agriculture is an important industry and like all other industries it also requires capital. The role of capital input is becoming more and more important with the advancement of farm technology. *Since the agriculturists' capital is locked up in his lands and stocks*, he is obliged to borrow money for stimulating the tempo of agricultural production. The main suppliers of money to the farmer are the money-lenders, traders and commission agents who charge high rate of interest and purchase the agricultural produce at very low price. *All India Rural Credit Survey Committee* showed that in 1950-51 the share of money lenders stood at as high as 68.6 per cent of the total rural credit and in 1975-76 their share declined to 43 per cent of the credit needs of the farmers. This shows that the money lender is losing ground but is still the single largest contributor of agricultural credit. Rural credit scenario has undergone a significant change and institutional agencies such as *Central Cooperative Banks, State Cooperative Banks, Commercial Banks, Cooperative Credit Agencies* and *some Government Agencies* are extending loans to farmers on easy terms.

10. Tradition Bound. In spite of some breakthroughs, Indian agriculture remains tradition bound even at the dawn of 21st century. Established centuries ago, the structures of a self-contained rural economy, founded in caste-drain occupational land tenure, made complex by absentee and parasitic landlords still continues. The tradition bound institutions have been the greatest hindrance in the way of modernisation and Indian agriculture has been rather slow in responding to new innovative ideas.

11. Primitive Technology. A large proportion of Indian farmers use primitive technology which hinders the requisite progress in agricultural production. They are hand tools like sickel, hoe, etc. and drought animals like bullocks, male buffaloes, camels, etc. as source of motive power in agricultural operations. Although agricultural machinery is replacing the animal and human power, yet the pace of progress is very slow and use of agricultural machinery is the privilege of a few rich farmers in selected states like Panjab, Haryana, Uttar Pradesh only.

12. Dependent on Monsoon Rainfall. In large parts of India irrigation facilities are either totally absent or are partially available and agriculture depends on monsoon rainfall. Unfortunately Indian monsoon rainfall is highly erratic and least dependable. It varies in time and space and variability of rainfall is the highest in areas of least rainfall. Whenever rain fails or there is deficiency of rainfall, the agricultural production drops to a miserably low level. There is overall scarcity of agricultural products in the market and the prices of agricultural products reach sky high. In extreme cases famine conditions prevail and humans and livestock die of hunger and starvation.

13. Lack of Crop Diversification. Crop diversification means growing a large number of crops and reducing dependency on a single crop. Unfortunately in India more emphasis is laid on food crops and other crops are given a secondary status. Although top priority to food crops is necessary in the back drop of fast growing population, neglecting other crops is detrimental to balanced growth of agriculture. Only 3.3 per cent of the reported area is under fodder crops which is very insignificant in view of the fact that India has the largest number of livestock in the world. Further, nitrogen fixing leguminous crops are ignored which leads to imbalance in the composition of soil and reduction in the soil fertility.

14. Low Productivity. In spite of the rapid strides made by India in agricultural field, particularly after the advent of the Green Revolution in 1960s, agricultural productivity in India still remains at a low level. Yield per hectare of almost all the crops is much lower as compared to international standards. This is due to low fertility of soil and little care to replenish is through fertilizers, green manure, fallowing, crop rotation etc. Other inputs like machinery, irrigation, better seeds etc. are also limited to a few selected areas and to a few rich farmers.

15. Government Apathy. Indian agriculture has been the victim of negligence and step motherly treatment by the government. Although agriculture got highest priority in the First Five Year Plan in view of the acute shortage of foodgrains immediately after partition of the country in 1947, agriculture has not been given its due important and more emphasis was laid on industrial growth in the subsequent plans. Farmers do not get remunerative price of their products and most of them permanently remain under debt. Even in some of the so-called rich areas from agriculture point of view like Punjab and Maharashtra, a large number of farmers have committed suicide out of distress and depression. However, the government has become slightly more sensitive to the problems of the farmers and some recognition has been given to agriculture in Tenth and Eleventh Five Year Plans.

16. Lack of Definite Agricultural Land use Policy. There is no definite policy concerning agriculture and land use at the national or regional level and the farmers grow one or the other crop at their own sweet will. It often leads to excess or scarcity of particular crops. In the event of excess crop the farmers are forced to sell their produce at throw away prices. On the contrary consumers are the main suffers when there is shortage of a particular crop.

17. Low fertility of soils. Indian soils have been used for cultivation for the last hundreds of years without much care to restore their fertility. Most of the Indian soils are exhausted and are not capable of giving high yields. They lack in various chemicals and humus which are necessary for high rate of productivity in the agricultural field.

18. Soil Erosion and Soil Degradation. Wrong agricultural practices coupled with reckless felling of trees has led to large scale soil erosion and soil degradation both by water and by wind. Rain water washes away huge amounts of fertile top soil in areas of heavy rainfall during the rainy season and in areas of scanty rainfall, strong winds blow away the fertile top soil.

19. Low Status of Agriculture in Society. In large parts of India agriculture is not given its due place of honour and is considered to be a profession of low status. This leads to disappointment and lack of enthusiasm amongst farmers. Younger generation belonging to families of farmers are no more interested in agricultural profession and tend to opt for petty jobs in government offices. Besides, rich farmers invest their agricultural profits in more lucerative non-agricultural sectors. Rural youth migrate to urban areas in search of non-agricultural or white colored jobs and many of them end up in slums, ghettoes and shanty colonies.

20. Land Tenancy. In many parts of India the actual tillers are not the owners of land and they are forced to till the land of absentee landlords. There are big landlords who own vast stretches of land but do not till the land themselves. The poor landless tanent cultivators do not take much interest in the development of agriculture as a result of which the yields of almost all the crops are at a miserably low level.

21. Lack of Agricultural Research, Education, Training and Extension Services. Although a number of research institutions were established immediately after Independence, and many advancements in agricultural research have been made since then, yet agricultural research hardly matches international standards. Further there is lack of coordination between research laboratories and farms and there is a big vacuum between the two. Farmers, especially small and marginal farmers are deprived of the benefit of the new findings of research laboratories. In a similar way hardly any attention is paid to educate the farmers about the new techniques of agriculture for increasing the farm production. There is need to raise an army of trained and dedicated workers which can help the farmers in coming out of the age old tradition bound agriculture and adopt new innovative ideas and enhance their production and income.

DETERMINANTS OF AGRICULTURE

Agriculture in India is determined by a set of factors. Some of the important factors are listed below.

1. Physical factors. relief, climate, soil.

2. Institutional factors. size of farm holdings, land tenure, land reforms.

3. Infrastructural factors. Irrigation, power, roads, credit, marketing, insurance and storage facilities.

4. Technological factors. High yielding varieties of seeds, chemical fertilizers, insecticidesa and farm machinery.

The above mentioned factors affect the level of agricultural development, cropping patterns and agricultural productivity in a region. A brief review of these factors is given below.

1. PHYSICAL FACTORS

Man's agricultural activities depend to a great extent on the physical environment in which he lives although he often tries to minimize the restriction imposed by various factors of physical environment. For example, he has been able to extend agriculture to arid and semi-arid lands with the help of irrigation, restore soil fertility by using manures and chemical fertilizers and save crops from pests and insects by applying pesticides and insecticides. But these ventures have a limited effect and physical environment has a much deeper impact on agricultural development and agricultural productivity. This is amply clear from the following description regarding the impact of relief, climate, and soils on agriculture.

1. Relief

Relief is the difference of height between the lowest and the highest point in the region and is expressed in terms of height above sea level and gradient of slope.

Effect of Altitude on Agriculture. There is gradual decrease in temperature with increasing atitude which affects agricultural productivity, types of crops and agricultural operations. Depending on altitude following land features and associated crops can be identified.

(*a*) **Plains.** Plains are the most preferred areas for agriculture due to their low altitude and gentle slope. Agricultural operations like ploughing, sowing, weeding and thinning, harvesting etc. are much easier in plain areas than in plateaus or mountains. Plains are usually blessed with fertile soils which offer greater opportunities for agricultural growth. This is the reason the Great Plain of North India is an area of intensive agriculture where rice and wheat are the major food crops. Besides, a large number of commercial crops like cotton, jute, sugarcane, pulses, coarse grains etc. are also grown. In the coastal plains rice is the main crop and orchards of coconut are found all along in coast.

(*b*) **Plateaus.** Plateaus are also useful for agriculture but their suitability for agriculture is less as compared to that of plains. The peninsular plateau of India provides suitable conditions for cultivation of a number of crops including rice, wheat, cotton, sugarcane, tobacco and some plantation crops. However, only selected parts of this vast plateau are suitable for cultivation and several parts of this plateau are characterized by rugged topography, dissected surface, steep scarps, shallow soils, bare rocks and intervening hill slopes.

(*c*) **Mountains.** Mountains are least preferred from agricultural point of view because of high altitude, steep slope, immature soils, low temperature, low pressure, rarified air and shortage of oxygen. Temperature decreases regularly with altitude which determines the types of crops grown on different altitudes and practically no agriculture is possible above 3500 m in the Himalayas. Sher Singh Dhillon (1973 : 75) has identified six fold altitudinal agro-climatic zones based on seasonal rhythm and temperature involving different agricultural practices in the Western Himalayas (**Fig. 20.1**). On the slopes of the Eastern Himalayas and those of the Nilgiri Hills of South India, the plantations dominate the agricultural scene. In South India, coffee plantations are also seen along with tea plantations. In several hilly areas, hill slopes are used for terraced cultivation wherein rice and other crops are grown.

2. Climate

Of all the physical factors, climate is the most potent determinant of agricultural land use and cropping pattern. Various elements of climate like

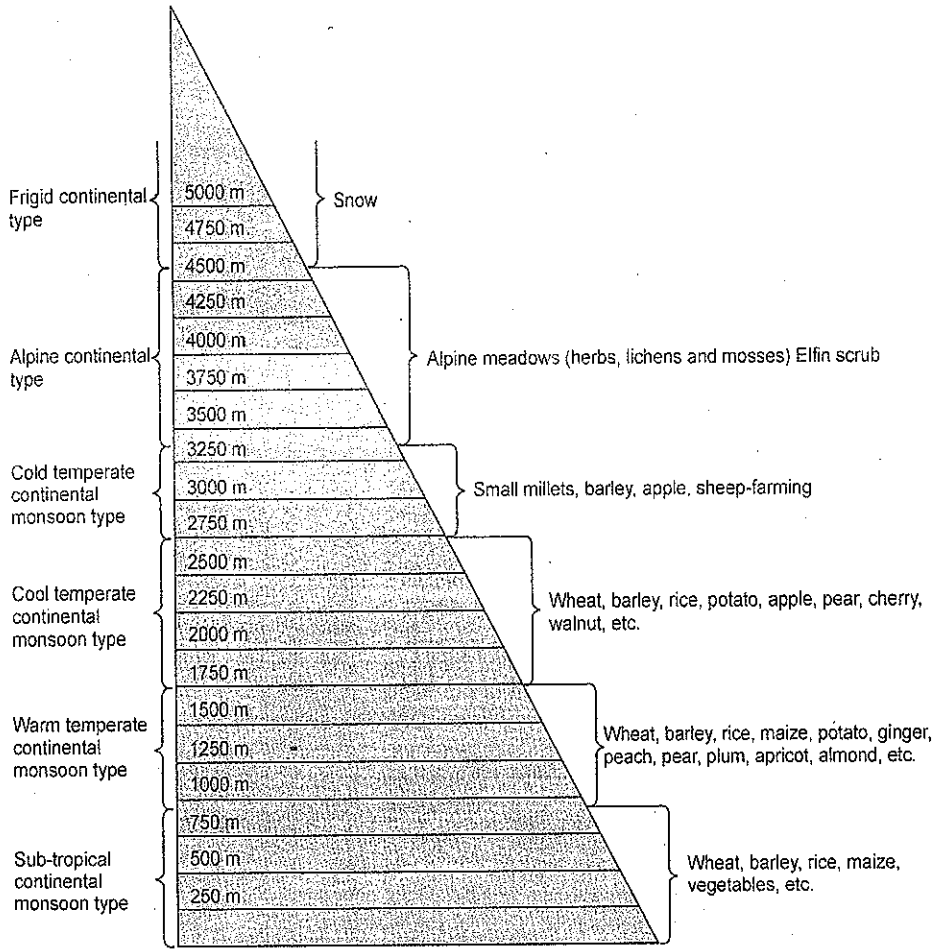


FIG. 20.1. Altitudinal agroclimatic zones in the Western Himalayas (after Dhillon)

temperature, humidity, sun shine and winds influence the agricultural activities in their own respective ways.

I. Temperature. Temperature is a dominant factor which determines the growth of plants. In the absence of suitable temperature conditions germination of seeds, growth of plants are retarded. Temperature regulates all the chemical and physical processes of plant metabolism. The metabolic processes begin at certain minimum temperature and increase with rise in temperature until they such a maximum at a temperature. which is known as ***optimum temperature.*** Further rise in temperature above the optimum level leads to slow down in metabolic activity until it ceases at a temperature called the ***maximum.*** Each species has its own minimum and maximum temperature beyond which its life activity ceases (Kochhar 1967). Each species has also the optimum temperature at which the plant growth is maximum. The minimum, the maximum and the optimum temperature required by plants species are known as ***cardinal temperature points.*** **Wilsie** (1962) has suggested cardinal temperature points for some selected crops which are reproduced in **table 20.1.**

TABLE 20.1. Cardinal temperature points for selected crops (°C)

Crops	Minimum Temperature	Optimum Temperature	Maximum Temperature
Rice	10-12	30-32	36-38
Wheat	4-5	25	30-32
Sugarbeet	4-5	25	28-30
Maize	8-10	31.5-35	38-40
Lentil	4-5	30	36
Tobacco	12.7-14	28	35
Sugarcane	21.1	32.2-37.7	38.5

Source : Wilsie (1962).

Each and every crop needs a certain number of a effective heat units for germination, growth, stalking, maturing and ripening. This is known as ***thermal constant*** which varies from crop to crop. Therefore, temperature above the minimum is effective in furthering the growth of a plant towards maturing and ripening. According to **Schimper** the crucial air temperature is 6°C above which the plants usually start growing. The ideal temperature conditions for crop production are from 18.3°C to 23.9°C.

The above mentioned temperatures conditions affecting different crops are reflected in the areal distribution of crops in India. Low winter temperatures the N.W. India encourage in cultivation of wheat crop while major rice producing areas are confined to South India. However, rice cultivation has become popular in Punjab, Haryana and Uttar Pradesh also due to availability of irrigation facilities. Sugarcane is grown both in North and South India although temperature conditions are more congenial in South India. This is the reason that sugarcane cultivation is slowly shifting from North India to South India. It is because of temperature difference that wheat is grown as a winter crop in Punjab and Haryana and as a summer crop in Ladakh region of Jammu and Kashmir because winter temperature in Ladakh is too low to permit the growth of any crop.

II. Frost. Sudden frost is enemy number one for a number of crops such as cotton. Such crops need frost free season which falls between the end of spring and the beginning of autumn. This period is generally recognized as ***growing season*** which is different for different crops. Statistically, frost-free season refers to all those days when the temperature continuously remains above the freezing point. The correct information of such a period helps farmers to plan their crops and also to have an idea of the extent of damage that could occur. In South India, there is no danger to crops from frost but in North India, the winter temperatures are very low and frost is common phenomenon.

III. Winds. Winds affect the growth of plants both directly and indirectly. The direct effect of strong winds is entirely of mechanical nature. In the months of May and June, strong winds raise a lot of dust and trees are uprooted, or leaves are stripped off and branches and stems of plants twist and break. A lot of raw fruits, such as mangoes, fall down and are bruished. Banana plantations need extra care, particularly when the plantations have borne fruits. Fruit trees are much damaged in the coastal regions whenever tropical cyclones originating in the Bay of Bengal and Arabian Sea hit these areas.

The indirect effect of winds is apparent on plants physiology. Transpiration from plants adds moisture to the surrounding air. Crops gradually dry up and the moisture diffuses into the surrounding atmosphere. The locally saturated atmosphere retards further transpiration and promotes the plant growth. However, if the wind is dry and strong, it will deprive the plants of its moisture and may cause heavy damage to plants.

Winds are also great agent of erosion, transportation and deposition of soil. In dry areas winds carry soil to such an extent that, sometimes, basal rock is visible and the land becomes unfit for cultivation. Such a phenomenon can often be observed in Rajasthan and the adjoining areas of Haryana and Gujarat.

IV. Snow. Snow has a deep impact on livestock and cropping in the higher reaches of the Himalayan region Snowy winter in these areas cause a severe loss to pastures due to thick snow cover on the grains. Hill sheep farming is adopted to snow conditions and flocks are moved to safer places. **Transhumance** is a common phenomenon in Jammu and Kashmir and in Himachal Pradesh. In these areas, shepherds move down slopes along with their flocks in winter and up slopes in summer to make use of pasture lands.

Winter snow blocks transport routes of all kinds and agricultural fields as well markets become inaccessible. All agricultural activities are suspended and are resumed only with the onset of summer.

Snow has a number of benefits also for agriculture. It provides cool climate to orchards, especially those of apples at sufficiently lower altitudes. Snow melt in summer provides large quantities of water for irrigation and for other purposes in daily life. Some of the snow melt water is available in the form of springs which is very rich in mineral contents and acts as fertilizer to most of the careal crops. The usual snow cover over standing potato fields in Himachal Pradesh makes farmers happy. The local adage "A good quantum of snow means to bumper potato crop in hand" still holds goods.

V. Humidity or Moisture. Humidity is of paramount importance as all crops need moisture for their proper growth. It has already been mentioned that for every crop, there is optimum temperature. Similarly for each crop there is optimum moisture. Maintenance of optimum moisture in the soil is very important because plants draw moisture from the soil through root system. Excessive moisture reduces the quantity of oxygen in the soil and increases the formation of compounds that are toxic to plant roots. Such a situation leads to stunted growth of plants. If the surface water goes to the subsoil in large quantities, it will deplete plant nutrients and hinder the development of plants. This problem can be solved by proper drainage of the ill-drained areas. On the other extreme, there can be shortage of moisture in the soil due to scarcity of rainfall which can be compensated by irrigation.

VI. Rainfall. Rainfall is the single most dominant climatic element influencing the intensity and location of farming systems and farmer's choice of enterprises. It also becomes a climatic hazard to farming if it is characterized with scantiness, concentration, intensity, variability and unreliability.

The amount of annual rainfall has a great impact on the cropping pattern in different parts of the country. For example rice is the main crop in areas of heavy rainfall whereas wheat is an important crop in areas of lesser rainfall. In fact, isohyete (line joining places of equal rainfall of) 100 cm divides the rice and wheat producing areas in India. Areas with more than 100 cm annual rainfall are predominantly rice producing areas and areas with less than 100 cm annual rainfall are mainly wheat producing regions. In areas of scanty rainfall of less than 50 cm annual rainfall, crops requiring lesser amount of water are grown. Jawar, bajra, maize etc. are such crops.

In addition to total amount of annual rainfall, seasonal distribution of rainfall is also very important. Most of the crops need sufficient amount of rainfall during the period of growth and practically dry season at the time of ripening. For example, rainfall in the month of September in northern India is extremely important for the cultivation of rice crop. Winter rainfall in north-western part of India is very useful for wheat crop. Ragi crop is adversely affected in south India if there is no rainfall in the months of October and November. Drought conditions prevail in the event of less than normal rainfall. Drought leads crop failure and famine. States of Rajasthan, Gujarat, Madhya Pradesh, Chhattisgarh, Jharkhand, Maharashtra, Andhra Pradesh, Telangana, Karnataka and parts of Punjab, Haryana, Bihar, Tamil Nadu etc. are often affected by drought conditions.

Rainfall effectiveness is as important as amount of total rainfall received in a particular area. It is usually expressed as the actual total rainfall minus the total possible evaporation. Thus the entire amount of water received from rainfall is not available to plant and it is in this context that rainfall effectiveness becomes import. Rainfall effectiveness depends on the total amount of rainfall, as well as temperature and moisture in the air and the wind velocity. It increases with the amount of rainfall and moisture present in air and decreases with increase in air temperature and wind velocity. Some water evaporates from the leaves of the plants. This is known as ***potential evapo-transpiration.*** Therefore, while assessing the rainfall effectiveness total amount of rainfall, evaporation and potential evapotranspiration have to be taken into account.

VII. Sunlight and Sunshine. Sunlight and sunshine are important to plants in two different ways. (*i*) they are useful in photosynthesis and (*ii*) they help in production of chlorophyll. Photosynthesis involves production of special sugar based substances which keeps plants alive. It is generated by the action of sunlight on green matter (chlorophyll) in leaves. Thus all plants depend on sunlight for food and

growth. Better the sunlight, more stout and more compact the individual plants will be. Some plants like sunflower, are so sensitive that its floral part moves from east to west with the movement of the sun.

3. Soils

Soil is of utmost importance to agriculture as each and every plant has its roots in the soil and growth in the soils itself. Soils constitute the physical base for any agricultural enterprise. Great civilizations have almost invariably flourished in areas of fertile soils. In fact, history of civilization is the history of the soil. The agriculture productivity and hence our standard of living largely depends on a combination of physical and chemical characteristics of soils. Physical characteristics of soils include their texture, structure and porosity as well as their colour and temperature. Chemical composition shows ingradients present in the soil which exist in shape of some compounds. These and some of the biological characteristics determine the fertility of the soils which is basic to the proper growth of agricultural crops.

Each crop has some specific requirements of soil and its fertility and each soil is suitable to selected group of crops **(Table 20.2)**.

TABLE 20.2. Suitability of different soils for different crops

Soils	Crops
1. Alluvial soils	Wheat, maize, barley, gram, oilseeds, pulses, sugarcane.
2. Clayey loams, fine and heavy soils	Rice, jute
3. Volcanic black soils or ragur	Cotton, wheat, oilseeds
4. Sandy loams and sandy soils	Jawar, bajra, groundnut, guar, pulses (green gram, red gram, black gram etc.)
5. Red and yellow soils	Jawar, groundnut, sugarcane.

Saline and alkaline soils are the result of wrong irrigation practices and are not fit for cultivation unless they are reclaimed by using chemical fertilizers and biological manure and fertilizers. These are cumbersome processes and involve high cost.

2. INSTITUTIONAL FACTORS

Institutional factors is the second important groups of determinants of agriculture in India. These include land tenure and land tenancy, size of holding and land reforms.

1. Land Tenure and Tenancy. Land tenure and tenancy is a system under which type of land ownership is determined. In the ancient days and in primitive societies like those of shifting cultivators, system of collective ownership was prevalent and land belonged to the entire community. At a later stage land ownership rights were vested in king, government, zamindars or talukdars. The Mughals established a comprehensive system of land revenue administration wherein Jogirdass or Zamindars were responsible for collection of land revenue from the cultivators. The Britishers introduced the system of permanent settlement or Zamindari, Roytwari and Mahalwari with a hope to make the system of revenue collection more effective and to improve agricultural production. After Independence Zamindari was abolished and a number of legislations were passed to restore the right of land to the tillers which could meet only partial success. Also not much success has been achieved to prevent division and fragmentation of holdings.

Land Holdings. As mentioned earlier in this chapter, the average size of land holding is very small. Table 20.3 shows that it reduce from 1.33 hectares in 2000-01 to 1.16 hectare in 2010-11. This table also brings to light the glaring fact that about 67 per cent of the holdings are less than one hectare with average size as low as 0.38 hectare. This size is too small to be economically viable for any effective method of agriculture. The owners of small holdings are not economically strong enough to afford irrigation, fertilizers, insecticides, pesticides, better seeds and farm machinery. Such a situation leads to low yields which India, with fast growing population, cannot afford.

Economic Holding

The Congress Agarian Reforms Committee (1949) defined "an economic holding as one which could provide a reasonable standard of living to the cultivator and give full employment for a family of "normal size". The concept of economic holding has been used to fix the upper limit for size of holdings because no Zamindar can possess more land than three times the economic holding.

TABLE 20.3. Number and Area of Operational Holdings by Size Group

No. of Holdings : ('000 Number)
Area Operated : ('000 Hectares)
Average size: (Hectares)

Category of Holdings	Number of Holdings			Area			Average Size of Holdings		
	2000-01	2005-06	2010-11	2000-01	2005-06	2010-11	2000-01	2005-06	2010-11
1	2	3	4	5	6	7	8	9	10
Marginal (Less than 1 hectare)	75,408 (62.3)	83,694 (64.8)	92,356 (67.0)	29,814 (18.7)	32,026 (20.2)	35,410 (22.2)	0.40	0.38	0.38
Small (1.0 to 2.0 hectares)	22,695 (19.0)	23,930 (18.5)	24,705 (17.9)	32,139 (20.2)	33,101 (20.9)	35,136 (22.1)	1.42	1.38	1.42
Semi-Medium (2.0 to 4.0 hectares)	14,021 (11.8)	14,127 (10.9)	13,840 (10.1)	38,193 (24.0)	37,898 (23.9)	37,547 (23.6)	2.72	2.68	2.71
Medium (4.0 to 10.0 hectares)	6,577 (5.5)	6,375 (4.5)	5,856 (4.3)	38,217 (24.0)	36,583 (23.1)	33,709 (21.2)	5.81	5.74	5.76
Large (10.0 hectares and above)	1,230 (1.0)	1,096 (0.8)	1,000 (0.7)	21,072 (13.2)	18,715 (11.8)	17,379 (10.9)	17.12	17.08	17.37
All Holdings	**1,19,931 (100.0)**	**1,29,222 (100.0)**	**1,37,757 (100.0)**	**1,59,436 (100.0)**	**1,58,323 (100.0)**	**1,59,180 (100.0)**	**1.33**	**1.23**	**1.16**

Figures in parenthesis show percentages
Source: Agricultural statistics at glance 2013 p. 302.

Factors affecting the Size of Economic Land Holding. Size of economic land holding depends on the number of factors which keep on changing from one place to another. Some of the normal factors are briefly described below:

1. Fertility of Soil. Even a small piece of land with fertile soil can feed all the members of the farmer's family. But even a large piece of land is unable to feed the farmer's family members if the soil is not fertile and the farmer needs a larger piece of land for his sustenance. This is the main reason of smaller holdings in more fertile lands and larger holdings in less fertile lands. Simply speaking, size of lands holding is inversely proportioned to the fertility of the soil.

2. Irrigation. Crops get the required supply of water at the time of need in irrigated areas. The yields are higher and there is no fear of crop failure. Thus a small piece of land can enable the farmer to produce enough for his family members. On the contrary crops have to depend on rainfall for their growth in area lacking irrigation facilities and rainfall in India is very erratic. The yields are low and the danger of crop failure looms large. Under such a condition, the farmer needs larger piece of land to feed his family members. Therefore, holdings are usually of large size in areas lacking in irrigation.

3. Type of Agriculture. In area of intensive cultivation even a small piece of land can give high production and holdings are generally of small size. In contrast, in areas of extensive agriculture the yields are low and a large piece of land is required to sustain the farmer and his family members. Thus the size of holdings is quite large in such areas.

4. Farm Mechanisation. Use of farm machinery is not useful practically and economically on small holdings. Hence the size of holdings is large

TABLE 20.4. Average Size of Holdings by Size Group, 2010-11 (Hectares)

State/UT	Marginal	Small	Semi-Medium	Medium	Large	All Holdings
1	2	3	4	5	6	7
A and N islands	0.44	1.43	2.63	4.34	36.88	1.85
Andhra Pradesh	0.44	1.41	2.63	5.56	15.50	1.08
Arunachal Pradesh	0.55	1.34	2.76	5.54	14.90	3.51
Assam	0.42	1.38	2.69	5.15	68.11	1.10
Bihar	0.25	1.25	2.59	5.09	14.45	0.39
Chandigarh	0.46	1.43	2.86	5.70	11.08	1.29
Chhattisgarh	0.44	1.42	2.68	5.71	16.30	1.36
Dadar and Nagar Haveli	0.51	1.37	2.77	5.74	15.46	1.38
Daman and Diu	0.23	1.36	2.56	6.27	19.97	0.38
Delhi	0.42	1.32	2.69	5.56	15.13	1.45
Goa	0.31	1.40	2.74	5.57	22.91	0.93
Gujarat	0.49	1.45	2.77	5.71	19.54	2.11
Haryana	0.46	1.47	2.87	6.09	17.95	2.25
Himachal Pradesh	0.41	1.39	2.72	5.66	15.44	0.99
Jammu and Kashmir	0.35	1.40	2.68	5.43	22.34	0.62
Jharkhand	0.41	1.38	2.74	5.63	15.35	1.17
Karnataka	0.48	1.41	2.68	5.69	14.71	1.55
Kerala	0.13	1.57	2.79	5.32	64.58	0.22
Lakshadweep	0.17	1.36	2.50	6.11	24.00	0.27
Madhya Pradesh	0.49	1.42	2.73	5.76	15.77	1.78
Maharashtra	0.47	1.42	2.67	5.62	16.07	1.45
Manipur	0.52	1.28	2.48	4.86	11.00	1.14
Meghalaya	0.56	1.58	2.75	5.49	17.24	1.37
Mizoram	0.60	1.27	2.42	5.13	15.09	1.14
Nagaland	0.51	1.14	2.59	6.13	17.54	5.99
Odisha	0.57	1.63	2.95	5.99	25.46	1.04
Puducherry	0.35	1.46	2.86	5.72	16.90	0.66
Punjab	0.61	1.38	2.64	5.74	14.75	3.77
Rajasthan	0.49	1.43	2.83	6.14	17.45	3.07
Sikkim	0.37	1.20	2.49	5.44	15.77	1.42
Tamil Nadu	0.37	1.39	2.70	5.63	20.13	0.80
Tripura	0.27	1.39	2.59	4.81	14.29	0.52
Uttar Pradesh	0.37	1.39	2.72	5.52	15.01	0.75
Uttrakhand	0.44	1.43	2.71	5.45	23.11	0.89
West Bengal	0.49	1.59	2.73	4.85	38.58	0.77
Total	**0.38**	**1.42**	**2.71**	**5.76**	**17.37**	**1.16**

Source: Agriculture Statistics at a glance 2013, p. 305.

in areas where modernization of farming activities has taken place. Conversely, it can be said that mechanization of farming is possible only in areas of large holdings. One man can manage more than 50 hectares of agricultural land with the help of modern machines like tractors, harvesters, threshers etc., but a person cannot manage more than 6 to 8 hectares of agricultural land if he has to work with his hands or with primitive tools.

5. Type of Crops. Type of crops grown in a particular holding also determines its size to a great extent. For instant, if the farmer grows vegetables, even a small piece of land measuring two hectares is enough to give a reasonably good employment to the farmer and his family members throughout the year. In contrast, the same family requires at least eight hectares of land if the farmer grows wheat in his agricultural land.

Areal Distribution of Size of Holdings. Table 20.4 shows the average size of holdings by size group in different states and union territories of India in 2010-11. The last column of the table shows average size of all holdings. This column reveals that the size of holdings varies widely from as small as 0.22 hectares in Kerala to as large as 5.99 hectares in Nagaland although the average size for the country as a whole is 1.16 hectares. A large number of states have average size of holding much smaller than the national average. In states and union territories like Bihar, Damon and Diu, Goa, Himachal Pradesh, Jammu and Kashmir, Kerala, Lakshadweep, Puducherry, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand and West Bengal, the average size of holdings is less than one hectare. This is really a depressing situation because no efficient cultivation, worth the name, is possible on such small holdings. The remaining states and union territories have holdings larger than the national average but the condition is not very satisfactory in these states also because in a large number of states, the holdings are less than two hectares in size. Gains of consolidation of holdings in Punjab, Haryana, Uttar Pradesh, Madhya Pradesh etc. have been nullified due to redistribution of land as a result of inheritance law. Large size of holdings in states like Nagaland and Arunachal Pradesh does not mean much because of rough terrain, thick forests and shifting agriculture. Moreover, large section of society lives in the form of clans which do not lead to division and fragmentation of holdings. Similarly large size of holdings in Rajasthan, is not of much use due to vast areas under desert conditions.

Fig. 20.2 shows the areal distribution of holdings in India characterized by lower level of fertility. This makes it necessary for the farmers to maintain large size of holdings.

Land Reforms

Two primary objectives of land reforms are (*i*) to make optimum use of limited land resources so that maximum benefit is drawn from labour and capital inputs and (*ii*) fixing the size of land holdings and redistributing the surplus land to landless and small farmers so that the actual tiller of the land feels secure and works hard to increase the agricultural production. Therefore, the scope of land reforms includes the following :

1. Abolition of intermediaries
2. Tenancy reforms
3. Ceiling of land holding and redistributing the surplus land to landless agricultural labourers and small farmers.
4. Agrarian reorganisation including consolidation of holdings and prevention of their sub-division and fragmentation.
5. Organisation of co-operative farms.
6. Improvement in the system of land record keeping.

1. Abolution of Intermediaries

Before Independence, the British rulers had introduced three categories of land tenure systems, namely Zanindari, Mahalwari and Roytwari.

(*a*) Zamindari or Permanent System. Although Zamindari system existed during the period of Mughal Empire the Zamindars were mere functionaries for collecting revenue on behalf of the Mughal Emperor and his representative or Diwan. The Diwan in turn would supervise the activities of he Zamindar to make sure of the rightful collection of revenue. This system underwent significant change after East India Company of the Britishers was awarded the diwani (overlordship) of Bengal by the Mughal Emperor following the Battle of Plassey in

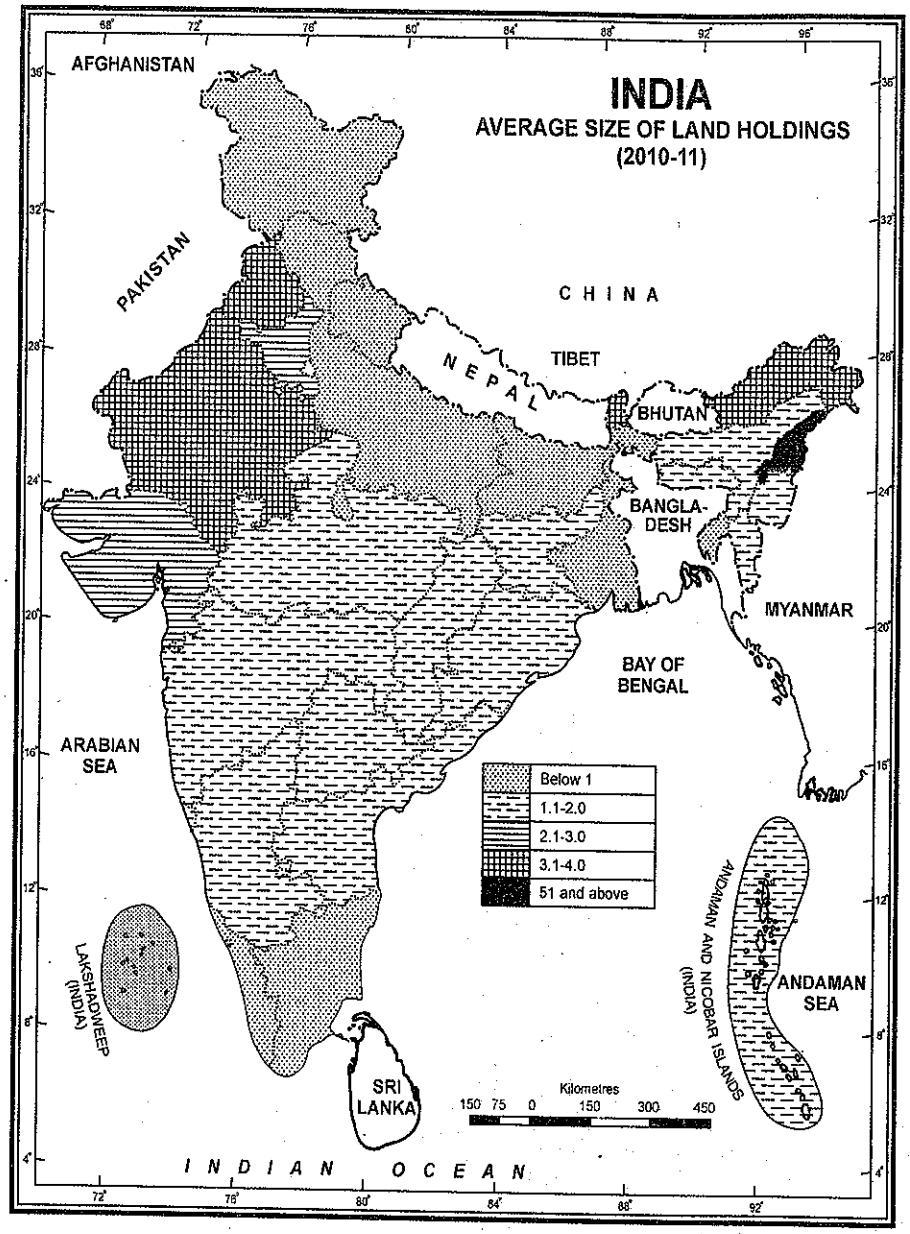


FIG. 20.2. India : Size of Land Holdings (2010-11)

1765. In the year 1793, **Lord Cornwallis** introduced 'Permanent Settlement' according to which feudal lords (jamindars, jagirdars etc.) were declared proprietors of land on the condition of fixed revenue payments to the British regime. Under this arrangement landlords were expected to pay 90 per cent of rent as revenue to the government in perpetuity and 10 per cent was left with them as

collection expenditure. This system prevailled over most of North India including the present day Uttar Pradesh, (except Awadh and Agra), Bihar, West-Bengal most of the Odisha and Rajasthan (except Jaipur and Jodhpur), and covered nearly 58 per cent of the total area cultivated. The landlords, in turn, created a hierarchy of intermediaries who were responsible for collecting rent from the cultivators. These landlords were living a luxurious life in the towns while the poor cultivators had to bear the burden of a large number of intermediaries.

In addition to permanent Zamindari with fixed land revenue in perpetuity there was temporary settlement of land revenue which used to be assessed for period ranging from 20 to 40 years and was subjected to revision. The East India Company introduced a system which could yield a regular flow of rent.

The British rulers argued that the Zamindars represent higher strata of rural society and assigning the job of rent collection will enhance the revenue and increase agricultural production. But this argument proved to be a myth. Demand for land increased due to increase in population and fall in rural industries and the Zamindars started collecting rent at higher rates. The system which was introduced to improve agriculture gave birth to ***absentee landlords*** and their number increased regularly. Thus there grew an intermediary between the state and actual tiller who was interested in land only to the extent of extracting exorbitant rent. So the Zamindara system represented large scale exploitation of the tillers by the absentee landlords and Indian agriculture was degraded to subsistence farming with low productivity.

(*b*) **Ryotwari.** The British rulers did not improve the above mentioned system of settlement in the rest of India after it came under their rule. Captain Munro introduced the second system of revenue collection known as the Ryotwari system of land settlement. It was first introduced in Madras in 1792 and in Bombay in 1817-18. Under this system, the individual cultivators (ryots or raiyats) were reorganised as proprietors of their land with rights to sub-let, mortgage and transfer their land by gift or sale. The individual land holder was directly responsible to the state for payment of land revenue. The settlement was concluded for a short period and the government reserved to itself the right to enhance the assessment for which no specific guidelines were laid down by law. This system of settlement was a complete contradiction to the prevailing old system where the land revenue was permanently fixed by custom and land was not a transferrable property. However, it reflected a kind of Zamindari system because the ryat was at liberty to sublet his land to the tiller. This system was known at ***batai***.

The Ryotwari system accounted for about 38 per cent of the total cultivated area of the country and was prevalent in most of South India, including the present day Maharashtra, Karnataka, Tamil Nadu, Kerala, Andhra Pradesh, Telangana, and most of Madhya Pradesh and Assam. The princely states of Jaipur, and Jodhpur in Rajasthan also fell under Ryotwari type systems. Pockets of ***zamindari***-type tenure existed within these ryotwari areas, particularly where administered by local rajas or nawabs.

(*c*) **Mahalwari.** Mahalwari was the third system of land settlement under which the village lands were held jointly by the village communities, the members of which were jointly and severally responsible for payment of land revenue. Peasant farmers contributed shares of total revenue demand for the village (mahal) in proporosition to their respective holdings. The state was initially entitled to as much as 83 per cent of gross produce in revenue, although this was reduced to 66 per cent at a later stage. The Mahalwari system was introduced between 1820 and 1840 in Punjab (including) both present day Punjab in Pakistan and India, and Haryana), parts of the present day states of Madhya Pradesh, and Odisha and Princely states of Awadh and Agra in Uttar Pradesh. It covered about 5 per cent of cultivated area. Usuallly the village *lumbardar* was entitled to collect the revenue for which he received *panchortra i.e.,* 5 per cent as commission.

Zamindari, Ryotwari and Mahalwari had ill effects on land tenure and led to low productivity in Indian agriculture. For example, legislation introduction in Ryotwari and Mahalwari areas during 1850s enabled money-lenders to recover debts on loans secured on land holdings. Indebtness grow out of proportion due to exorbitantly high rates of revenue and dispossession of land led to rapidly rising tenacy. Thus, the rural society was polarized into landlords and rich peasants versus tenants and agricultural labourers and the distribution of land became highly

unequal. According to Royal Commission on agriculture, 1924-25, as much as 86 per cent of the cultuivated area was held by a minority of 12 per cent of rich cultivators. In Punjab, by 1939, 2 per cent of land owners held 38 per cent of cultivated area. Since the actual cultivator had the right to land as property and the land became transferable under Ryotwari, there was larger scale alienation of land to non-agriculturist moneylenders due to excessive increase in revenue demand and increasing indebtness. In this way land gradually began to pass from the cultivators to money-lenders who were not much interested in improving the agricultural production.

In **Zamindari** areas, rural society was even more hierarchically divided between landlords, tenants with heredity rights (raiyats), sub-tanents, share croppers and agricultural labourers, and land distribution was even more unequal than in ryotwari areas (Bhalla 2007 : 21). In spite of a large number of legislations passed between 1859 and 1937 to help the cultivators very little benefits of reduction of rent reached the actual cultivator. The state of peasantry was quit dismissal. In Punjab about 40% of the cultivators were tenants at will. In Madras 48% of villagers were landless labourers. In Bengal, there was and increase of 62% in number of rent recovers between 1921 and 1931.

The above description makes it clear that the system of intermediaries was deep rooted and prevailed for a pretty long period in the agricultural history of India. Steps were taken immediately after Independence to abolish intermediaries, to stop the tyranny and exploitation by Zamindars and to restore the tillers right over the land. The first such legislation was enacted in Madras in 1948. It was followed by Bombay in 1949-50, Hyderabad in 1951 Bihar, Madhya Pradesh, Uttar Pradesh, Central India and Assam in 1952 and Karnataka, Delhi, West Bengal and Himachal Pradesh in 1954-55. These steps led to abolitions of about 2,60,000 zamindars and intermediaries and 30 lakh tanents and share croppers acquired ownership rights of about 25 lakh hectares of cultivated land throughout the country. Also the governmet acquired vast starches of forests, barrens and waste land. Further, it resulted in the emergence of a middle class of peasantry which is now playing an important role in the development of Indian agriculture.

The Zamindari abolition act was however not without its inherent drawbacks and loopholes due to which the land could not be transferred to actual tillers and landless agricultural labourers. In many parts of the country, landlords with the connivance of local bureaucracy, were able to resume land for self-cultivation by ejecting a large number of tenants. In states like Bihar, Odisha, Rajasthan, Madhya Pradesh and West Bengal, landlords managed to keep very large holdings because of their power and influence. However, the general view is that land reforms were fairly successful in abolition of zamindari, jagirdari, inams etc. in more parts of India. Extent of tenancy declined considerably and self-cultivation became the dominant mode of production in most parts of the country.

2. Tenancy Reforms

Before Independence, the British rulers had introduced Zamindari, Ryotwari and Mahalwari system under which tenancy cultivation was very common in large parts of the country. Under tenancy cultivation system, small and marginal farmers as well as landless laboureres were forced to till the land of big landlords because they did not have their own land in sufficient measure. Following three types of tenants were recognized under this system:

(*i*) Occupancy or permanent tenants with permanent and heritable rights.

(*ii*) Tenants at will or temporary tanents.

(*iii*) Sub-tenants *or Shikmi-Kisan*.

The condition of temporary and sub-tenants was miserable because they were allowed to till the land on adhoc basis and were subject to ruthless exploitation. Frequent enhancement of rent, eviction on petty grounds and begari (free service) were some of the ways adopted by landlords to exploit the poor farmers and landless labourers. Even after so many reforms in the post Independence era, about 20 per cent of the agricultural land is devoted to share-cropping (*batai*) where 50 per cent of the produce is the normal rent. In certain cases, the rent may be as high as two-thirds of the total produced. In spite of the **National Policy** of giving full ownership of land to the actual cultivators, the desired results could not be achieved due to weak legislations and their faulty implementation. However, under the tenancy reforms about 112.92 lakh cultivators have acquired

ownership right over 62.13 lakh hectares of land. The tenancy reforms pertain to the following:

(*i*) regulation of rent

(*ii*) security of tenant and

(*iii*) conferment of ownership on tenants

States have made the following provisions to achieve the third objective

(*a*) All tenants have been given full security of tenure, without giving the owners the right of personal cultivation.

(*b*) Owners have been given the right to resume a limited area (not more than a family holding in any case) subject, however, to conditions that a minimum area is left with the tenant.

(*c*) A limit has been placed on the extent of land with a land-owner may resume, but the tenant is not entitled to retain minimum area of cultivation in all cases.

Regulation of Rents. As mentioned earlier, the tanents were supposed to pay very heavy rent ranging from 1/2 to 2/3rd of the total produce which left the poor farmers with little produce and led to overall extreme poverty among the majority of the farmers. As a result of legislations passed by a large number of states, the maximum rates of rent have been fixed at levels not exceeding 1/4 to 1/5th of the gross produce in all the States except in Andhra Pradesh, Haryana and Punjab. In some of the States, as in Gujarat, Maharashtra and Rajasthan, the maximum rent now stands at one-sixth of the produce. In Assam, Kerala, Odisha and Union Territories, the rent payable is about one-fourth of the produce or less. In several States, the normal level of rent is still about a third of the produce.

Security of Tenure. According to Sir Arther Young, "Give a man the secure possession of a bleak rock and he will turn it in to a garden, give him nine years lease of a garden and he converts it into a desert." It clearly implies that the tenant, who is the actual cultivator of land should be provided security against eviction and exploitation. In the absences of proper security he tries to get maximum output with minimum input. He tends to spend minimum on irrigation, fertilizers, better seeds and field boundaries and the lack of these inputs adversely affect the agricultural production. Therefore, the tenant should be provided with sufficient security for which strong legislation should be enacted. Unfortunately, the legislation and its implementation had been very weak and could not improve the conditions of tenancy to the desired level. This is because the social and economic position of tenants in the village is weak and it becomes difficult for them to seek the protection of law. Moreover, resort to legal process is costly and generally beyond the means of tenants. Thus, despite the legislation, the scales are weighted in favour of the continuance of existing terms and conditions. However, some progress could be recorded in some selected states like West Bengal, Kerala and Karnataka. In West Bengal 14 lakh share-croppers benefited from ***Operation Barga***. In Kerala 24 lakh tenant farmers achieved ownership of land as a result of efforts made by the tenants associations. Land tribunals set up in Karnataka to settle tenancy issues decided in favour three lakh tenants involving 11 lakh acres of land.

More than 20 million ***adivasis*** living in forests have been clamouring for rights over forest land and forest products for a very long period. The Scheduled Tribes and other Forest Dwellers (Recognition of Forest Rights) Act 2006 has granted heritable, inalienable right to use 2.5 hectares of forest land per family to all legitmate dwellers in forests. The Act came into force in January, 2008.

A new form of tenancy known as ***commercial tenancy*** had become popular in the agrarian economy of India. In areas where agriculture is technologically more advanced, small farmers lease and their land to bigger farmers because they cannot afford high technology inputs. For example, in Punjab this form of tenancy stands in stark contrast to the semi-feudal subsistency tenancy of the yore.

3. Ceiling on Landholdings

Imposition of ceiling on landholdings and distribution of surplus land among the landless labourers was the third most important objective of land reform legislation in India. It envisaged that all land more than a certain specified limit belonging to landlords would be taken over by the state and allotted to small farmers to make their holdings economic or to landless labourers to meet their demand for land. The idea of land redistribution

through fixation of land ceiling has gained wide acceptance in India. The strategy basically is to ration land in such a way that poor farmers are not deprived of the land (the basic asset) while big landlords enjoy the privilege of having vast stretches of land. Ceiling laws were enacted and enforced in two phases. The first phase was from 1960 to 1972 during which ceiling legislation largely treated land holder as the unit of application. In the second phase after 1972 it was decided to have family as the basis of holding. **Table 20.5** depicts the ceiling limit on different categories of land in different states.

TABLE 20.5. Ceiling on Land Holdings

(In Acres)

State	Irrigated Land with two crops	Irrigated Land with one crop	Dry land
1	2	3	4
As recommended in 1972 National Guidelines	10-18	27	54
Proposed in Agenda Notes 1985 of Regional Ministers Conference	12	18	30
Andhra Pradesh	10 to 18	15 to 27	35 to 54
Assam	17	17	17
Bihar	15 to 18	25	30 to 45
Gujarat	10 to 18	15 to 27	20 to 54
Haryana	18	27	54
Himachal Pradesh	10	15	30 to 70
Jammu and Kashmir	9 to 12.5	9 to 12.5	15 to 23 (In Ladakh 19)
Karnataka	10 to 20	25 to 30	54
Kerala	12 to 15	12 to 15	12 to 15
Madhya Pradesh	18	27	54
Maharashtra	18	27	54
Manipur	12	12	15
Mizoram	Nil	Nil	Nil
Odisha	10	15	30 to 45
Punjab	17	27	51
Rajasthan	18	27	54 to 175
Tamil Nadu	12	30	60
Sikkim	12.5	12.5	50
Tripura	10	10	30
Uttarakhand	18	27	45
Uttar Pradesh	18	27	45
West Bengal	12	12	17
Andaman and Nicobar Islands	nil	nil	nil

Notes : 1. The actual limits for lands in Karnataka and Uttar Pradesh are higher due to classification of land.
2. The actual ceiling limits in Himachal Pradesh and Rajasthan are higher due to hilly terrain and desert lands.
3. 1 Acre = 0.404686 lectare.

Source : Agricultural Statistics at a glance 2013 p. 318.

Till 1972 *i.e.*, under the old ceiling laws only 9.30 lakh hectares of land was declared surplus out of which only 5.26 lakh hectares were redistributed among small and marginal farmers as well as landless labourers.

The Conference of Chief Ministers held in July, 1972 approved the following guidelines for implementation of land ceiling.

(*i*) For irrigation land with two crops per year, the ceiling was fixed from 4.05 to 7.28 hectares.

(*ii*) For irrigation land with one crop a year, the ceiling was fixed at 10.93 hectares.

(*iii*) In case of inferior dry land with practically no irrigation, the ceiling was put at a higher level of 21.85 hectares.

(*iv*) The unit of application should be a family of five members. Additional land may be allotted for each member in excess of five members subject to a maximum of twice the limit of the celings.

(*v*) The celing process was not to be applied to land under plantation crops (tea, coffee, rubber, spices, coco etc.) as well as under industrial and commercial establishments.

(*vi*) State governments were allowed to exempt religious, cheritable and educational trusts of public nature from the purview of ceiling.

(*vii*) While distributing the surplus land, priority should be given to landless agricultural labourers especially to those belonging to scheduled castes and scheduled tribes.

(*viii*) Compensation payable for surplus land as a result of ceiling should be fixed well below the market value so that it is within the capacity of the new allottees.

(*ix*) The compensation may be fixed in graded slabs and preferably in multiple of land revenue payable for the land.

The Conference of Chief Ministers (1972) was followed by Regional Ministers Conference in 1986 which suggested some changes in the ceiling on land holdings (**Table 20.5**).

In spite of ceiling laws the progress of acquiring land from big landlords and redistributing it among the poor farmers has not been satisfactory. According to Annual Report (2004-05) of the Ministry of Rural Areas and Employment, only 73.36 lakh acres of land was declared surplus during the period stretching from the time of implementation of the ceiling laws and March 2004. The area declared surplus so far is less than 2 per cent of the total cultivated area of the country. The area for which possession was taken amounted to 64.97 lakh acres and actually distributed area was 54.3 lakh acres only. The number of beneficiaries were 57.46 lakhs of which 16 per cent were scheduled castes and 15 per cent were scheduled tribes. Details of area declared surplus, area taken possession of, area distributed and number of beneficiaries are given in table 20.6.

TABLE 20.6. Achievements under Land ceiling laws (lakh acres)

Details/date	31.3.80	31.3.85	31.3.90	31.3.2004
Area declared surplus	69.13	72.07	72.25	73.36
Area taken possession	48.50	56.98	62.12	64.97
Area distributed	35.50	42.64	46.47	54.03
No. of beneficiaries (lakhs)	24.75	32.90	43.60	57.46

Source : Ministry of Rural Areas and Employment Annual Report (2004-05).

Failure of land ceiling laws is attributed to loopholes caused by the following :

(*i*) Provision for holding land upto twice the ceiling limits by families with more than 5 members.

(*ii*) Provision to give separate ceiling limited to major sons of the family.

(*iii*) Provision to treat every share-holder of a joint family as a separate unit for ceiling limits.

(*iv*) Exemption of plantation gardens, religious and charitable institutions from the provisions of ceiling.

(*v*) Individual states allowed landlords to retain control over land holdings, mostly through *benami* transactions namely transactions that transferred holdings in the names of

deceased or ficticious persons registered with the connivance of the village *patwari*.

(*vi*) Misuse of exemption and misclassification of land.

(*vii*) Non-application of appropriate ceiling to lands newly brought under irrigation by public investment.

Furthermore, it is opined that lack of accurate updated records of rights on land was a major constraint on effective implementation of land ceilings as also tenancy reforms.

Conclusions. Following three conclusions are drawn :

(*i*) The share of small and marginal farmers both in ownership holdings and total area owned is increasing at a rapid pace. For instance, during 1953-54 the small and marginal farmers owning less than 2 hectares of land constituted 51.64% of the total holdings but accounted for only 16.31% of the total owned areas. By 2003, the share of these farmers in the number of ownership holdings had increased to 80.4% and their share of area had increased to 43.43%.

(*ii*) The proportionate share of large farmers both in total holdings and land owned has declined rapidly over the years.

(*iii*) Semi-medium and medium farmers are the main gainers in terms of share of owned land although their share in total ownership holding has declined considerably.

4. Consolidation of Holdings

As mentioned earlier, most of the land-holdings in India are small and fragmented. This results in large scale wastage of time and energy of the farmer because he has to operate his several small holdings scattered in different parts of the village agricultural land. The only way to take the farmer out of such an unwanted situation is consolidation of holdings which involves bringing together in one compact block all plots of land of a farmer which are scattered in different parts of the village. Under this scheme all land of the village is first pooled into one compact block and then divided into smaller blocks called *chaks* and then allotted to individual farmer. Laws for this purpose have been passed into 15 states.

Historically, 4.5 million hectares of land was brought under consolidation upto 31st January, 1956. This figure rose to 33 million hectares in 1972 and by the end of the Sixth Five Year Plan 45 million hectares were consolidated. Thus about one-fourth of the consolidable land was brought under consolidation. But consolidation of holdings has shown its impact in a few selected areas only. Punjab, Haryana and Western part of Uttar Pradesh are some such areas. This process has not even started in Rajasthan and some south Indian states. Among the eastern states only Bihar and Odisha have started this process. (Planning Commission, Seventh Five Year Plan-1980-85, p. 115). According to the data collected by the Ministry of Rural Development, consolidation was completed for 1663 lakh acres till 31st March, 2004. Out of this Maharashtra, 527 lakh acres or 32.2% and Uttar Pradesh 482 lakh acres or 29.4% were the main achievers. The programme of consolidation of holding has succeeded to a great extent in Punjab, Haryana and Madhya Pradesh. Efforts are being made to implement this programme in Bihar and Jammu and Kashmir. It has not been implemented in West Bengal and Assam. The states of Andhra Pradesh, Tamil Nadu, Kerala, Puducherry (U.T.) and all north-eastern states have not even passed the laws necessary for this purpose. Till now only 49% of the agricultural land of India is consolidated and the remaining 51% is yet to be consolidated. According to 2004-05 report of the Ministry of Rural Development no consolidation has been done in 9000-10,000 villages in Uttar Pradesh. These facts and figures indicate that consolidation of holdings has not yielded the desired result for which following factors may be responsible.

1. Farmers are emotionally attached to their ancestral land and are generally not willing to take advantage of this scheme.
2. Farmers possessing more fertile land are not in favour of this scheme for fear of being allotted infertile land after consolidation.
3. Consolidation of holding is a lengthy and cumbersome process. The government officials who are responsible for implementing the scheme of consolidation of holdings are usually slow, careless and corrupt.
4. Cooperation of the farmers was badly lacking with respect to implementation of this scheme.
5. A large number of farmers were unhappy with the redistribution of land after consolidation. This led to large scale litigation and many cases concerning land disputes are still pending in different courts. Such a situation has vitiated the serene social atmosphere of the rural areas.
6. Under the existing law of inheritance, the land belonging to father is divided among his heirs and land holdings continue to be divided and fragmented. Thus the initial gain of consolidation of holdings is nullified and need for a new scheme of consolidation of holding is badly felt.
7. In every consolidation about 5 to 10 per cent of the village land is taken out for providing house sites to weaker sections of society, approach (*chak*) roads and village utility services. Thus if the process of consolidation of holdings is repeated 3 to 4 times, a sizeable portion of agricultural land is lost to non-agricultural uses.
8. The cost of consolidation of holdings is realised from the farmers who are generally unwilling to bear this cost and are usually against this scheme. Further, it dries up their financial resources and has adverse effect on their economy.
9. It has been observed that small farmers usually get inferior quality of land with low fertility and low productivity. Since they do not possess enough money power, they are unable to bribe the corrupt officials and also fail to get proper justice in the court.

5. Cooperative Farming

Cooperative farming is a type of farming in which the farmers pool their resources and distribute the agricultural products in proportion to their resources. It helps in efficient farming and small farmers get the benefits which are usually available to big farmers. Problem of small and fragmented holdings is solved and economic position of poor farmers is improved. According to Planning Commission "Cooperation represents institutionalization of the principle and impulse of mutual aid. It has the merit of combining freedom and opportunity for the small man with the benefit of large scale management and organisation."(Draft Fifth Five Year Plan Vol. II, p. 76.) Although cooperative movement started way back in 1882, more emphasis on this type of farming was laid after Independence only. But like other institutional factors, cooperative farming also could not achieved its target and could not yield the desired results. About 60% of the cooperative societies are not functioning satisfactory.

6. Land Records

Updating of land records is most essential to implement the land reforms in their right earnestness. In India land records maintenance is highly unsatisfactory and is responsible for lots of land disputes leading to large scale litigation in the rural areas. Centrally sponsored scheme for updating land records and strengthening the revenue administration was introduced during the Seventh Plan. The Central Government provides financial assistance to states and union territories for using modern technology such as photo maps, areal photographs, remote sensing, computers etc. A committee on Revitalization of Land Revenue Administration submitted its report on March 2, 1995 on which necessary follow-up action was initiated by the Government of India and the State/Union Territories. Several legislations have been passed regarding land reforms and ceiling on land holdings. Till now, more than 250 land laws have been included in the Ninth Schedule of the Constitution.

3. INFRASTRUCTURAL FACTORS

Infrastructural factors include irrigation, power, roads, credit, insurance, marketing, storage facilities etc.

1. Irrigation. Need, feasibility and sources of irrigation in India have been described in details in Chapter 16. Expansion of irrigation facilities along with other infrastructural factors is the main strategy for increasing agricultural production. It is one of the most important inputs required at different critical stages of plant growth of various crops for optimum growth. Although India has made considerable progress with respect to irrigation during the planned

period, more than half of the cultivated area is still without irrigation which entirely depends on monsoon rainfall for agricultural production. Since the monsoon rainfall is very erratic, there are large scale spatial and temporal variations in agricultural outputs. The adage that *Indian agriculture is a gamble in monsoons still holds time for large part of India.* However, irrigation has made a major contribution to solve the food problem in India. It is estimated that about 60% of the food grains production comes from the irrigated areas and the remaining 40% from rainfed areas. Yields of almost all the crops are much higher in irrigated areas as compared to rainfed areas.

The growth of irrigation facilities has failed to keep pace with the increasing demand for irrigation. This has been particularly the case in major/medium irrigation potential. The major/medium irrigation potential increased from 12.20 million hectares in the First Five Year Plan to 42.35 million hectares in the Tenth Five Year Plan. Whereas minor irrigation potential increased from 26.26 million hectares to 60.42 million hectares during the same period (**Table 20.7**). The chief reasons for low progress in major/medium irrigation were (a) long gestation period required for these projects (*b*) financial constraints as these projects involve heavy cost (*c*) inter-state disputes about water allocation of almost all major rivers (*d*) problems of acquisition of vast stretches of land and (*e*) resettlement and rehabilitation of the oustees.

The other major problem is the widening gap between potential created and potential utilized which increased from 1.22 million hectares in the First Five Year Plan to 15.54 million hectares in the Tenth Five Year Plan. The main gap occurs in major/medium projects. This happens due to lack of command area development, cropping pattern changes (shift to higher water consuming crops like rice cultivation in Punjab and Haryana) and lack of field channels. Regarding minor irrigation, although over 70% of the groundwater potential has been utilized, there are very serious problems of over-exploitation of ground

TABLE 20.7. All-India Irrigation Potential Created and Utilized, Planwise

(cumulative in million ha)

	Potential Created			Potential Utilized			Diff Col 4-7
Period	Major/ Medium	Minor	Total	Major/ Medium	Minor	Total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Pre Plan up to 1951	9.70	12.90	22.60	9.70	12.90	22.60	--
I. Plan (1951-56)	12.20	14.06	26.26	10.98	14.06	25.04	1.22
II. Plan (1956-61)	14.33	14.75	29.08	13.05	14.75	27.80	1.28
III. Plan (1960-66)	16.57	17.00	33.57	15.17	17.00	32.17	1.40
Annual Plan (1966-69)	18.10	19.00	37.10	16.75	19.00	35.75	1.35
IV. Plan (1969-74)	20.70	23.50	44.20	18.69	23.50	42.19	2.81
V. Plan (1974-78)	24.72	27.30	52.02	21.16	27.30	48.46	1.56
Annual Plan (1978-80)	26.61	30.00	56.61	22.64	30.00	52.64	3.97
VI. Plan (1980-85)	27.70	37.52	65.22	23.57	35.25	58.82	6.40
VII. Plan (1985-90)	29.92	46.62	76.44	25.47	43.12	68.59	7.94
Annual Plan (1990-92)	30.74	50.35	81.09	26.31	46.51	72.85	8.24
VIII. Plan (1992-97)	32.95	53.31	86.26	28.44	48.77	77.21	9.02
IX. Plan (1997-2002)	37.05	56.90	93.95	31.01	49.99	81.00	12.05
X. Plan (2002-07)	42.35	60.42	102.77	34.42	52.81	87.23	15.54

Source : *Bhagirath*, October-December, 2011.

water and its rapid depletion, particularly in the north-western part of the country.

Another major set-back to the progress of irrigation is decelaration in irrigation investment during the Plan period. The funding for the irrigation sector as proportion of the total state plan size from the Sixth Five Year Plan onwards has been declining. It fell from 23.2% during the First Five Year Plan to only 6.0% during the Tenth Five Year Plan (**Table 20.8**).

TABLE 20.8 . Irrigation investment as percentage of state outlay

Plan	Irrigation Invest. as % of state outlay
First (1951-56)	23.2
Second (1956-61)	12.6
Third (1961-66)	12.8
Annual (1966-69)	15.6
Fourth (1969-74)	16.3
Fifth (1974-78)	10.7
Sixth (1980-85)	11.3
Seventh (1985-90)	9.0
Eighth (1992-97)	8.4
IX Plan (1997-02)	7.4
X Plan (2002-2007)	6.0

Source : Tenth Five Year Plan, and Economic Survey, 2005-06.

The Central Government initiated the Accelerated Irrigation Benefit Programme (AIBP) in 1996-97 for extending assistance for the completion of incomplete irrigation schemes. Under the AIBP ₹ 55,416 crore of central loan assistance (CLA)/grant have been released upto December, 2012. An irrigation potential of 7622.5 thousand hectares has been created by states, from major/medium/minor irrigation projects under AIBP till March, 2011. The Command Area Development Programme has also been amalgamated with the AIBP to reduce gap between potential created and potential utilized.

These are large variations in the total irrigated area and percentage of irrigated area of total area under different crops. (**Table 20.9**). For example 48.3% of the area under foodgrains is irrigated and this percentage varies from a meager 8.9% in case of Jowar to 91.3% in case of wheat. Rice, its most important food crops of India has 58.7% area under irrigation. Among the other crops sugarcane gets the maximum irrigation benefit because 93.7% of the sugarcane area gets irrigation facilities. A little over one-third of the cotton area is irrigated. Oil seeds are usually grown in the rainfed areas and a little more than one-fourth of the area under oil seeds is provided with irrigation.

Another major problem regarding irrigation is low efficiency of water use which ranges from 38 to 40% canal irrigation against an ideal value of 60%. Efficiency of water use in case of ground water irrigation schemes is about 60 percent. Low water use efficiency results in low agricultural productivity, iniquity in water supply to tail enders and water logging and salinity in water surplus areas. Among the several reasons for low efficiency of water use are dilapidated condition of irrigation canal system due to silting, weed growth and breakage of regulating structures leading to over-use of water. In several old delta systems like those of the Mahanadi, the Godavari and the Cauvery, irrigation is practiced by field-to-field flooding. Concessional water rates also lead to over use of canal water and results in low efficiency of water use. Dilapidated system of irrigation, operation and maintenance charges, low water rates and participatory irrigation system are all inter-related. Therefore the entire problem of low efficiency of water use should be tackled as a package of measures so that enough water is made available to crops and agricultural productivity is increased. The package should include modernization, conjunctive use through shallow augmentation tube wells, provision of temper-proof outlets, replacement of old canal road bridges, development of canal banks as roads for maintenance of canals and improving the rural transport system, promotion of water saving devices like sprinkler and drip irrigation systems through tax concession and subsidy-cum-loan schemes (Bhalla 2007: 130-31).

2. Power. Indian agriculture is going the industries way as more and more agricultural operations are depending on regular supply of cheap power in the form of hydro electricity and diesel. It is heartening to note that the average farm power availability for the cultivated areas has increased from 0.48 kW/ha in 1975-76 to about 2.6 kW/hr in 2014.

TABLE 20.9. Irrigated area under different crops

(Million hectares)

Year	1970-71	1980-81	1990-91	2000-01	2005-06	2006-07	2007-08	2008-09
1	2	3	4	5	6	7	8	9
Rice	14.3	16.4	19.5	24.3	25.0	25.3	25.2	26.5
%	38.4	40.7	45.5	54.4	56.6	58.1	57.8	58.7
Jowar	0.6	0.8	0.8	0.8	0.7	0.7	0.7	0.7
%	3.6	4.7	5.6	8.3	8.2	8.1	8.6	8.9
Bajra	0.5	0.6	0.5	0.8	0.9	0.9	1.0	0.8
%	4.0	5.5	5.1	7.8	9.2	9.6	10.3	9.4
Maize	0.9	1.2	1.2	1.5	1.7	1.7	2.0	2.0
%	15.9	20.1	19.7	21.8	22.5	22.4	24.4	25.2
Wheat	9.9	15.6	19.5	22.8	24.1	25.7	26.0	25.5
%	54.3	70.0	81.1	88.4	90.3	90.6	91.0	91.3
Barley	1.3	0.9	0.5	0.5	0.4	0.5	0.5	0.5
%	52.0	50.6	54.5	67.0	68.8	70.9	72.2	75.1
Total cereals	28.1	35.8	42.3	50.9	53.0	55.0	55.5	56.2
%	27.6	34.1	41.0	50.2	52.9	54.6	55.0	55.9
Total Pulses	2.0	2.0	2.6	2.7	3.4	3.6	3.9	3.8
%	8.8	9.0	10.5	12.6	14.4	15.4	15.8	16.0
Total Food grains	30.1	37.9	44.9	53.6	56.5	58.6	59.4	60.0
%	24.1	29.7	35.1	43.7	45.5	47.2	47.3	48.3
Sugarcane	1.9	2.4	3.4	4.3	4.3	4.9	4.8	4.5
%	72.4	81.3	86.9	92.2	93.2	93.8	94.0	93.7
Oil Seeds	1.1	2.3	5.8	5.5	8.6	8.2	7.8	8.2
%	7.4	14.5	22.9	22.4	28.1	28.7	27.0	27.1
Cotton	1.4	2.1	2.5	2.8	3.2	3.4	3.5	3.3
%	17.3	27.3	32.9	32.2	37.3	37.8	37.1	35.3

Source : Economic Survey 2011-12, p. A-21.

However, the current farm power availability is much lower than Korea (7 + kW/ha), Japan (14 + kW/ha) and the U.S.A. (6 + kW/ha). Thus it is concluded that more farm power should be made available to the farmers to upscale farm productivity so as to grow more foodgrains in view of stagnation in increase in net area sown.

Table 20.10 shows that there has been increasing trend with respect to consumption of electricity in agriculture. It increased from 23,422 GWh in 1985-86 to 1,26,377 GWh in 2010-11, thus registering of more than five times increase in a span of 15 years. Decline in percentage of electricity consumed in agriculture is not due to fall in total electricity consumption in agriculture but because of increase in electricity consumption in other fields like domestic, industry and commerce.

There are large spatial variations in the total consumption of electricity and percentage of share of

TABLE 20.10 . Consumption of Electricity for Agricultural Purposes

Year	Consumption for Agricultural purposes (GWh)	Total Consu-mption (GWh)	% Share of Agriculture consumption to total consumption
1985-86	23,422	1,22,999	29.04
1990-91	50,326	1,90,357	26.44
1995-96	85,732	2,77,029	30.90
2000-01	84,729	3,16,600	26.76
2005-06	96,292	4,11,887	21.92
2006-07	99,023	4,55,748	21.73
2007-08	104,182	5,01,977	20.75
2008-09	107,776	5,27,564	20.43
2009-10	119,492	5,69,618	20.98
2010-11	126,377	6,16,969	24.48

GWh = Giga Watt Hour

Source : Agricultural Statistics, at a glance 2013, p. 288.

TABLE 20.11. State-wise Consumption of Electricity for Agriculture purpose in 2009-10

Region	State/UTs	Consumption for Agricultural Purpose (GWh)	Total Energy Sold (GWh)	% Share of Consumption for Agriculture
1	2	3	4	5
Northern	Haryana	9,190.03	22,803.23	40.29
	Himachal Pradesh	36.82	5814.51	0.63
	Jammu and Kashmir	204.88	3538.71	5.79
	Punjab	10469.31	31291.49	33.46
	Rajasthan	12072.59	30622.78	39.42
	Uttar Pradesh	7340.72	41625.1	17.64
	Uttrakhand	298.10	6249.21	4.77
	Chandigarh	1.02	1237.58	0.08
	Delhi	39.67	19295.84	0.21
	Sub-Total	**39653.14**	**162484.45**	**24.40**
Western	Gujarat	12813.60	49777.64	25.74
	Madhya Pradesh	5985.65	22323.67	26.81
	Chhattisgarh	1751.60	11311.42	15.49
	Maharashtra	13264.22	77660.62	17.04
	Goa	110.76	2657.63	4.17
	Daman and Diu	2.49	1452.25	0.17
	D and N. Haveli	3.00	3329.74	0.09
	Sub-Total	**33931.52**	**16813.17**	**2.11**
Southern	Andhra Pradesh	18825.02	59677.44	31.54
	Karnataka	12384.77	36198.33	34.21
	Kerala	266.00	13967.15	1.90
	Tamil Nadu	11951.00	57722.33	20.70
	Lakshadweep	73.80	1920.96	3.84
	Puducherry	0.00	25.48	0.00
	Sub-Total	**43500.59**	**169511.69**	**25.66**
Eastern	Bihar	794.01	6067.22	13.09
	Jharkhand	65.72	13082.67	0.50
	Odisha	149.57	12227.86	1.22
	West Bengal	1322.97	31455.00	4.21
	A and N Islands	0.74	176.89	0.42
	Sikkim	0.00	301.50	0.00
	Sub-Total	**2333.0**	**63311.14**	**3.68**
North-Eastern				
	Assam	32.00	3257.00	0.98
	Manipur	0.71	220.65	0.32
	Meghalaya	0.63	898.42	0.07
	Nagaland	0.00	225.0	0.00
	Tripura	39.73	494.46	8.04
	Arunachal Pradesh	0.00	311.00	0.00
	Mizoram	0.50	191.33	0.26
	Sub-Total	**73.57**	**5597.86**	**1.31**
	Total (All India)	**119491.83**	**569618.31**	**20.98**

GWh: Giga Watt-hour

Source : Agricultural Statistics at a glance, 2012, pp. 291-92.

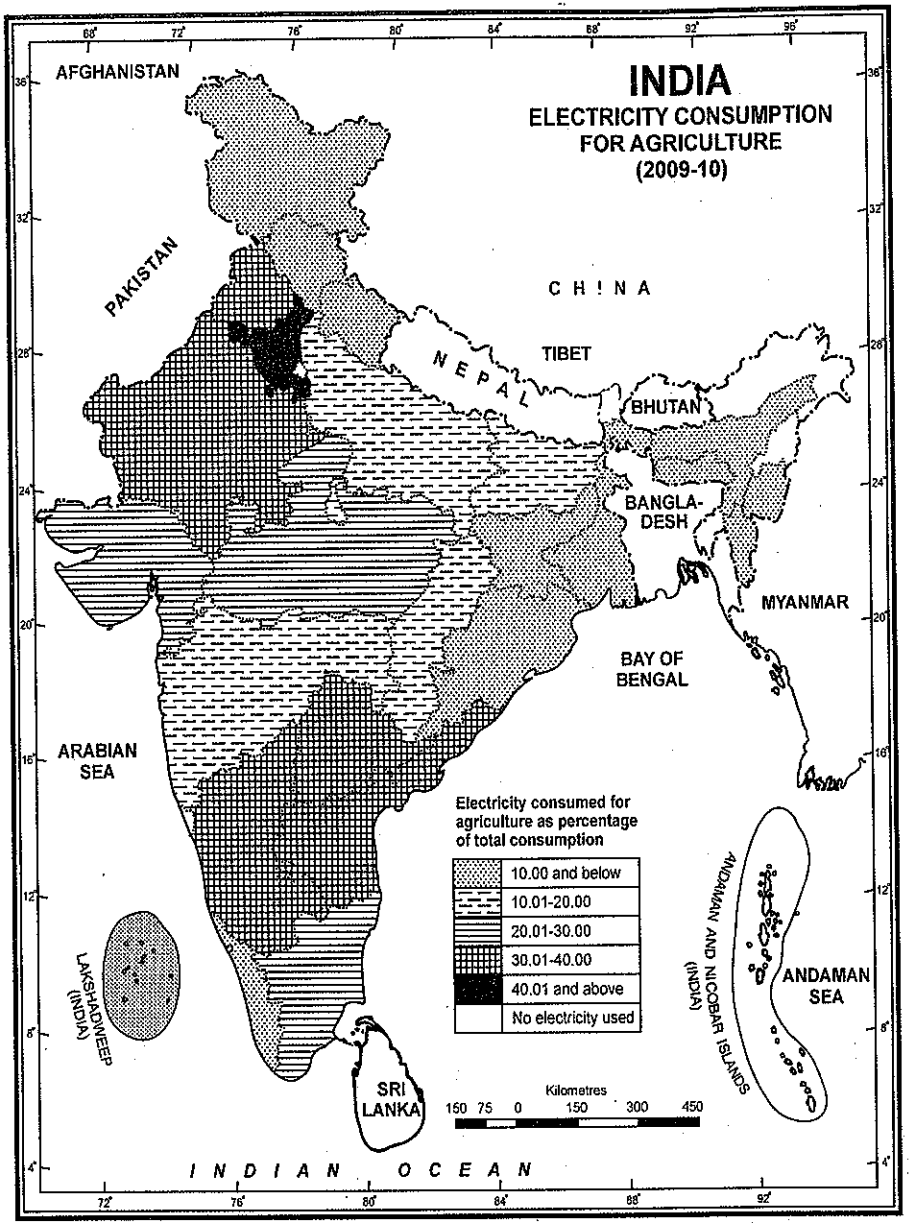


FIG. 20.3. Consumption of electricity for Agriculture Purpose (2009-10)

consumption of electricity in the agricultural field as percentage of the total consumption for agricultural purposes so far as total consumption of electricity for agriculture is concerned, Andhra Pradesh is at the top with more than 18.8 thousand GWh. The other states with more than ten thousand GWh electricity in agricultural field are : Maharashtra (13.3 thousand GWh), Gujarat (12.8 thousand GWh), Karnataka (12.4 thousand GWh), Rajasthan (12.1 thousand GWh), Tamil Nadu (11.9 thousand GWh) and Punjab (10.4 thousand GWh). Most of the north-eastern states are least developed with respect to total consumption of electricity for agricultural purposes.

Regarding percentage share of agricultural consumption to total consumption of electrically, Haryana with 40.29 per cent is at the top. This is followed by Rajasthan (39.42%), Karnataka (34.21%), Punjab (33.46%) and Andhra Pradesh (31.54%). The other states with percentage share of electricity consumption in agriculture above the national average of 20.98% are Gujarat and Madhya Pradesh. Tamil Nadu with 20.70% is just near the national level. Sikkim, Arunachal Pradesh, Nagaland and Puducherry do not use electrically for agricultural purposes at all. The other states and union territories with less than five per cent share of agricultural consumption to total consumption are Himachal Pradesh, Uttarakhand, Chandigarh, Delhi, Goa, Daman and Diu, Dadra and Nagar Haweli, Kerala, Lakshadweep, Jharkhand, Odisha, West Bengal, Andaman and Nicobar islands, Assam, Manipur, Meghalaya, and Mizoram.

In order to increase the efficiency and productivity of agricultural operations, cheap and regular supply of electricity to farmers should be assured. Already some state electrically boards are facing heavy financial burden due to highly subsidized or almost free electricity to farmers. However, huge power shortage and erratic power supply with long declared and undeclared cuts in several parts of the country is the major cause of farmers' agitation in some of the agriculturally advanced states like Punjab, Haryana and Uttar Pradesh where tubewells are the major source of irrigation. The problem of power shortage is likely to be further complicated with sharp increase in demand for power in agriculture and other fields of economic activities. Therefore, there is an urgent need to increase power supply and make it more regular.

3. Roads. Road connectivities to villages is very essential for economic and social development of rural areas. Farmers have to frequently visit the nearby urban markets to purchase seeds, fertilizers, insecticides, pesticides, farm implements etc. and also articles of daily use. They also go the urban markets to sell their agricultural products. Village roads are lifelines for the rural folks particularly when sale of perishable commodities like vegetables, fruits, milk etc. is involved.

Although the total length of village roads is about 4.5 lakh kilometers, it is not sufficient keeping in view the size of the country and the percentage of people living in the rural areas. Further only about 15% of the village roads are surfaced. Considering the important role played by the village roads for the overall development of the rural areas, the Government of India launched hundred per cent centrally sponsored scheme of Pradhan Mantri Gram Sadak Yojna (PGSY) in December 2000 with the objective of providing connectivity by all weather roads to about 1.6 lakh unconnected habitations with population of 500 persons and above in plain areas and 250 persons and above in hill states, tribal areas and desert and left wing extremist (LWE) affected areas. Under the programme upto January 2012, about 4.41 lakh km roads had been cleared and 3,41,257 km length of roads had been completed and new connectivity was provided to a large number of villages.

Government of India has identified 'Rural Roads' as one of the six components of '*Bharat Nirman*' with a goal to provide connectivity to all eligible unconnected habitations with a population of 1000 persons and above in plain areas and 500 persons and above in hilly or tribal areas with an all weather road upto January 2012, a total of 42,531 habitations were connected out of 63,940 habitations to be connected and works for 58,387 habitations was sanctioned. In 2011-12, a target of 4000 habitations was set up to cover 33,000 kms of road length was to be constructed. Till January 2012 a total of 4142 habitations were covered and a total of 21750 kms road length was constructed.

4. Agricultural Credit. Agriucultural credit plays a significant role in improving agricultural production and productivity and mitigating the distress of farmers. Indian farmers need credit both for working capital and for investment. Demand for both for short-term and long term credit started raising rapidly with the onset of Green Revolution in mid 1960s. It happened due to the fact that farmers had to purchase costly inputs like fertilizers, better seeds, pesticides etc. Money was also required for land improvements, purchase of farm machinery, to build farm structures and dig wells.

The sources from which the farmers can borrow money can be divided into two categories viz. (*i*) non-institutional and (*ii*) institutional. The main non-institutional sources are the village money lenders who have been operating for several centuries. Borrowing money from the money lenders is very easy but they charge high rate of interest from the farmers. Often, the farmers are unable to repay loan and interest from their routine earning and have to mortgage their land to do so. Once mortgaged, the farmer finds it extremely difficult to get back his land.

In order to free the farmers from the clutches of the money lenders, the Government of India initiated institutional sources which include cooperative banks, commercial banks and Regional Rural Banks (RRBs). These institutions provide loans for productive purposes at much lower rates of interest. The state governments also provide Taccavi loans to farmers and extend financial support to State Cooperative Banks and Land Development Banks.

Although institutional credit system was initiated in the beginning of 20th century, much headway was not made till Independence. In the post-Independence era, credit institutional were developed in the following three phases.

(*i*) The ***first phase*** ranged from 1947 to 1969 during which cooperative agencies were the main institutions for providing loans to the farmers.

(*ii*) The ***second phase*** was between 1969 and 1975 during which the commercial banks were to provide agricultural credit and supplement credit by cooperatives.

(*iii*) The ***third phase*** started in 1975. During this phase, the Regional Rural Banks (RRBs) were established to provide credit to small and marginal farmers and also the weaker sections of society.

The cooperative credit services and credit structures. It consists of two wings viz., (*i*) short term credit structure and (*ii*) long term credit structure. The ***short term credit*** structure is designed to provide credit for production purposes and is based on three tier pattern consisting of (*a*) State Cooperative Banks (SCBs) (*b*) District Central Cooperative Banks (DCCBs) and (*c*) Primary Agricultural Credit Society (PACs). The **long term credit** is meant for land development and other capital expenditure. It is provided by the Primary Cooperative Agricultural and Rural Development Banks (PCARD) and State Cooperative Agricultural and Rural Development Banks (SCARD).

Finance to cooperatives is provided by National Bank for Agricultural and Rural Developmnent (NABARD) which was established in 1982. Three main functions of NABARD are development, credit and supervision.

The Government of India (GoI) is implementing a revival package for Short-term Rural Cooperative Credit Structure involving financial outlay of ₹ 13,596 crore. Twenty five states have signed memorandum of understanding with GoI and the NABARD. As of July 2012, ₹ 9002.11 crore had been released by NABARD as GoI share for recapitalization of 53,202 primary agriculture cooperative societies in 17 states.

Commercial Banks. Commercial banks started extending agricultural credit after the nationalization of 14 banks in 1969. These banks were to lend 18% of their total credit to agriculture as a priority sector and this mode of credit increased rapidly. In 1969, out of a total of 8262 bank branches, only 1860 were located in rural or semi-urban areas and there were only 2 lakh agricultural borrowing accounts. By 2004-2005, the number of agricultural borrowing accounts increased to over 16 million and the loans issued amounted to ₹ 72,886 crores. By 2005-06, commercial banks accounted for 69.52% of the total agricultural credit.

Regional Rural Banks (RRBs). These were set up in 1975 with the main objective of taking banking to the doorsteps of the rural masses, particularly in those areas where banking facilities were not existing. The idea was to serve the weaker sections of society. Initially only 5 RRBs were set up one each at Moradabad, Gorakhpur, Bhiwani, Jaipur and Malda. The number of RRBs increased to a 1996 by 2004 with 14,000 branches spreading over 516 districts.

Rural Infrastructural Development Fund (RIDF). Established in 1995-96, RIDF aims at providing loans to State Governments and State owned corporations to enable them to complete ongoing rural infrastructural projects. The total fund at its disposal amounted to ₹ 42,000 crore by 2005.

Kisan Credit Card (KCC) Scheme. This scheme was introduced in 1998-99 to provide adequate and timely credit to the farmers from the banking system for their cultivation needs in a flexible, hassle-free and cost effective manner. The farmers can use their cards for purchasing agricultural inputs like fertilizers, pesticides, seeds, etc. and also draw cash for their production needs. Credit limits are fixed on the basis of size of operational land holding, cropping pattern, scale of finance etc. It has been adopted by 27 commercial banks, 378 District Central Cooperative banks/State Cooperative Banks and 196 regional rural banks. The number of credit cards issued had risen to 16.38 crore upto 31st March. 2012. Table 20.12 gaves bankwise distribution of Kisan Credit as on 31st March, 2013.

TABLE 20.12 Distribution of Kisan Credit Cards according to categories of banks upto 31st March, 2012.

Category of Banks	Number of Kisan Credit Cards
1. Cooperative Banks	4,63,37,280
2. Regional Rural Banks	1,92,21,127
3. Commercial Banks	5,47,49,373
Total	12,03,07,780

Source : Agricultural Statistics at a glance, 2013, p. 292.

A revised Kisan Credit Card Scheme was introduced in March, 2012 in which KCC pass book has been replaced by an ATM-cum-debit card to all eligible and willing farmers in a time bound manner.

Self Help Groups (SHG) Bank Linkage. This programme was initiated in 1992 for improving the flow of credit to poor sections of the society and it has emerged as the largest and the fastest growing micro-finance programme in the country. As many as 560 banks are involved in this programme. These include 48 commercial banks, 196 RRBs and 316 cooperative banks. By December 2006, 18.29 lakh SHGs had been financed by banks with credit of over ₹ 8,719 crores. Over 90% of the SHGs are exclusive woman groups.

5. Agricultural Insurance. Agricultural insurance is necessary to provide financial compensation to farmers for losses in crop yields due to non-preventive risks including natural calamities like floods, droughts etc., pests and diseases and adverse weather conditions. It is a useful means of encouraging farmers to diversity to high value crops like fruits and vegetables which are susceptible to large fluctuations in output because of changes in weather (Bhalla 2007: 170). The government of India is currently implementing the following four Central Crop Insurance Schemes :

(i) National Agricultural Insurance Scheme (NAIS). This scheme was introduced in the rabi season of 1999-2000 with a view to providing insurance cover and financial support to farmers in the event of failure of crop due to natural calamities such as drought, flood, fire, pests and diseases. The scheme covers a wide range of crops including all food crops (cereals, millets and pulses), oilseeds and annual commercial/horticultural crops. At present the scheme is being implemented in 24 states and 2 union territories. During the 27 crop seasons from rabi 1999-2000 to rabi 2012-13, 2075 lakh farmers have been covered over an area of 3218 lakh hectares insuring a sum of ₹ 2,90,748 crore. Claims to the tune of about ₹ 25.352 crore have become payable against the premium of about ₹ 8,595 crore benefiting 524 lakh farmers.

(ii) Modified National Agricultural Insurance Scheme (MNAIS). With the aim of further improving crops insurance schemes the MNAIS is under implementation on pilot basis in 50 districts of 16 states from rabi 2010-11 season. The major changes introduced in this scheme *inter-alias* include village panchayat as a unit area of insurance for major crops, rationalization of calculation of threshold/guaranteed yield actuarial premium with adequate subsidy etc. Since the inception of the scheme from rabi 2010-11 to kharif 2012, 36.27 lakh farmers have been covered over an area of 39.35 lakh hectare insuring a sum of ₹ 8911.70 crore. Claims of ₹ 201.10 crore have been paid against premium of ₹ 897.03 benefiting about 3.47 lakh farmers.

(iii) Pilot Weather Based Crop Insurance Scheme (WBCIS). This scheme was implemented in Kharif 2007 season with the intention to provide insurance protection to farmers against adverse weather incidence such as deficit and excess rainfall, high or low temperature, and humidity that are deemed to adversely affect crop production. The scheme is based on actuarial rates of premium but to make it more attractive, premium actually charged from the farmers has been restricted to at par with

NAIS. Form kharif 2007-08 to rabi 2011-12, 370.69 lakh farmers cultivating an area of about 520.86 lakh hectares with a sum insured of about ₹ 64905 crore have been covered under the scheme. Claims of about ₹ 3208 crore have been paid against premium of about ₹ 5791 crore.

(iv) Coconut Palm Insurance Scheme (CPIS). This scheme was also approved on profit basis during the year 2009-10 and 2010-11 in selected areas of Andhra Pradesh, Goa, Karnataka, Kerala, Tamil Nadu, Maharashtra, Odisha and West Bengal. The sum insured is based on the input cost of the plantation and the age of the specific plant and it varies from ₹ 60 per palm in the age groups of 4-15 years to ₹ 1150 per palm in the age group of 16 to 40 years. The premium rate varies from ₹ 4.2 per palm in the age group of 4 to 15 to ₹ 5.75 per palm in the age group of 16 to 40 years. Fifty per cent is contributed by the Central government, 25 per cent by the concerned State Government and the remaining 25 per cent by the farmers.

6. Marketing. Although agricultural markets have existed in India for the past hundreds of years, they were largely unorganized and informal and could not play important role to help the farmers and the consumers. The farmers had limited choice because they had little surplus to sell and sold their crops to the village trader-cum-money lenders to pay of their rents, debts and to meet other cost requirements. Sometimes, farmers could venture to take their produce to a market in a nearby town where they could hardly get remunerative price for their produce due to underdeveloped nature of the markets, monopoly of a few traders, illiteracy of the farmers, malpractices like under weigthment, illicit deductions etc. and interlocking of credit and marketing. Simultaneously, price paid by the consumers used to be very high due to high profit of the traders and other middle men. It is estimated that producess received only 53% of the price of rice, 39% of the price of vegetables and 35% in the case fruit.

Although Agricultural Produce (Grading and Marketing) Act was passed way back in 1937, the rural development of agricultural marketing took place in the mid 1960s when the marketed surplus become much larger due to increased production as a result of effect of the Green Revolution. According to the Sub-Group an Estimation of Marketed Surplus Ratio Government of India (2004), 43% production of rice and other cereals and 51.5% of that of wheat were marketed during 2002-03. For pulses and oilseeds the share was 72.4% and 79.6% respectively. Commercial crops recorded a much higher marketed surplus. For example marketed surplus was about 93% in case of sugarcane and cotton. These developments necessitated the growth of agricultural markets and all the states of India enacted legislation known as the State Agricultural Produce (Markets) Act with a view to having regulated markets. The number of regulated markets was only 286 in 1950 and their number stood at 7157 as on 31st March, 2010. The advent of regulated markets has helped in mitigating the market handicaps of producers/sellers at wholesale assembling level, but rural periodic markets in general, and tribal markets in particular remain out of its development embit.

Organised marketing of agricultural products has been promoted through a network of regulated markets to ensure reasonable gains to farmers and consumers by creating a market environment conductive to fair play of supply and demand. A modal Agricultural Produce Market Committee (APMC) Act was prepared in 2003 for bringing about reforms in agricultural marketing. Many state governments have brought about amendments in APMC Act to further benefit the farmers and the consumers alike. But some states are yet to implement the provisions of the APMC Act.

Recently a major initiative has been taken to promote modern terminal markets for fruits, vegetables and other perishable in important urban centres of the country. These markets would be provided with state-of-the-art infrastructure facilities for electronic auction, cold chain and logistic and operate through primary collection centres conveniently located in producing areas to allow easy access to farmers. They are evasisaged to operate on "Hub" and Spoke" format wherein the Terminal market (the Hub) would be linked to a number of collection centres (the Spokes) conveniently locate in key production centres to allow easy access to farmer for marketing their produce. These markets would be set up under the scheme of National Horticulture Mission (NHM).

Agriculture sector requires competitive and well functioning markets with alternate choices to the

farmers. Reforms in agricultural markets were initiated to ease out restrictive and monopolistic approach of state and 2-3 grades were prescribed for each commodity. Grades help farmers/traders to get prices of agricultural commodities as per their quality and the consumers get the desired quality. As many as 105 Grading and Marketing Rules (GMR) covering 213 commodities have been notified under the provisions of Agricultural Produce (Grading and marketing) Act, 1937. These include fruits and vegetables, cereals, pulses, oilseeds, vegetable oils, ghee, spices, honey etc.

The Department of Agriculture and Cooperation (DAC) has the following three organizations dealing with marketing under its administrative control.

(i) Directorate of Marketing and Inspection (DMI) has its head offices at Faridabad (Haryana). Branch Head Office at Nagpur (Maharashtra), 11 Regional Offices and Central Agmark Laboratory at Nagpur.

(ii) Ch. Charan Singh National Institute of Agricultural Marketing (NIAM) set up Japiur on 8th August, 1988 with a mandate for Training Research Consultancy and Education in the field of Agriculture Marketing.

(iii) Small farmers Agri-Business Consortium (SFAC) registered in January, 1994 for innovative ideas, generating income and employment in rural areas by promoting private investment in agricultural project.

7. Storage and Warehousing. Farmers often find it difficult to retain their production due to lack of storage facilities and are force to opt for distress sale in the market. Storage facilities are, therefore, of utmost importance to help the farmers for getting remunerative prices and to facilitiate regular flow of agricultural products to the consumers. Considerable storage capacity has been created in the country after Independent and particularly in the post Green Revolution era, both at the national and the state levels. Whereas the Food Corporation of India (FCI) and the Central Warehousing Corporation (CWC) have created large storage facilities at the centres of all India importance, the State Governments and the State Warehousing Corporations (SWC) have built storage at centres of State/district level importance. FCI is the main agency which provides storage facilities for agricultural products. In addition to its own godowns, its hires storage capacity from other sources such as CWC, SWC and private parties. As on 1st February, 2012 the FCI had covered storage capacity 300.83 lakh tonnes (owned and hired) where the State Agencies (SWCs) had covered capacity of 155.34 lakh tonnes which is used for storage of central pool of foodgrains.

Although there had been considerable increase in storage capacity, the storage system in India came under severe stress after 2001-02 when marketable surplus in agriculture increased rapidly and the total foodgrains status with the FCI reached levels ranging from 50 to 60 million tonnes. Shortage of storage facilities results in damage of huge quantities of foodgrains. Large quantities of foodgrains are stored in open. In the year 2012-13 out of 57.85 million tons of grains stocks, 42.50 million tons were stored in covered storage and the remaining 15.35 million tons were stored in the open; a large proportion of which was exposed to rain and rodents. Rice and wheat amounting to about 11 million metric tons costing

TABLE 20.13. Procurement of major crops in India according to Marketing year (thousand Tonnes)

Crop/ year	2001-2002	2002 2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
Rice/ (Oct-Sept)	22128	16422	22828	24684	27656	25107	28736	34104	32034	34198	35026	35.020
Wheat (April-March)	20630	19054	15801	16795	14787	9226	11128	22689	25382	22514	28335	38148
Coarse Grains	314.75	59.81	650.75	827.07	1153.50	0.20	203.56	1375.2	406.83	127.83	360.00	—

Source : Agricultural statistics at a glance 2012, p. 2 225-227 and 2013 pp. 223-24.

over ₹ 2050 crore was lost in storage and transit during three years from 2010-11 to 2012-13. (**Table 20.14**).

TABLE 20.14. Loss of foodgrains in storage and transit (matric tons)

Year	Storage loss	Transit loss	Worth (₹ in crores)
2010-11	1,74,904	1,77,037	605.72
2011-12	2,04,761	1,96,477	738.37
2012-13*	1,70,300	1,84,159	719.75

*Provisional

Source : FCI.

In order to meet the requirement of all time high stock levels of 823.174 lakh tons achieved in the year 2012-13 the FCI resorted to short term hiring to efficiently manage the stocks. Recognizing the problem of acute shortage of storage capacity, the government has set up a High Level Committee to look into the storage issues. Additional storage capacity has to be credited at suitable locations in order to meet the challenge of achieving broad objectives of food security. In this regard, the Government has formulated a scheme for construction of godowns under Private Entrepreneurs Guarantee (PEG) Scheme. Under the PEG scheme, the FCI guarantees 10 year usage of storage capacities to private investors and nine years to Central Warehousing Corporation and State Warehousing Corporations. The construction of godowns in 19 states with a total capacity of 197 lakh tons has been approved out of which a capacity of 132.73 lakh tons had been sanctioned for construction.

Gramin Bhadaran Yojna (GBY) or Rural Godowns Scheme (RGS) was lanch as on April 1, 2001 to create a network of rural godowns and to enable the farmers to retain the produce till the market prices are favourable and also to meet their credit requirements. The project for construction of rural godowns can be taken up by individuals, farmers, groups of farmers/growers, partnership/proprietory firm, Non-Government Organisations, Self Help Groups (SHGs), Companies, Corporations, Cooperatives, Local bodies other than Municipal Corporations, Federations, Agricultural Produce Market Committees, Marketing Boards and Agro Processing Corporations in the entire country. The Government provides subsidy for constructing these godowns. Since its inception from 01.04.2001 and upto 31.7.2013 a total number of 31,897 godowns having a capacity of 423.84 lakh metric tons had been sanctioned. The scheme has helped the formers to store their agricultural products near their fields and obtain pledge loans and marketing credit from banks, thereby avoiding distress sale immediately after the harvest.

4. TECHNOLOGICAL FACTORS

Technological factors pertain to high yielding varieties of seeds, chemical fertilizers, insecticides, pesticides an farm machinery etc.

Seeds. High Yielding Varieties (HYV) of seeds comprise one of the most important inputs for enhancing agricultural productivity and production. Efficiency of other agricultural inputs such as fertilizers, pesticides and irrigation is largely determined by it. Seed quality is estimated to account for 20-25 per cent of productivity. In addition to their genetic potential for high grain yield, the other important attributes of HYV seeds are (*a*) their high level of responsiveness to fertilizers and other inputs. (*b*) their high grain stalk ratios, and (*c*) photo-period insensitivity and short period maturity in most cases. The new seed varieties being short maturing also enable double cropping, have dwarf stems which are tough enough to carry heavy load, are resistant to wind damage, and have large leaf surface for faciliting photosynthesis. (Bhalla 2007: 101).

The High Yielding Variety Programme (HYVP) was launched in 1966-67 and covered 18.9 lakh hectares or 2.2% of the total cropped area of the six involved crops (rice, wheat, jowar, bajra, maize and ragi) in that year. Since then, the production and consumption of HYV seeds has been increasing steadily. At present more than four-fifth of the total cropped areas under these crops enjoys the facility of HYV seeds. The Central Government has been addressing this issue through various programmes/ schemes. This include the Indian Seed Programme involving the participation of the Central and State Governments. Indian Council of Agricultural Research (ICAR), State agricultural universities, cooperatives and the private sector and farmers and plant breeders. Currently the seed production system consists of production of breeder, foundation and certified seeds and their distribution. ***Breeder seeds*** represent the first stage of quality seed development and are prepared by the ICAR and some selected agricultural universities. ***Foundation seeds*** represent the second stage of quality seed development and are produced from the breeder seeds. These seeds are produced by the National Seeds Corporation (founded in 1963) and some selected agricultural universities. The seed multiplication and supply is done through a large number of agencies such as Central Government Seed Farms, State Seed Farms, State Departments of Agriculture, private seed producers and Seed Producers' Corporatives. Private producers produce seeds under strict supervision of scientists in the universities. ***Certified seed*** is the ultimate stage in seed production chain and is the progeny of foundation seed. The seeds have to be certified by the competent authorities before they are released to farmers for use in their fields. **Table 2.15** shows the progress in production and distribution of HYV seeds.

The Seed Act 1966 provides for legislative framework for regulation of quality seeds sold in the country. Considering the vital importance of the seed industry in promoting agricultural growth the Ministry of Agriculture has seen proposing replacement of the existing Seeds Act, 1966 by a suitable legislation. The new Act is expected to (*i*) create a facilitative climate for growth of seed industry. (*ii*) enhance seed replacement rates for various crops. (*iii*) boost export of seeds and encourage import of useful germ plasm and (*iv*) create a conductive atmosphere for application of frontier sciences in variety development and for enhanced investment in Research and Development (R & D). The Seeds Bill 2004 was introduced in the Rajya Sabha on 9th December, 2004 and is pending consideration by Parliament.

The New Policy on Seed Development (NPSO) was formulated in 1988 with a view a providing best planting material to Indian farmers. This policy has facilitated import of seeds under various categories. Initially seeds of cereals, oilseeds, pulses etc. were allowed to be imported. Subsequently seeds of more crops were allowed to be imported under prescribed conditions.

A Central Sector Scheme for Development Strengthening of Infrastructure Facilities for production and distribution of Quality Seeds with the aim of making quality seeds of various crops available to farmers at affordable price is under implementation since 2005-06. As a result of this initiative, availability of certified quality seeds has increased from 126.75 lakh quintals in 2005-06 to 328.6 lakh quintals in 2012-13. For achieving timely availability of seeds at affordable price to farmers in hilly/remote areas of north-eastern states, a transport Subsidy on Movement of Seeds scheme is in operation.

A look at the cropwise distribution of Certified/ Quality seeds (**Table 20.16**) shows that food crops have been given top priority so that sufficient foodgrains are made available to the fast growing population. Oilseeds have also received considerable attention because India heavily depends on imports of oilseeds to meet her growing demand.

TABLE 20.15. Production of Breeder and Foundation Seeds and Distribution of Certified/ Quality Seeds

Year	1991-92	1995-96	2000-01	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Production of Breeder seeds (Thousand Quintals)	34.90	43.36	42.69	68.64	73.83	91.96	94.41	105.00	119.21	119.21
Production of Foundation Seeds (Lakh Quintals)	3.75	4.76	5.91	7.40	7.96	8.22	9.69	10.50	17.53	21.86
Distribution of Certified Quality Seeds (Lakh Quintals)	57.50	69.90	86.27	126.75	155.01	179.05	215.81	257.11	277.34	283.85

Source : Agricultural Statistics at glance, 2012, pp. 273-74.

TABLE 20.16 . Cropwise distribution of Certified/Quality seeds (lakh Quintals)

Crops/Year	1983 -84	1991 -92	2000 -01	2005 -06	2006- 07	2007- 08	2008- 09	2009- 10	2010- 11	2011- 12	2012- 13
Cereals (weat, paddy, maize, jawar, bajra, ragi, barley)	25.67	35.35	59.97	86.73	109.87	123.80	147.43	165.15	182.62	184.52	189
Pulses (gram, lentil, peas, urad moong, arhar, cowpea, others)	2.09	3.29	3.85	7.37	9.63	12.57	14.48	19.69	20.83	22.26	23.95
Oilseeds (groundnut, rapeseed and mustard, til, sunflower, linseed castor seeds safflower, others.	6.49	9.66	12.54	24.35	27.00	34.33	39.92	50.1	50.61	61.49	62.07
Fibre crops (cotton, jute, mesta others)	1.91	2.03	2.91	2.89	3.05	2.63	2.58	2.65	2.64	3.09	2.85
Other miscellaneous crops	8.81	7.17	7.50	5.41	5.46	5.72	11.40	18.91	20.63	18.38	
Total	**44.97**	**57.50**	**86.27**	**126.75**	**155.01**	**179.05**	**215.81**	**257.11**	**277.34**	**294.85**	**299.90**

Source : Agricultural statistics at a glance, 2013, pp. 284-86.

Merits of HYV Seeds. A brief description of merits of HYV seeds has been given in the beginning of section on HYV seeds. However, a detailed description is required to appreciate the merit of these seeds and their contribution to enhancement in agricultural productivity will be very useful at this stage :

1. **Suitable for use of Fertilizers.** HYV seeds are suitable for use of fertilizers. It has been observed that new seeds give much higher yields as compared to old seeds for the same amount of fertilizers input. This is the reason that areas using higher amount of new seeds are also using fertilizers in larger quantities.

2. **Shorter Life Cycle.** HYV seeds have shorter life cycle. These seeds give early maturing crops and give greater opportunities a farmer to venture for multiple cropping. For example, new seeds of rice and wheat complete life cycles in 100 and 110 days respectively in contrast to 130 and 150 days respectively in case of traditional varieties of seeds. Thus new seeds help in increasing the farm production and economise on land.

3. **Economic on Irrigation.** Although new seeds require large amount of irrigation for proper growth of crops, yet the per quintal requirement of irrigation is much lower as compared to old seeds. This is due to the fact that per hectare yields in quintals is much higher in case of new seeds when compared with those of old seeds.

4. **Employment.** Agriculture based on HYV seeds requires more labour per unit area and generate more employment. Prior to the introduction of new seeds in the Indian agriculture, farmers were largely dependent on monsoon rainfall. This was particularly the case in the North-Plains of India. The farmers could not find any employment during the period between the harvesting of rabi crops and sowing kharif crops and were forced to sit idle from April to June. With the introduction of new seeds, the farmers can grow second crop immediately after harvesting the first and are thus able to find employment throughout the year.

5. **Easy to Adopt.** It does not require any special skill to adopt HYV seeds. They can be easily adopted by any class of farmers, whether big landlords or small farmers after elementary training. However, a little adjustment of dates of sowing the wheat crop is required because this crops requires relatively cool temperature at the time of sowing and during early period of its growth. This is due to the fact that wheat based on new seeds is of early maturing variety and has to be sown a little later. For example, in Punjab, Haryana and western part of Uttar Pradesh wheat based on old seeds was sown in the beginning of October, but wheat based on new seeds is now sown in November-December in these areas. In contrast, rice is a kharif crop and does not require much adjustment in time of sowing. However, introduction of new seeds has enabled the farmers to take two crops of rice in place of only one crop obtained earlier on the basis of old seeds.

Constraints in Adoption of New Seeds

Although new HYV seeds have entirely transformed agricultural scenario in India and have made India a food deficit to a food surplus country even in the wake of rapidly increasing population, yet there are some constraints in the use of these seeds. Some of the major difficulties in adopting these seeds are briefly described as under :

1. **Irrigation.** New seeds do not tolerate dry weather and water shortage and need copious irrigation for the successful growth of crops based on these seeds. The monsoon rainfall occurs only for 3-4 months in the whole duration of the year and remaining 8-9 months are almost completely dry. Thus Indian agriculture is heavily dependent on irrigation and this dependency has further increased with the introduction of new seeds. New seeds have led to high crop intensity which requires much higher level of irrigation. The new seeds need right amount of irrigation at right time during the crop's growth. Under irrigation or over irrigation or irrigation at inappropriate time can hinder the proper growth of crops. It has been estimated that in areas like Punjab, Haryana and western part of Uttar Pradesh, 50 per cent increase in the wheat yields can be obtained by irrigation without other inputs like fertilizers etc. The first irrigation of wheat around the third week of sowing alone can increase the yields by as much as 30 percent. Other inputs like fertilizers, pesticides, insecticides etc. are of no use if proper irrigation at the proper time is not provided to crops.

2. **Fertilizers.** Indian soils, particularly those of the Great Plains of North India, have been tilled for the last thousands of years. As such they are exhausted and they have lost much of their fertility. This loss of fertility is to be compensated by using chemical fertilizers because conventional manures like cowdung, compost and green are not able to cope with the increasing demand. The introduction of new seeds has further increased the demand for chemical fertilizers because these seeds require higher inputs of fertilizers for giving higher crop yields. As mentioned earlier, new seeds have dwarf stems which are strong enough to carry heavy load, are resistant to wind damage, and have large leaf surface to facilitate photosynthesis. All these characteristics require heavy dose of chemical fertilizers. This is the reason that demand for chemical fertilizers has increased considerably since mid-1960s.

3. **Insecticides and Pesticides.** Crops based on new seeds are very delicale and are highly susceptible insects, pests and diseases. This is due to the fact that new seeds require heavy dose of irrigation, fertilizers and air as well as soil contains a lot of moisture and chemicals. These conditions lead to fast growth and multiplication of insects and pest in hot and humid climate of India. These insects and pests cause heavy damage to crops and reduce their yields substantially. This problem can be solved by spraying the crops with insecticides and pesticides at required intervals. For this purpose, the farmers are supposed to have adequate knowledge of the crop diseases and the types of chemicals to finish such diseases. The diseases may spread from one field to another as from one village to another village. Therefore quick and sufficient steps must be taken to spray the crops with the required insecticides and pesticides. Otherwise the insects and pests may damage the crop partially or wholly. Normally, insecticides and pesticides are very expensive and are out of read of the small and marginal farmers. Therefore, such farmers should be provided with financial assistance to cope with such a situation.

4. **Capital Constraint.** Use of new seeds is capital intensive because their use needs heavy inputs of irrigation (canal, tube wells), chemical fertilizers, insecticides and pesticides and agricultural machinery (tractors, harvesters, threshers, sprayers etc). All these

inputs are complimentary to one another and one cannot be of any use in the absence of the other. Their purchase requires sufficient capital which majority of the farmers, especially small and marginal farmers do possess. They should be extended loans at easy terms by different agencies like State Cooperative Banks, District Central Cooperative Banks, Primary Agriculture Credit Societies etc. Unfortunately, it is the big farmers who get the maximum advantage of loan facilities due to their strong influence and corrupt officials and poor farmers are usually deprived of such facilities. Therefore, there is urgent need to strengthen the agencies extending loans to farmers so that the most needy farmers get their due.

5. **Mechanization.** Use of modern agricultural machines is also essential for successful cultivation of HYV seeds. Raising of 2-3 crops is possible only by applying modern technology. The traditional farm implements like sickel, hoe, wooden plough, bullock cart etc. are more labour intensive and less efficient. Modern machines like tractors, harvesters, threshers, tillers, sprayers, pumping sets etc. are less labour intensive and more efficient. Since the farm machines are more efficient, they became big time savers and the farmer gets sufficient time to prepare for the second crop after harvesting the first crop. Thus it is possible for the farmer to take more than one crop during the course of year from the same field. Farm mechanization also helps in optimum utilization of the complementary inputs like irrigation, fertilizers, insecticides, pesticides etc. Availability of power in the form of hydroelectricity or diesel at cheap rates is of paramount importance for mechanisation of Indian agriculture. Power gives motion to farm machines in the absence of which the entire farm machinery comes to a stand still.

6. **Marketing and Storage Facilities.** The use of HYV seeds leads to high agricultural productivity which requires adequate facilities of marketing and storage. Food Corporation of India (FCI) was established by the Government of India for storing foodgrains which has helped in storing foodgrains after harvesting and releasing these foodgrains at the time of need. Usually the farmers take their agricultural products to the nearby urban market and sell them there. They also purchase seeds, fertilizers, pesticides, insecticides, farm machinery and things of daily use from these markets. For successful marketing of the agricultural products, it is essential that villages should be connected to the nearby urban markets by all weather metalled roads. A well developed transport system acts as blood veins for the producers and the consumers alike. Sale of perishable commodities like milk, vegetables, fruits, flowers etc. in the urban markets from the surrounding rural areas is simply impossible in the absence of a cheap and efficient transport network.

7. **Extension Services.** HYV seeds are very sensitive to irrigation, fertilizers, pesticides, insecticides, sowing, weeding and thinning etc. and mismanagement of any one of these inputs can adversely affect the farm productivity. For all these things to function properly, the farmers need to be adequately educated. This requires extension services by well trained, efficient and dedicated agents. Full utilization of extention services requires perfect understanding and coordination between farmers extension agents, farm supervisors, researchers and agricultural scientists. Any slackness on any front will lead to low agricultural productivity and overall poverty of farmers and aggravate the food problem.

8. **Human Factor.** Like all other major inputs, adoption of HYV seeds depends very much on human factor. Utilization of facilities like fertilizers, pesticides, insecticides and farm machinery for proper use of HYV seeds much depends on attitude of the farmers. There are certain farmers who are open to new ideas and technologies and adopt them easily. On the other hand there are other farmers who are conservative and orthodox in their approach towards life and do not accept new ideas in agriculture. In almost all the villages of India there are some progressive farmers who have improved their farm production and their standard of living while their conservative and orthodox counterparts are still living a life of poverty, deprevation, hunger and starvation. Unfortunately, farmers in large parts of India are still uneducated and do not adopt new technologies easily.

This is the season that in spite of large scale progress in Indian agriculture after 1960s, India agricultural productivity is still far behind the world averages. The effect of Green Revolution has been maximum in Punjab and Haryana because farmers in these states are progressive and hardworking and adopt new technologies with ease and comfort. These two states have recorded unprecedented increase in the production of wheat after the advent of the Green Revolution. A similar progress has been noted in the coastal areas of Andhra Pradesh and Tamil Nadu with respect to increase in rice production because the farmers in these areas have easily adopted new techniques of rice cultivation.

Deficiencies of HYV Seed Programme

Although HYV seed programme has contributed a great deal in increasing the agricultural productivity. some glaring deficiencies in this programme have been noticed. Lack of appropriate scientific tests by the concerned government agencies before buying the seeds from seed farmers and distribution of seeds by some unscrupulous private dealers have resulted in reduced yields, variability in performance and increased growth of pests and insects. All these factors have exposed the farmers to bigger risks than ever before. Following concerns have become more serious at present :

(*i*) Inadequate inspection and certification of seeds has resulted in mushrooming seed production under lax scientific conditions. There is flood of non-"certified seeds marked as "Truthfully Marked Seeds" in the market and the farmers have to bear the brunt of this unhealthy practice.

(*ii*) Non-availability of good quality seeds has led to increasing tendency for farmers to produce their own seeds. The seed replacement rate continued to be much below 20% for most crops. As a result there is deterioration of quanlity seeds and the yields are adversely affected.

(*iii*) The major emphasis of seed programme has been on the development of better seeds for wheat and rice and other crops have received much less attention.

(*iv*) Throwing seed trade to multinationals has led to entry of genetically modified seeds in some high value crops like cotton, vegetables and fruits. Most important was Bt. cotton. Introduction of this seed led to phenomena increase in yields of cotton in the beginning to but a stage of saturation reached soon. The yield of cotton increased from 106 kg/ha in 1970-71 to 499 kg/ha in 2010-11 and fell to 486 kg/ha in 2012-13. However it increased to 529 kg/ha in 2013-14 as many farmers had discarded Bt-cotton seed. Further due to lack of affective legislation, some unscrupulous traders started selling spurious seeds to the farmers. This combined with bad weather led to ruination of many cotton farmers driving some to commit suicide. (Bhalla 2007:104). Hundreds of farmers growing cotton have committed suicide in Maharashtra and other states due to crop failure.

Fertilizers. Fertilizers is a crucial input for increasing the farm productivity and new HYV seeds are of no use without fertilizers. High level of plant nutrients is essential to achieve the objective of increasing farm production through high cropping intensity under multiple cropping programme. Green Revolution would have remained a dream for India but for the introduction of fertilizers, in spite of large scale use of HYV seeds and irrigation. In fact HYV seeds fertilizers and irrigation is that ***trilogy*** which has led to unprecendented increase in agricultural production.

Production Import and Consumption of Fertilizers. India is the third largest producer of fertilizers after China and USA and second largest consumer after China in the world. There are three main types of chemical fertilizers which are known as Nitrogenous (N), Phosphatic (P) and Potassic (K) fertilizers. Nitrogeneous fertilizers are the most important and account for about three-fourth of the total fertilizers production in the country. The remaining one-fourth are phosphatic and potassic fertilizers. The production of all fertilizers (NPK) increased from 1059 thousand tonnes in 1970-71 to 16092 thousand tonnes in 2013-14 recording more than 15 times increase within a span of four and a half decades. Similarly imports and consumption also

have recorded phenomenal increase (**Table 20.17**). Uttar Pradesh is the largest consumer with a consumption of 4207.75 thousand tonnes in 2011-12. This is followed by Andhra Pradesh and Maharashtra consuming more than 3000 thousand tonnes each. Most of the north-eastern states are least dependent on chemical fertilizers. Entirely different picture emerges when we look at per hectare consumption of fertilizers. From this point of view, Andhra Pradesh is at the top consuming 266.11 kg/ha. This is followed by Punjab (243.56 kg/ha), Tamil Nadu (227.01 kg/ha) and Haryana (224.85 kg/ha). Again, north-eastern states are the least consumers per hectare. Among the union territories Puducherry is at the top consuming 674.06 kg/ha (**Table 20.18**).

India meets 80 per cent of its urea requirement through indigenous production but is largely import dependent for meeting her requirements of potassic (K) and phosphate (P) fertilizers. The government has notified the New Investment Policy 2012 (NIP-2012) in the urea sector which will encourage investments leading to increase in indigenous capacities, reduction in import dependence and savings in subsidy due to import substitution at prices below import parity price (IPP).

Although India has progressed a lot with regard to production and consumption of fertilizers, we still lag far behind several countries of the world so far as consumption of fertilizers per hectare is concerned (**Table 20.19**). Even some of the neighbouring countries like Pakistan, China and Bangladesh consume much more fertilizers than India. Most of the European countries. Egypt in Africa, Chile in South America. Japan in Asia and New Zealand in Oceanic use much larger quantities of fertilizers than India. This brings us to the conclusion that there is much scope for increasing the consumption of fertilizers so that our agricultural productivity increases and we are able to meet the growing needs of rapidly increasing population. However, proper consideration should be given to environmental problems arising out of thoughtless use of fertilizers. Already we are facing so many environmental problems resulting from unscientific use of fertilizers.

TABLE 20.17. Production Imports and Consumption of Fertilizers

(Thousands tonnes of nutrients)

	1970 -71	1980 -81	1990 -91	2000 -01	2007 -08	2008 -09	2009 -10	2010 -11	2011 -12	2012 -13	2013 -14
1	2	3	4	5	6	7	8	9	10	11	12
A. Nitrogen Fertilizers											
Production	830	2164	6993	11004	10900	10870	11900	12157	12259	12194	12338
Imports	477	1510	414	154	3677	3844	3447	4493	5240	4801	3920
Consumption	1487	3678	7997	10920	14419	15090	15580	16558	17300	16820	NA
B. Phosphatic fertilizers											
Production	229	842	2052	3748	3807	3464	4321	4223	4104	3541	3714
Imports	32	452	1311	396	1391	2927	2756	3802	4427	2797	1588
Consumption	462	1214	3221	4215	5515	6506	7274	8050	7614	6653	NA
C. Potassic fertilizers											
Imports	120	797	1328	1541	2653	3380	2945	4069	3335	1559	1926
Consumption	228	624	1328	1567	2636	3313	3632	3514	2676	2061	NA
D. All fertilizers (NPK)											
Production	1059	3006	9045	14752	14707	14334	16221	16380	16363	15735	16092
Imports	629	2759	2758	2090	7721	10151	9148	12364	13002	9157	7434
Consumption	2177	5516	12546	19702	22570	24909	26486	28122	27740	25536	NA

NA = Data Not Available

Source : Economic Survey 2013-14, Statistical Appendix p. 24.

TABLE 20.18 . Statewise / Zonewise Consumption of fertilizers in India (2011-12)

Sl. No	State/Zone	Total Consumption (Thousand Tonnes)				Consumption in kgs/hectare			
		N	P	K	Total	N	P	K	Total
South Zone									
1.	Andhra Pradesh	1977.29	1043.02	322.04	3342.35	157.43	83.04	25.64	266.11
2.	Karnataka	1215.94	786.76	332.85	2335.55	94.46	61.12	25.86	181.43
3.	Kerala	135.54	66.16	99.63	301.33	50.78	24.79	37.33	112.90
4.	Tamil Nadu	684.56	316.39	263.96	1264.91	122.86	56.78	47.37	227.01
5.	Puducherry	14.61	3.90	3.06	21.57	456.56	121.88	95.63	674.06
6.	A & N Islands	0.37	0.37	0.17	0.91	21.76	21.76	10.00	53.53
7.	Lakshadweep	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
West Zone									
8.	Gujarat	1183.30	417.02	132.74	1733.06	106.24	37.44	11.92	155.60
9.	Madhya Pradesh	1061.75	750.76	79.47	1891.98	49.59	35.06	3.71	88.36
10.	Chhattisgarh	356.40	177.33	61.84	595.57	64.09	31.89	11.12	107.10
11.	Maharashtra	1610.91	1011.76	399.48	3022.15	71.24	44.74	17.67	133.65
12.	Rajasthan	913.49	416.11	26.18	1355.78	42.01	19.14	1.20	62.35
13.	Goa	3.06	2.67	1.89	7.62	19.13	16.69	11.81	47.63
14.	Daman & Diu	0.06	0.01	0.00	0.07	15.00	2.50	0.00	17.50
15.	D&N Haveli	0.60	0.41	0.00	1.01	25.00	17.08	0.00	42.08
North Zone									
16.	Haryana	1020.90	369.62	37.53	1428.05	160.75	58.20	5.91	224.85
17.	Punjab	1416.56	448.65	52.85	1918.06	179.88	56.97	6.71	243.56
18.	Uttar Pradesh	3067.10	1024.23	116.42	4207.75	123.85	41.36	4.70	169.91
19.	Uttarakhand	123.78	32.31	10.34	166.43	106.16	27.71	8.87	142.74
20.	Himachal Pradesh	32.80	9.70	8.93	51.43	35.19	10.41	9.58	55.18
21.	Jammu & Kashmir	66.13	28.65	5.29	100.07	57.76	25.02	4.62	87.40
22.	Delhi	0.35	0.22	0.01	0.58	7.61	4.78	0.22	12.61
23.	Chandigarh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Zone									
24.	Bihar	967.78	297.01	115.36	1380.15	129.19	39.65	15.40	184.24
25.	Jharkhand	118.02	42.01	11.34	171.37	84.36	30.03	8.11	122.49
26.	Odisha	323.41	135.48	55.80	514.69	35.51	14.88	6.13	56.52
27.	West Bengal	831.99	476.17	309.04	1617.20	87.30	49.97	32.43	169.70
North East Zone									
28.	Assam	151.05	49.08	75.52	275.65	36.85	11.97	18.42	67.25
29.	Tripura	10.42	5.49	2.73	18.64	33.72	17.77	8.83	60.32
30.	Manipur	6.59	0.97	0.44	8.00	28.28	4.16	1.89	34.33
31.	Meghalaya	3.27	1.24	0.25	4.76	9.73	3.69	0.74	14.17
32.	Nagaland	0.75	0.49	0.20	1.44	1.54	1.01	0.41	2.96
33.	Arunachal Pradesh	0.55	0.10	0.03	0.68	1.99	0.36	0.11	2.46
34.	Mizoram	0.92	0.21	0.06	1.19	7.48	1.71	0.49	9.67
35.	Sikkim	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	All India	**17300.25**	**7914.30**	**2525.45**	**27740**	**90.01**	**41.18**	**13.14**	**144.33**

Source : State of Indian Agriculture 2013, pp . 182-185.

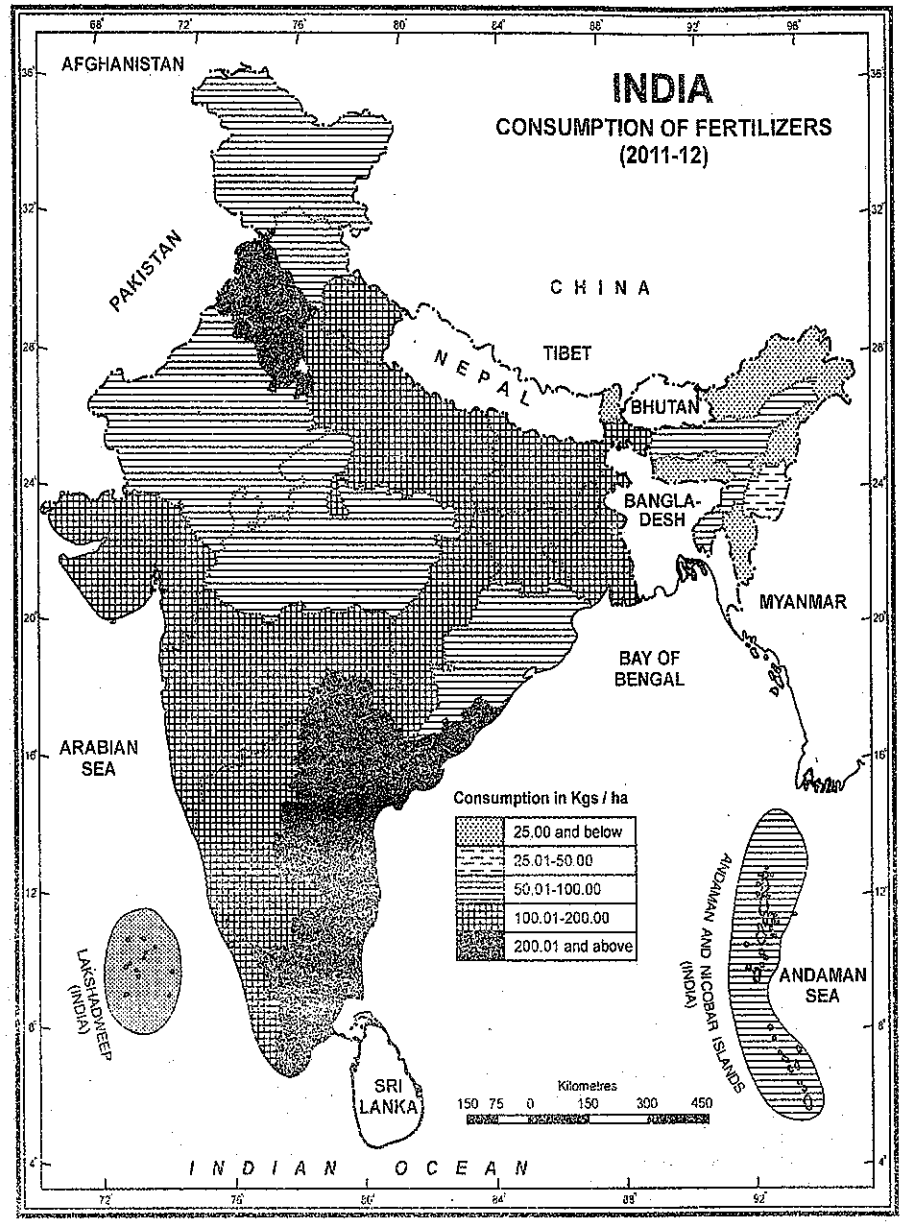


FIG. 20.4. India : Consumption of fertilizers in kilograms per hectare (2011-12)

Subsidy on Fertilisers. Under the Nutrient Based Subsidy (NBS) scheme for phosphatic and potassic (P&K) fertilizers implemented in 2010, a fixed amount of subsidy, decided on annual basis, is provided to each grade of P&K fertilizers, depending upon its nutrient content. An additional subsidy is also provided to secondary and micro-nutrients. Under this scheme, manufacturers/marketers are allowed to fix the maximum retail price (MRP). Under NBS, as of Mrach 2014, farmers pay 61 to 75 per cent of the delivered cost of P&K fertilizers; the rest is borne by the Government of India in the form of subsidy. However, the government continues to share a substantial burden in the form of fertilizer subsidy (**Fig. 20.5**). Fertilizer subsidy was ₹ 67,971 crore in 2013-14 (Revised Estimate) an increase of 11 per cent over 2009-10. While the quantum of fertilizer subsidy increased, subsidy as percentage GDP has been declining since 2010.

TABLE 20.19. Fertilizers Consumption of Arable Land and Land under permanent crops in selected countries in 2010

Country	Consumption/ Fertilizers (kg/ hectare)
1. Egypt	368.7
2. Chile	285.1
3. Bangladesh	224.0
4. China	400.3
5. India	165.8
6. Japan	212.5
7. Koren Republic	278.4
8. Malaysia	275.4
9. Pakistan	184.7
10. Belarus	253.6
11. France	176.8
12. Germany	206.3
13. Netherlands	270.6
14. U.K.	247.2
15. New Zealand	1,507.0

Source : Agricultural Statistics at a glance 2013, p. 281.

Unbalanced Use of Fertilizers. One of the major problems of fertilizers in India is their unbalanced use. According to recommendation of the agricultural scientists, the ideal ratios in which nitrogeneous, phosphatic and potassium (NPK) fertilizers should be used is 4:2:1. This ratio was 6.0:2.4:1 in 1990-91. The prices of different fertilizers were changed after the Government of India adopted the policy of liberalization in 1991 which resulted in highly unbalanced use of fertilizers and it rose to 9.7:2.9:1 in 1993-94. Some of the agriculturally advanced states like Punjab, Haryana, Uttar Pradesh, Andhra Pradesh and Tamil Nadu showed still greater unbalanced use of NPK fertilizers. **Table 20.20** gives an idea of unbalanced use of fertilizers in Bihar, Haryana and Punjab. This led to a serious degradation of soil nutrients. In order to remove this unbalanced use of fertilizers, the Government of India come out with subsidies of varying extent to different types of fertilizers. In spite of steps taken to correct the

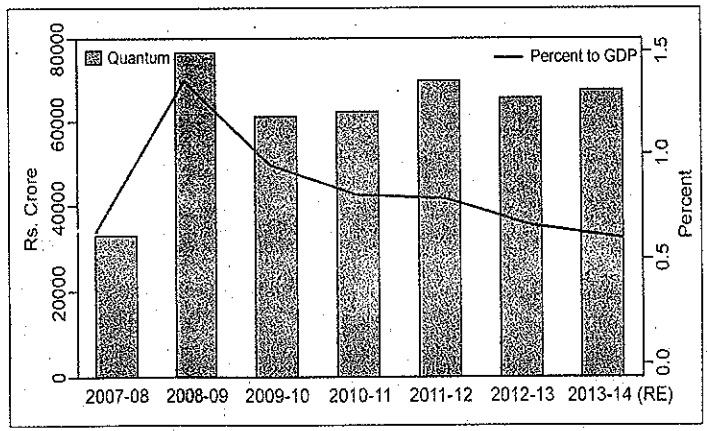


FIG. 20.5. Fertilizer subsidy disbursed

TABLE 20.20. Unbalanced use of NPK fertilizers

	2009-10	2010-11	2012-13
Bihar	5.3 : 1.5 : 1	5.8 : 1.9 : 1	12.3 : 3.6 : 1
Haryana	15.9 : 5.5 : 1	20.4 : 6 : 1	61.4 : 18.7 : 1
Punjab	18.4 : 5.9 : 1	19.1 : 5.4 : 1	61.9 : 19.3 : 1
All India	4.3 : 2 : 1	5.0 : 2.4 : 1	8.2 : 3.2 : 1

Source : Economic Survey 2013-14, p. 144.

unbalanced use, the NPK ratio stood at 8.2 : 3.2 : 1 in 2012-13 which still remained skewed in favour of N and P against K. Use of urea in higher proportion adversely affects the soil profile. Proper growth of plants occurs only when the soil contains all sixteen nutrients. The soil should have sufficient quantity of sulphur, zinc and calcium in addition to NPK.

Fatigue of the Green Revolution and stagnation in agricultural growth in 1990s was largely due to unbalanced used of fertilizers. Crop productivity has not increase in proportion to the use of fertilizers in areas of higher consumption of fertilizers. It seemed that crop production in India has reached its zenith with reference to the present day level of technological advancement but is still at a very low level where compared with some other advanced countries.

Fertilizer Quality Control. The Central Government ensures the quality of fertilizers through Fertilizers (Control) Order (FCO) issued under Essential Commodities Act 1953 to regulate the trade, price, quality and distribution of fertilizers in the country. The State Governments are the enforcement agencies for implementation of provisions of FCO, 1985. The order prohibits the manufacturing, import and sale of any fertilizer, which does not meet prescribed standards. To check the quality of fertilizers, 74 laboratories have been set up in different parts of the country. These include 4 Central Government laboratories, namely Central Fertilizers Quality Control and Training Institute at Faridabad and its three Regional Laboratories at Chennai, Navi Mumbai and Kalyani. Details of these laboratories are given in **table 20.21**.

TABLE 20.21. Fertilizer Quality Control Laboratories in India

Year laorato ries	No .of Labo-ratories	Annual Analytical Capacity (No. of samples)	No. of Samples analysed	%age of Non-standard samples
2005-06	67	1,22,488	1,11,745	6.0
2006-07	68	1,29,250	1,16,142	6.0
2007-08	68	1,29,231	95,866	6.2
2008-09	71	1,32,965	1,04,498	5.5
2009-10	74	1,30,635	1,18,312	5.2

Source : India 2012. Reference Annual, p.107.

Farm Mechanisation

Like other inputs such as HYV seeds, fertilizers, irrigation etc., farm mechanization is a very important and has immense potential for improving farm productivity. It has been estimated that adoption of appropriate mechanization of farm operations can increase farm productivity by 10-15 per cent, cropping intensity by 5-20 per cent, fertilizers and chemicals upto 15-20 per cent and time labour upto 20-30 per cent. Unfortunately, a vast majority of Indian farmers still use primitive and inefficient farm implements thereby causing great hinderance in the path to agricultural progress. The wooden plough and the bullock cart are still most commonly used implements in large parts of the country. However, some progress has been made towards farm mechanization and impressive achievement is visible in the field of power-operated irrigation pumps. At present about 84 lakh electric pumps/tube wells are operating in different parts of the country. Tractors are the main power source for various farm operations and India is the world leader in tractor promotion. The number of tractors produced in the country increased from a modest 71 thousand in 1970-71 to 54.9 lakh in 2011-12. Uttar Pradesh has the largest number of tractors followed by Rajasthan, Punjab and Haryana. Tillers, harvesters, threshers etc. are other important machines being used in agricultural operations.

Small, fragmented and shrinking size of the holdings and low purchasing power of small and marginal farmers are making individual ownership of agricultural machinery progressively uneconomical. This requires steps for setting up of custom-hiring centres/high-tech machinery banks so that small and marginal farmers can reap the benefits of farm mechanization. So far, advantages of farm mechanization are available to rich landlords only who own vast stretches of land and have sufficient financial resources to purchase costly farm machinery. To help the poor farmers, the government initiated a Sub-Mission on Agriculture Mechanisation in the Twelfth-Five Year Plan. Introduction of technologically advanced equipments through extension and demonstration besides institutional credit has also been taken up. A huge industrial base for manufacturing agricultural machines has also been developed.

CROPPING PATTERN

Cropping pattern refers to proportion of area under different crops at a given point of time. It gives an idea of relative importance of different crops in a region or a country at specific time. Cropping pattern is not static; it changes with reference to time and space. Any change in cropping pattern reflects the change in land used to grow different types of crops. At the time of Independence, about three-fourths of the total cropped area was under food crops. There was very little diversification in the pattern of cropping and almost entire Great Plain of North India was dominated by food crops including sugarcane. Cotton in Maharashtra, tea in Assam and jute in West Bengal were the other major crops.

There was no major change in cropping pattern in the country during the first three Five Year Plans from 1951 to 1966. However, food crops gained further importance with the advent of the Green Revolution and due to rapid increase in population. As much as 82% of the cropped area was devoted to food crops. The major increase in area, yield and production was in case of wheat and rice, two main food crops of Indians. In due course of time diversification in the cropping pattern started showing its impact and in 1990-91, the pattern became rather complex as non-food crops became more prominent. Rice and wheat covered about 40% of the cropped area while oilseeds became more prominent occupying 13% and pulses occupied 14 per cent of the cropped area. **Table 20.22** shows changes in cropping pattern in India.

Identification of cropping pattern becomes easy when we work out the cropping pattern of area by considering the dominant (primary), major, secondary and minor crops. Normally dominant crops are those that are first rank crops; major crops occupy over 15 per cent of the cropped areas, secondary crops 5 to 15 per cent and minor crops less than 5 percent. Thus the number of crops and their relative strengths in land occupance makes for emergence of any number of cropping pattern regions. For the sake of simplicity minor crops are usually eliminated and are not considered while reckoning with cropping pattern.

In any cropping pattern, each crop is given its position in terms of percentage in relation to the total cropped area of an areal unit. This is expressed as

$$C_p = \left(\frac{C_a}{N}, \frac{C_b}{N}, \frac{C_c}{N} \ldots\ldots \frac{C_z}{N}\right) \times 100$$

where, C_p represents the cropping pattern : C_a, C_b, C_c etc. in cropped area under crops a, b, c ... in an enumeration unit and N is the total cropped area in the same unit.

A review of the cropping pattern of India highlights the fact that cropping pattern in the country is still tradition bound in which food crops occupy prominent place and little attention is paid to the commercial crops. Even among the food crops, rice is the most important crop which is the staple food of

TABLE 20.22. Change in cropping pattern of India

Crops/Years	1990-91	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2008-09	2009-10
Food Crops	68.82	65.29	64.72	64.83	64.90	63.06	63.14	63.80	63.86
Other Crops	31.18	34.71	35.38	35.17	35.10	36.94	36.86	36.20	36.14
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source : (*i*) Statistical Abstract of India 2007, pp. 109-111, (*ii*) Agricultural Statistics at a glance, 2012, p. 263.

people living in the southern part of the country. Wheat is the second most important food crop which is primarily grown in the north-western part of the country. Coarse grains like jowar, bajra, maize, barley, ragi etc. are given comparatively less importance. The cropping pattern in a large number of regions in India is typical of an underdeveloped agricultural economy in which most of the cultivated area is devoted to subsistence foodgrains. These are mainly produced for domestic use and there is hardly any surplus to be sold in the market. In spite of the unprecedented increase in the production of foodgrains due to positive effects of the Green Revolution, food surplus is still a far cry in view of the fast increasing population. Cash crops constitute only a negligible percentage of the cropped area (Table 20.23).

TABLE 20.23. Gross Cropped Area Percentage Distribution

Crop	Percentage Share of Area to Gross Cropped Area	
	2009-10*	2010-11*
1	2	3
Rice	22.52	22.05
Jowar	4.13	3.70
Bjara	4.80	4.86
Maize	4.32	4.22
Ragi	0.65	0.63
Wheat	15.10	14.99
Barley	0.33	0.36
Other Cereals & Millets	0.48	0.43
Coarse Cereals	**14.71**	**14.20**
Total Cereals	**52.34**	**51.24**
Gram	4.23	4.46
Tur	1.73	2.16
Other Pulses	5.98	6.33
Total Pulses	**11.94**	**12.94**
Total Food-grains	**64.28**	**64.18**
Sugarcane	2.41	2.66
Condiments & Spices	1.66	1.67
Total Fruits	**2.10**	**2.17**
Potatoes	0.83	0.79
Onions	0.32	0.30
Total Vegetables	**2.84**	**2.71**
Groundnut	2.87	2.93
Sesamum	1.10	1.09
Rapeseed & Mustard	2.83	2.80
Linseed	0.15	0.15
Other Oil Seeds	7.80	7.64
Total Oil Seeds	**14.76**	**14.60**
Cotton	5.28	5.50
Jute	0.43	0.39
Mesta	0.04	0.04
Total Fibers	**5.79**	**5.96**
Tobacco	0.25	0.22
Other Crops	5.91	5.84
Cross Cropped Area	**100.00**	**100.00**

*Provisional

Source : Agricultural Statistics at a glance, 2013, p. 261.

Factors affecting cropping pattern

It is but natural to find regional variations in cropping patterns in a vast country like India. These variations are due to geographical, economic and political factors.

I. Geographical Factors

Geographical factors like relief, soil, temperature and rainfall bring about regional variations in cropping patterns in their own way.

1. **Relief.** Most of the crops prefer plain areas where vast stretches of land are available for cultivation and agricultural operations are much easier as compared to hilly areas. But there are some crops like tea and coffee, which require large amount of water for their growth but stagnent water is harmful for their roots. Therefore, these crops are grown on hill slopes where rain water can easily drain down the slope. Some of the hill slopes are cut into terraces and terraced cultivation is practised there. Rice is the main crop on these hill terraces.

2. **Soil.** Rice is mainly grown in clayey soils while loamy soils are best soils for wheat. The regur soil of the Deccan Plateau is ideal for cultivation of cotton. Coarse grains such as jowar, bajra, maize, ragi, barley etc. are grown in inferior soils which include light sandy soils, light black soils, red and laterite soils etc. Fertility of soil is a major determinant of crop productivity and hence of cropping pattern in any region. Delta soils of West Bengal are renewed by floods every year and are very fertile. The Ganga-Brahmaputra delta is world renowned for jute cultivation. These fertile delta soils enable the farmers to take 2-3 and sometimes even four crops in a year. In fact the whole of Great Plain of North India is drained by mighty rivers like the Ganga, the Indus and the Brahmaputra and is blessed with some of the most fertile soils of the world. It is because of its fertile soils that this region is agriculturally the most productive part of the country. Soils of the Darjiling hills in West Bengal contain sufficient quantities of humus, iron, potash and phosphorus which are necessary for tea bush to grow. This is the reason that Darjiling tea is famous all over the world for its high quality.

3. **Temperature.** Temperature has a great bearing on the cropping pattern of an area because each crop requires specific temperature for its growth and ripening. Most crops require lower temperature at the time of sowing and higher temperature at the time of ripening. Some crops require higher temperature and are sown in the summer season. These are known as ***kharif*** crops. There are other crops which require lower temperature and are sown in the winter season. These are known as ***rabi*** crops. India's two most important food crops viz. rice and wheat are kharif and rabi crops respectively.

4. **Rainfall.** Rainfall is one of the main factors that affects the choice of crops and the cropping pattern of any place largely depends on the amount and distribution of rainfall. In areas where land use depends exclusively on rainfall, the main determining factor is the duration and amount of rainfall. Depending on the amount of annual rainfall, following three types of cropping patterns can be recognized.

(*a*) **Cropping pattern in Areas of Heavy Rainfall.** Areas receiving more than 150 cm annual rainfall are termed as areas of heavy rainfall. They include most parts of East India and the west coastal plains. Rice is the most important crop of these areas because it requires plenty of water for its successful growth. Tuber crops, plantation crops and some cereal crops like maize and ragi are also grown. Vast areas are marked by monoculture of rice though there is considerable scope for diversifying the cropping pattern. Animal population is fairly high due to availability of grazing area.

(*b*) **Cropping Pattern in Areas of Medium Rainfall.** Areas receiving 75 to 150 cm annual rainfall are termed as areas of medium rainfall. Areas in the vicinity of 150 cm annual rainfall isohyets are suitable for the cultivation of rice while those near 75 cm annual rainfall isohyets usually grow maize, cotton and soyabeans. These areas are rich in natural resource but people living here are poverty sticken due to poor management of resources. Eastern part of Uttar Pradesh, Bihar, Odisha, eastern parts of Madhya Pradesh and Vidarbha region of Maharashtra receive 30 cm or more rainfall in July-August and 20-30 cm in June and September. Vast areas are to be left as fallow land in kharif season to enable the soil to recoup its lost fertility. Wheat is the principal rabi crop. Different crops require different amount of water and mixed cultivation is often practiced. Rice is grown if sufficient rainfall is received in September, otherwise millets are the natural priority. Jawar is the main crop in areas of lesser rainfall. In addition cotton, soyabean and pulses are also grown.

Areas of medium rainfall have vast potential for improving agriculture and changing the cropping patterns. The main objective should be to fit the crops into a climate rhythm prevailing in those areas. The risk in forming can be reduced considerably by growing less moisture demanding crops such as maize, soyabean and jowar.

(*c*) **Cropping Pattern in Areas of Low Rainfall.** These areas receive 25 to 75 cm annual rainfall and stretch in a long belt running from Kashmir in the north to Kanniyakumari in the south. Beside scarcity of rainfall, variability of rainfall is high and only those crops are grown which can survive in dry conditions and tolerate large variations in the amount of rainfall. Therefore, the major crops in this belt are millets, jowar, and bajra in the northern, jowar in central and ragi in the southern part. Wheat is the main rabi crop which is grown in irrigated areas. Mixed cropping is very common in which pulses are mixed with cereals. Groundnut is an important commercial crop grown in dry areas. Sunflower , rapeseed and mustard are other oilseeds. Cropping has been developed in such a way that no one crop dominates as is the case in areas of heavy rainfall.

II. Economic Factors

Irrigation is the most dominating of all the

economic factors. The other major economic factors are those of size of land holdings, sale price of crops and income of farmers, insurance and investment.

1. Irrigation. Irrigation is an important input and assumes greater significant in arid and semi-arid areas. Rainfall is scanty and erratic in these areas and crops cannot sustain without irrigation. Irrigation provides the right amount of water at the right time and thus saves crops from the vagaries of weather. Now a days, irrigation is widely used even in areas of higher rainfall so that higher yields could be obtained. In the semi-arid areas of Punjab, Haryana and western part of Uttar Pradesh, wheat is the traditional crop which has been grown in these areas for hundreds of years. With the increase in irrigation facilities after the mid-1960s these areas have become major rice producing areas and the cropping pattern has undergone major changes.

2. Size of Land Holdings. Size of land holdings has a direct bearing on the cropping pattern. In case of small holdings, the priority of the farmers would be to grow foodgrains for his family members and opt for commercial crops only if he has same surplus land over and above his personal requirements. Obviously farmers with large holdings can opt for cash crops and help in crop diversification, leading to changes in the cropping pattern.

3. Sale price of crops and Income of Farmers. The farmers want to sell their crops at highest rate and get highest amount for their products so that their income level improves. Farmers in Punjab, Haryana and western part of Uttar Pradesh are traditionally wheat growers but they started rice cultivation with effect from second half of 1960s because rice could fetch higher prices in the market. A large number of tube wells have been sunk to irrigate, rice crop in these areas and the ground water is depleting at an alarming rate. Unmindful of this dangerous trend in depletion of the ground water resources, farmers continue grow rice crop, rather vigorously, to take maximum financial advantage of irrigation facilities. In certain areas where the farmers are unable to get remunerative prices for their products, they opt for cash crops.

4. Insurance. Indian monsoon climate is characterized by wide variations from the normal weather conditions and the farmers run heavy losses in the event of bad weather when the crops are damage partially or wholly. The farmers become bankrupt and are unable to repay their loans. In extreme cases they commit suicide out of frustration. Hundreds of cotton growers have committed suicide in the otherwise agriculturally rich areas of Maharashtra, Andhra Pradesh, Gujarat and Punjab. Under such circumstances it is of utmost importance that the farmers are provided with crop insurance at easy terms so that they can pursue agriculture without any fear and most appropriate cropping pattern is adopted. The Government has taken several steps to provide crops insurance coverage to farmers in the recent past.

5. Investment. Changing the cropping pattern requires huge investment because large sums of money are required for irrigation, seeds, fertilizers, farm machinery etc. The main reason of groundnut replacing cotton in Madhya Pradesh is easy availability of better quality groundnut seeds to the farmers. Even otherwise, groundnut has short maturing period than cotton and farmers get good return after selling groundnut in the market.

III. Political Factors/Government Policies

Government policies can influence the cropping pattern in any region to a great extent. Government can encourage any crop by providing subsidy on seeds, fertilizers, electricity etc. and discourage any other crop by putting restriction on it. Increase in the production of foodgrains and decrease in the cultivation of tobacco, indigo, poppy are largely the result of government policies. Moreover, government can change the cropping pattern by strengthening rural road transportation. Farmers tend to opt for cash crops like vegetables and fruits when the villages have direct road link to the neighbouring urban market.

AGRICULTURAL PRODUCTIVITY

Although usually treated as synonymous with agricultural efficiency, by several authors, agricultural productivity has a special meaning in agricultural geography and is defined as total agricultural output per unit of cultivated area per agricultural worker or per unit of input in monetary values. These may be referred to as 'land productivity', 'labour productivity' and 'capital productivity', respectively.

Improvement in agricultural productivity is generally the result of a more efficient use of the factors of production, viz., environment, arable land, labour, capital and the like. Productivity, which may be industrial or agricultural, is a difficult theme, both in concept and in terms of measurement of its level. Therefore, any definition that is adopted is bound to suffer from certain weaknesses. It is important to remember, however, that productivity is a physical rather than a value concept, which describes the relationship between the output and the major inputs like land, labour and capital. It is essentially a measure of the efficiency with which the inputs are utilized in production. The regional differences in agricultural productivity are the result partly of natural advantages of abiotic environment (soils and climate) and partly of farming efficiency as controlled by cultural ecology. Farming efficiency refers to the properties and qualities of various inputs and the manner in which they are combined and put to use for production. Increase in agricultural productivity is largely related to the choice of inputs, and their relative quantities, and the techniques and the skill with which they are used in the production processes. (Singh and Dhillon, 1984:226)

The level of agricultural productivity, as a concept, means the degree to which the economic, cultural, technical and organizational variables (*i.e.*, the man-made frame) are able to exploit the abiotic resources of the area for agricultural production (Singh, 1979).

Computation and delineation of agricultural productively is of great significance because of its following advantage :

(*i*) It helps in ascertaining the relative productivity of the component areal units of a region.

(*ii*) Agriculturally weakers areas with lower productivity can be identified.

(*iii*) The present agricultural productivity helps in assisting the past development.

(*iv*) A study of present productivity provides a sound base for future agricultural planning.

Several techniques adopted for computing efficiency in level of agricultural productivity per unit area per unit of time, or per unit of farm work force, etc. are detailed below :

1. Assessing the value of agricultural production per unit area.
2. Measuring production per unit of farm labour or man-hour.
3. Determining output in relation to input, or output-input ratio and profitability of farming measured in terms of the return for the sum total of human efforts or paid-out-cost in relation to the output (Khusro, 1964)
4. Expressing production of agriculture in terms of grain equivalents per head of population (Buck, 1967; E. de Vries, 1967; Clark and Haswell, 1967).
5. Considering output per unit area or yields per hectare after grading them in ranking order, thereby deriving the ranking coefficient (Kendall, 1939; Stamp, 1960; Shafi, 1960).
6. Giving weightage to the ranking order of the output per unit area with the percentage share under each crop (Sapre and Deshpande, 1964; Bhatia, 1967).
7. Using the carrying capacity of land in terms of population (Stamp, 1958, 1967).
8. Determining an index of productivity (Enyedi, 1964; Shafi, 1972, 1974).
9. Calculating the index number of agricultural efficiency by expressing the per unit area carrying capacity (in terms of population) of the component enumeration unit as a percentage of the per unit area carrying capacity for the entire region (Singh 1972, 1974).
10. Computing the crop yield and concentration indices ranking coefficient (Singh, 1976)
11. Involving the area, production and price of each cultivated crop in each of the constituent areal units of the region, and then relating the out turn in terms of money of the unit to the corresponding productivity of the region (Hussain, 1976).
12. Delimiting agricultural productivity by computing the intensity and spread indices of three variables, i.e. (i) yield, (ii) grain equivalents, and (iii) cropping system (Singh, V.R., 1979).

13. Assessing net income (farm business income) in rupees per hectare of cropped area or per adult-male unit of farm family work force (Singh, Jasbir *et al.*, 1982).

The above mentioned techniques differ widely from one another and none of them gives a flowless assessment of agricultural productivity. The first three techniques seem to require such statistics as are not readily available and even easily accessible in most of the underdeveloped and developing countries of the world. Statistics, though available at the farm level in some states of India, do not seem to be adequate for area-analysis of agricultural efficiency. Technique (3), however, has little validity in a subsistence farm economy where (*i*) foodgrains dominate and constitute 75 to 85 per cent of all agricultural production, (*ii*) the major output is retained for domestic consumption, and (*iii*) most of the inputs are provided by the farmer himself. However, Khusro (1964) has expressed himself in favour of paid-out-cost in relation to output as a measure of farm efficiency. The efficiency and profitability of agriculture measured by the surplus or deficit of output over paid-out-cost excluding the *imputed value* of farm family labour is an ideal method of determining farm efficiency at the level of different size-class of operational holdings.

Technique 4 of expressing production of agriculture in teutrs of grain equivalents per head of population was used for the first time by Buck in 1967. He realized that in a subsistence agricultural economy as in China, or for that matter in India productivity expressed in terms of monetary value has no meaning because the crops may be grown for local domestic consumption, and only a small portion of it may be sold for cash. To him, therefore the natural unit for measuring the level of agricultural productivity in such a community appeared to be the conversion of kilograms of agricultural products into grain equivalents. He considered all grains to be equal in food value. He converted agricultural products other than foodgrains into grain equivalents according to the local market price at which they are exchanged against foodgrains which are grown predominantly in a locality. Buck's grain equivalent device for measuring agricultural progress was modified and also used by **E. de Vries**. He expressed all output of grains in Asian countries in terms of *milled-rice equivalents* per head of total population. This is a better method because different types of grains are converted into rice equivalents depending on the local market price of each grain. In contrast **Buck** counted all grain equally. The main drawback in **E. de Vries** method is that he worked out rice equivalents per head of total population without caring for the fact that in many instances the effective population which contributes towards agricultural efficiency is the rural population widely engaged in agriculture.

Clark and **Haswell** (1967) used a system in terms of wheat equivalents per person. In this scale total agricultural production is expressed in terms of economic wheat equivalents/person/annum.

Technique 5 of considering output per unit area or yield per hectare was developed by Kendall in 1939 in which he devised a system of ranking coefficient. He explained by taking into account the hectare yield of ten leading crops for 48 administrative countries of England. Stamp (1960) applied Kendall's *ranking coefficient* technique for international comparisons, by selecting twenty countries and nine major crops. In India Shafi (1960) too used this technique, for determining the efficiency of the districts comprising the state of Uttar Pradesh by considering the hectare yield of eight foodgrain crops.

Kendall followed the following procedure for determining agricultural productivity :

(*i*) the enumeration units are ranked in order of output per heactare for each of the selected crops.

(*ii*) the ranks occupied by each unit in respect of the selected crops added.

(*iii*) sum of ranks of each unit is divided by the number of selected crops.

Technique 6 of giving weightage to ranking order of the output per unit area with the percentage share under each crop was devised by Sapre and Deshpande in 1964. It was a modification of Kendall's technique in the sense that this technique used *weighted average ranks* instead of *simple average ranks*. The weighted ranks for various crops is proportionate to the percentage of cropland under each crop.

Bhatia in his study in 1967 made the following two assumptions :

(*i*) hectare yields express all the physical and human factors connected with the production of crops.

(*ii*) sharing of cropland among the various crops reflects various factors involved in land utilization.

A weighted average of the yield efficiency of all crops in component regional unit, where the weights are proportionate to the share of cropland devoted to each crop, would give a measure of overall agricultural efficiency of the component regional unit relative to the entire region. This may be expressed as:

$$I_{ya} = \frac{Y_c}{Y_r} \times 100$$

where I_{ya} is the yield index of crop *a*; Y_c is the hectare yield of crop '*a*' in the component areal unit, and Y_r is the hectare yield of crop '*a*' in the entire reigion; and

$$E_i = \frac{I_{ya} \times C_a + I_{yb} \times C_b + \ldots + I_{yn} \times C_n}{C_n + C_b + \ldots + C_n}$$

where 'E_i' is the agricultural efficiency index, I_{ya}, I_{yb},..., I_{yn} are the yield indices of various crops, and C_a, C_b.....C_n are the percentages of cropland under the different crops.

With this technique a picture of overall performance of an area can be had, but this does not give any weightage to the harvested area under different crops which actually contribute to establish agricultural efficiency.

Technique 7 using the carrying capacity of land in terms of population was devised by L.D. Stemp in 1958 and modified in 1967. The idea of using carrying capacity struck him in the backdrop of fast increasing population pressure on land resources. He had taken into account, first a *standard nutrition unit*, that is, to what extent food and land are required to support one average human being and to produce that much amount of food respectively; second the *caloric value* of some leading food crops since 90 per cent of the world population depends upon foodgrains. In this approach the production of crops is converted into calories, which then can be used to measure the *optimum carrying capacity* of land in terms of population. In a sense that carrying is a measure of farming efficiency.

Technique 8 of determining an index of productivity was suggested by **Enyedi** in 1964. **Shafi** (1972 and 1974) also adopted this approach to determine the productivity indices in respect of twelve food crops of India. Enyedi's formula of productivity index is :

$$\text{Productivity Index} = \frac{Y}{Y_n} \div \frac{T}{T_n}$$

where, Y is the total production of the selected crop in unit area.

Y_n is the total production of the same crop on national scale,

T is the total cropped area of the unit area. and

T_n is the total cropped area on national scale.

Technique 9 is a modification of technique 7 in which Jasbir Singh (1972,74) calculated the index number of agricultural efficiency by expressing per unit area carrying capacity of the component enumeration unit as a percentage of the per unit area carrying capacity for the entire region. He opined that actual production of foodgrains is more important particularly in those countries which suffer from food shortage.

After making some allowances for the quality of production (*i.e.*, to change the crop production into caloric values) and the usages and wastages in the form of seed, cattle feed, storage losses, etc. it can be inferred that higher the caloric output per unit area greater is the carrying capacity of land in terms of population and hence the efficiency of farming. The carrying capacity of agricultural areas, *i.e.*, their maximum caloric return from the soils, can be considered as their index of efficiency. The variations in caloric productivity per unit area are the result of differential interaction between the combination of environmental conditions and the combination of human activities.

In 1974 **Jasbir Singh**, determined caloric output (C_o) available for ingestion per unit area under food crops and oil seeds after making a careful total deduction for usages and wastages which add up to

16.80 per cent of the total production. He then proceded to compare the calorific output with the weighted average standards nutrition (S_n) for ingestion in calories/person/annum. Finally, the carrying (C_p) was expressed as :

$$C_p = \frac{C_o}{S_n}$$

For an objective measurement of agricultural efficieny the carrying capacity per unit area in the component enumeration unit may be expressed as a percentage of the carrying capacity in the entire region to obtain index numbers, which would give a measure of the agricultural efficiency of the component enumeration unit relative to the entire region. The above may also be read as :

$$Ia_{a_e} = \frac{C_{pe}}{C_{pr}} \times 100$$

where, I_{ae} is the index number of agricultural efficiency of an enumeration unit,

C_{p_e} is the carrying capacity in terms of population in the component enumeration unit, and

C_p is the carrying capacity in the entire region.

Technique 10 was also introduced by Jasbir Singh in 1976 in which he computed the crop yield and concentration indices ranking coefficient in order to assess the regional differences in levels of food produced and to determinate the weaker areas form the point of view of agricultural productions. He used average food crop yields proportions of these crops in the total harvested area as twin-elements for measuring the index of the level of food production. For an objective measurement of the level of agricultural productivity, the relative crop yield and concentration indices arranged in ranking order and computed into average coefficient, would give a measure which one may call *the crop yield and concentration indices ranking coefficient*. The procedure may be explained as follows :

$$Y_i = \frac{Y_{a_e}}{Y_{a_r}} \times 100$$

where, Y_i is the crop yield index,

Y_{a_e} is the average yield per hectare of crop a in the component enumeration unit, and

Y_{a_r} is the average yield if the crop a in the entire region or country.

$$C_i = \frac{P_{a_e}}{P_{a_r}} \times 100$$

where C_i is the crop concentration index,

P_{a_e} is the percentage strength of crop 'a' in the total harvested area in the component enumeration unit, and

P_{a_r} is the percentage strength of crop 'a' in the total harvested area in the entire region or country.

The crop yield and concentration indices thus derived for all the regional units and the crops are ranked separately. Yield and concentration ranks for individual crops are added and thereafter divided by 2, thus giving the *crop yield and concentration indices ranking coefficient*. The equation is :

$$\text{Crop yield and concentration indices ranking coefficient for crop 'a'} = \frac{\text{Crop yield index ranking of crop 'a'} + \text{Crop concentration index ranking of crop 'a'}}{2}$$

The result thus derived will give us an idea of the level of agricultural productivity, the lower the ranking coefficient, the higher the level of agricultural productivity and *vice versa*.

Technique 11 was devised by Hussain in 1976 while establishing agricultural productivity of the Satluj-Ganga plains. He converted the agricultural production into money value of the regional unit in proportion to the whole region. He argued that other things remaining the same, higher the return in terms of value in money, greater is the productivity of land.

V.R. Singh (1979) used 12th technique in technique 13 which is concerned with delimiting agricultural productivity by computing the intensity and spread indices of three variable, namely (*i*) yield, (*ii*) grain equivalents and (*iii*) cropping system.

Jasbir Singh *et al.* (1985 followed technique 13 while studying the agricultural productivity in Haryana. The technique involves assessing net income (farm business income) in rupees per hectare of cropped area or per adult male unit of farm family work force. Adult male unit (adult male equivalent)

for standardization 2 children (7-15 age group), 1.5 female (15-59 age group and 1 male (15-59 age group) may be considered equal to one adult male unit. It was found that agriculturally productive regions registered highest net income per hectare of the cropped area. Besides net income increases with size of the farm with a few exceptions here and there.

AGRICULTURAL INTENSITY OR INTENSITY OF CROPPING

Agricultural production and productivity, can be increased in two ways; by expanding the cropped area and by increasing the intensity of cropping. Since much of the physically suitable land for cultivation is already under plough, there is little scope for expansion of net sown area. The only alternative left is the intensification of cropping. *The intensity of cropping refers to the number of crops raised on a field during an agricultural year. The total cropped area as percentage of the net sown area gives a measure of cropping intensity.*

$$\text{Thus, cropping intensity} = \frac{\text{Total cropped area}}{\text{Net sown area}} \times 100$$

The above formula can be illustrated by taking example of a village. Suppose the total cropped area (net sown area + area sown more than once) in the village is 1,200 hectares (700 hectares in the rabi season and 500 hectares in the *kharif* season) and the net sown area in the entire village is 1,000 hectares, then the agricultural intensity in this village will be :

$$\frac{700 + 500}{1{,}000} \times 100 = 120\%$$

Agricultural intensity in India has undergone significant change after Independence (**Table 20.24**).

The above table shows that there has been gradual increase in the cropping intensity between 1950-51 and 2009-10. This is an indication of our success in increasing agricultural production by bringing more area under **'area sown more than once'** category. This has been made possible due to a variety of inputs like irrigation, fertilizers, early maturing varieties of seeds and farm modernization.

Cropping intensity for India as whole was calculated to be 137.3% which is just an average figure. There are large variations in intensity of cropping at the state level as indicated in **Table 20.25** and **Figure 20.6**.

It varies from 100 per cent in Manipur, Mizoram, Daman and Diu and Lakshadweep to 178.9 per cent in Haryana, 181.13 per cent, in West Bengal, 186.0 per cent in Sikkim, 189.4 per cent in Punjab and 204.3 per cent in Delhi. It is easy to understand higher rate of cropping intensity in agriculturally advanced states like Punjab and Haryana where Green Revolution has shown its maximum impact with respect to two basic foodgrains like wheat and rice. Similarly, some parts of West Bengal gets three crops of rice in a year and the cropping intensity is high there. Most parts of Delhi are engaged in cultivation of vegetables which have ready local market in one of the most urbanized areas of the country. Both rabi and kharif vegetables are grown which keep the farmers busy throughout the year and high cropping intensity of more than two hundred per cent is recorded. But high cropping intensity in the hilly state of Sikkim is a real surprise which needs further investigation. On the whole 14 states and union territories have cropping intensity higher than the national average of 137.7 per cent. The remaining 21 states and union territories have cropping intensity lower than the

TABLE 20.24. Temporal change in cropping intensity in India (Million hectares)

Year	1950-51	1960-61	1970-71	1980-81	1990-91	1995-96	2000-01	2005-06	2006-07	2007-08	2008-09	2009-10
Net area sown	118.75	133.20	140.86	143.00	141.63	142.20	141.34	141.34	139.85	141.38	141.93	140.02
Total cropped area	131.89	152.77	165.79	185.74	185.70	187.47	185.34	192.76	192.41	195.14	195.36	192.20
Cropping Intensity (%)	111.06	114.69	117.69	129.88	131.12	131.84	131.14	136.55	137.58	138.02	137.64	137.27

Source : Calculation made on the basis of data available in Agricultural Statistics at a glance 2012 pp. 259-260.

TABLE 20.25. State level variations in cropping intensity in India (2009-10)

State/Union Territory	Net area sown (Thousand hectares)	Total cropped area (Thousand hectares)	Cropping Intensity (%)
1. Andhra Pradesh	9,991	12,560	125.7
2. Arunachal Pradesh	212	276	130.2
3. Assam	2,811	4,099	145.9
4. Bihar	5,332	7,491	140.5
5. Chhathisgarh	4,683	5,561	118.7
6. Goa	132	160	121.8
7. Gujarat	10,302	11,138	108.6
8. Haryana	3,550	6,351	178.9
9. Himachal Pradesh	542	932	171.9
10. Jammu & Kashmir	735	1,145	155.7
11. Jharkhand	1,250	1,399	111.9
12. Karnataka	10,174	12,368	121.6
13. Odisha	5,574	9,107	163.6
14. Punjab	4,158	7,875	189.4
15. Rajasthan	16,976	21,745	128.1
16. Sikkim	77	144	186.0
17. Tamil Nadu	4,892	5,572	113.9
18. Tripura	280	309	110.3
19. Uttarakhand	741	1,166	157.4
20. Uttar Pradesh	1040.4	12,873	123.7
21. Kerala	2,079	2,669	126.4
22. Madhya Pradesh	14,972	21,411	143.0
23. Maharashtra	17,401	22,612	129.9
24. Manipur	233	233	100.0
25. Meghalaya	283	336	118.9
26. Mizoram	123	123	100.0
27. Nagaland	361	486	134.8
28. West Bengal	5,256	9,530	181.3
29. Andaman & Nicobar Islands	15	17	112.4
30. Chandigarh	1	2	151.5
31. Dadra and Nagar Haveli.	22	46	204.3
32. Daman & Diu	4	4	100.0
33. Delhi	22	46	204.3
34. Lakshadweep	3	3	100.0
35. Puducherry	19	32	170.3
All India	14,40,022	1,92,197	137.3

Source : Agricultural Statistics at a glance 2012, pp. 266-270.

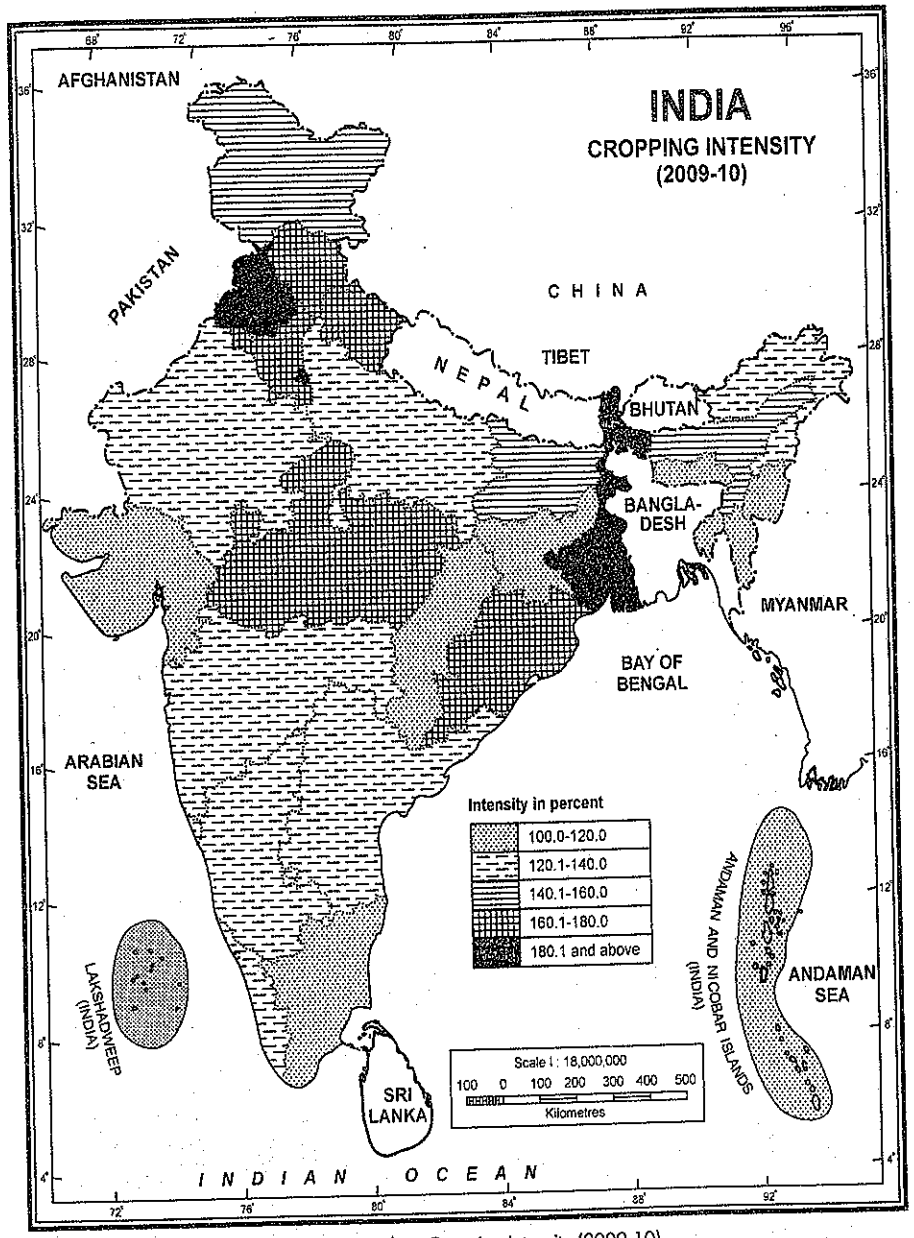


FIG. 20.6. India : Cropping Intensity (2009-10)

national average. Most of the north-eastern states as well as states like Gujarat, Chhattisgarh, Jharkhand and Tamil Nadu have very low cropping intensity of less than 120 per cent.

The index of the intensity of cropping depends upon the extent of area sown more than once. Higher the extent of area sown more than once, higher will be the intensity of cropping. In other words, intensity

of cropping is the indicator of the efficiency of land use. Higher the index of intensity of cropping, higher is the efficiency of land use. The main factors influencing intensity of cropping are irrigation, fertilizer, early-maturing high yielding varieties of seeds, mechanisation of agriculture and plant protection measures through the use of insecticides, pesticides and weedicides. The availability of water for irrigation ensures the use of higher doses of fertilizers which, in turn, reduces the extent of fallow land. The quick-ripening varieties of seeds help in taking more than one crop from the same field in one agricultural year and result in higher intensity.

CROP COMBINATION

Crop combination is concerned with the number or diversity of crops grown in a particular area during a specific interval of time. Study of crop combinations has a greater significant in Indian agriculture because it presents a true picture of crop distribution and provides a solid base for agricultural regionalisation of the country. In a predominantly agricultural country like India, crops are grown in selected combinations, except a few small pockets of plantation agriculture. These crops assemblages are fairly stable because ecological, socio-economic and other conditions suitable for such combinations in various parts of the country have remained stable since long. The relative positions and strengths of different crops or livestock in different enumeration units can better be comprehended with combination analysis. **Weaver** (1954) listed the following advantages of studying crop combinations:

(*i*) The establishment of crop, livestock or ranking combinations is essential for an adequate understanding of geography of crops, livestock etc. that hold variable ranks in the combinations.

(*ii*) The combinations of crops, livestock or agricultural enterprises are composite realities that guide distributional analysis.

(*iii*) Such combination are essential, and they must be made available if one wishes to build still more complex structure for valid agricultural regions.

In fact, crop, livestock or agriculture combination analysis is one of the most vital methods of studying agricultural patterns. It is invaluable in providing a comprehensive basis for basic regional planning for rural areas.

Study of crop combinations help knowing the density and concentration of individual crops and it is still more important to view the integrated assemblage of various crops in a region. For example in India, isohyet of 100 the annual rainfall separates rice producing areas from wheat producing areas. Area receiving more than 100 cm annual rainfall are predominantly rice producing areas whereas those receiving less than 100 cm annual rainfall are popular for wheat cultivation. But other food and commercial crops are also grown in these areas which cannot be ignored.

Several attempts have been made for demarcation of crop combinations regions of which Weaver's attempt is the most popular. In India Jasbir Singh (1971), Singh and Dhillon (1984) and Tirath and Krishan (1996) made significant contributions. However, all these studies are based on data which has become obsolete now. Moreover, their coverage was limited, often to the crop groups and areal strength of individual crops is not recognised well in these studies. Therefore, there is great scope for a fresh look on the subject and give it a new orientation. Following two categories of methods are applied for determining the crop combination regions :

1. The arbitrary choice method
2. The statistical method.

1. Arbitrary Choice method

In this method, first two or three crops grown in an area are included and the remaining are excluded from the combination. When only one crop covers maximum percentage of area, then only the first crop is shown on the map. Similarly, first two or three crops are shown in two crop or three crop combination on the crop combination map of an area. This fact is universally known that rice growing areas are different from wheat growing area in India. It implies that rice growing areas do not grow wheat and wheat growing area do not grow rice. (In this context, it should be noted that traditionally wheat growing areas of Punjab, Haryana and western part of Uttar Pradesh have started growing rice by taking advantage of irrigation facilities available in these areas). Therefore macro level production zones are demarcated on the basis of these two major crops

only. Micro regions are delineated on the basis of other crops which are important at the micro level. This method suffers from the following limitations :

1. Only first two or three crops are taken for consideration and other crops are excluded from the combination irrespective of the percentage of area covered by them and also their monetary value. Therefore this is an unscientific method of determining crop combination.
2. There is always a fear of repetition while presenting and analysing the crop combinations.
3. This is not a very sensitive method because subjectivity often overpowers the objective analysis.
4. The number of crop combinations increases with the number crops which makes the process very complicated.
5. Some times the cumulative area covered by the crops which are included in the combination is less than 50% and a large number of crops of lesser importance are not included. This leads to erroneous results.

In spite of its above mentioned limitations, this is a widely used method because of its simplicity.

Statistical Method

Since this method is based on statistical analysis, it is more scientific, accurate and hence more popular than the arbitrary choice method. It has greater capacity to handle the strongly developed cropping diversity or even agricultural diversification in an area. It was proposed by **J.C. Weaver** in 1954 for studying the complex structure of crop-combination regions and the Middle West (U.S.A.). He computed the percentage of the total cultivated area in each of the 1081 counties covered in his research work. He adopted such an approach that could provide an objective, constant and precisely repeatable procedure and would yield comparative results for different years and localities. First of all, he determined the percentage of each of the selected crop to the total cropped area. Then he considered each percentage against a standard norm and determined the right crop combinations with the help of theoretical standard deviations. The theoretical curve for the standard measurement was employed as follows :

Monoculture = one crop accounts for 100.00 per cent of total harvested or cropped area.

2 crop combination = each crop 50 per cent
3 crop combination = each crop 33.33 per cent
4 crop combination = each crop 25.00 per cent
5 crop combination = each crop 20.00 per cent
6 crop combination = each crop 16.67 per cent
7 crop combination = each crop 14.29 per cent
8 crop combination = each crop 12.50 per cent
9 crop combination = each crop 11.11 per cent
10 crop combination = each crop 10.00 per cent

For accurately comparing the actual percentages within the individual regional units with the theoretical distribution, following formulae concerning variances and standard deviation were used :

1. Variance = $\frac{\sum d^2}{n}$

2. Standard deviation (SD) = $\sqrt{\frac{\sum d^2}{n}}$

where d = difference between actual crop percentage in a given country (regional unit) and the percentage in the theoretical distributions

and n = number of crops in a given combination.

Weaver's technique can be illustrated by following example :

Suppose in a region the area occupied by crops in percentages is as given in the following table :

Crop	Percentage of area
Wheat	40
Jowar	30
Bajra	15
Pulses	10
Maize	5

If it is one crop region, then $\frac{(100-40)^2}{1'} = 3{,}600$

If it is two crop region, then

$$\frac{(50-40)^2+(50-30)^2}{2} = \frac{100+400}{2} = 250$$

If it is three crop region, then

$$\frac{(33.33-40)^2+(33.33-30)^2+(33.33-15)^2}{3}$$

$$= \frac{44.89 + 11.08 + 335.99}{3} = \frac{391.96}{3} = 130.65$$

If it is four crop region, then

$$\frac{(25-40)^2 + (25-30)^2 + (25-15)^2 - (25-10)^2}{4}$$

$$= \frac{225 + 25 + 100 + 225}{4} = \frac{575}{4} = 143.75$$

If it is five crop region, then

$$\frac{(20-40)^2 + (20-30)^2 + (20-15)^2 + (20-10)^2 + (20-5)^2}{5}$$

$$= \frac{400 + 100 + 25 + 100 + 225}{5} = \frac{850}{5} = 170$$

It is clear from the above computation that the minimum deviation from the normal curve is in three crop-region. Therefore the concerned area is three crop region (wheat, jaws and bajra).

Weaver's technique suffers from the following drawbacks :

(*i*) Sometimes, there may be crops covering insignificant area but they might be of great importance for that particular region. However, weaver tried to solve this problem by imprinting the name of such crop(s) on the map after the crop combination has been prepared.

(*ii*) Weaver himself admitted that this technique occasionally tends to show lowest deviation for a crop combination which includes even a crop occupying as less and one per cent of the total harvested cropland.

(*ii*) This method gives most unwieldy combinations for areas of high crop diversification.

(*iv*) It involves laborious calculations.

Doi (1959), **Peter Scot, Thomas** (1963), **Coppock** (1964), **Singh** (1974) and several other scholars have tried to modify Weaver's technique with the help of standard statistical algorithm, namely the *lest squares*. Doi presented a modification of Weaver's technique by substituting the variance $\left(\frac{\sum d^2}{n}\right)$ or least standard deviation $\left(\sqrt{\frac{d^2}{n}}\right)$ of Weaver with the sum of square deviations ($\sum d^2$) *i.e.*, of actual percentages from the theoretical distributions. **Peter Scot** made some modifications in Weaver's technique by suggesting that animals are as important as crops while determining the crop combination regions of Tasmania. **Thomas** modified the version of minimum variance or least standard deviations approach of Weaver. His technique was designed to make use of data available for all crops in an enumeration unit for the calculation of variances for crop combinations. **J.T. Coppock** modified Scot's method by suggesting conversion of all animals on the farm to a common unit according to the quantity of food taken by the animals and then each type to be expressed as a percentage of the total animals. He even prepared the following scale of conversion for the type of animals and the common unit on the basis of the quantity of food taken by them.

Types of animals	Number of animals on the basis of food units
Horses	1
Cows, oxen, buffaloes	1
Other animals (more than 1 year but less than two years)	2/3
Other animals (less than 1 year)	1/3
Sheep	1/15
Chicken (more than 6 months)	1/50
Chicken (less than 6 months)	1/200

Coppock demarcated 11 crop region (of first order) and 38 crop combinations by using the least square method. These 11 crop regions were based on first rate crops. These crops included rice, jowar, wheat, maize, bajra, pulses, ragi, barley, cotton, groundnut and tea. These crops are grown over larger areas while other crops are grown over limited areas.

Generalised Crop Combinations in India. Although crop combinations keep on changing with time and space, yet generalised crop combinations can be visualised as under :

1. Rice. Rice is the staple food of a vast majority of India's population and it is grown as the first crop in the following seven regions.

(*i*) ***Monoculture of rice.*** The areas exclusively growing rice are called areas of rice monoculture. These areas include large parts of Chhattisgarh and adjoining areas of east Madhya Pradesh, Chotanagpur Plateau, West Bengal, delta regions of the Krishna, the Godavari and the Cauvery rivers, coastal areas of Odisha, the Brahmaputra valley, Tripura, Manipur and Nagaland in the north-east region and Andaman and Nicobar Islands in the Bay of Bengal.

(*ii*) ***The West Coastal Plains.*** It includes the Malabar and the Konkan coastal regions. Besides rice, these areas grow rubber, coconut, ragi, vegetables and fodder crops.

(*iii*) ***The East Coastal Plains.*** It includes the non-deltaic coastal regions of Tamil Nadu and Andhra Pradesh. Crops other than rice include groundnut, bajra, jowar and maize.

(*iv*) ***Middle Ganga Valley in eastern Uttar Pradesh and Bihar.*** Rice is the first ranking crop which is followed by wheat, pulses, sugarcane, barley and maize.

(*v*) ***South Karnataka Plateau.*** In this region, rice is followed by coffee, ragi, pulses, cardamom, coconut and citrus fruits.

(*vi*) ***Hilly areas of northern part of West Bengal.*** This area spreads in the Jalpaiguri district where rice is the first ranking crop and maize is the second ranking crop.

(*vii*) ***Meghalaya Plateau.*** Potato, maize and cotton are the crops grown in this area in addition to the first ranking crop of rice.

2. Wheat. Wheat is the second most important food crop of India next only to rice. Nowhere in India, one would find monoculture of wheat. Hence areas having more than 40 per cent the cropped area are called wheat regions. Following four wheat regions may be recognised :

(*i*) ***The Ganga-Yamuna Doab.*** This is the most prolific wheat growing region of the country. Apart from wheat, rice, maize, sugarcane, bajra, pulses and fodder are the main crops.

(*ii*) ***Eastern Haryana.*** Pulses, bajra, jowar sugarcane, and fodder crops are grown in combination with wheat.

(*iii*) ***Himachal Pradesh and the neighbouring areas of Punjab.*** It is a plain tract adjoining the hilly area where pulses, jowar, bajra, sugarcane, and fodder are the main crops in addition to wheat.

(*iv*) ***Rest of Punjab.*** The rest of Punjab, excluding the foothill areas is famous for maize, rice, and pulses in combination with wheat.

3. Jowar. This is the first ranking crop in the following five regions.

(*i*) ***Tamil Nadu highland (Salem-Coimbatore).*** The other crops grown in this region are groundnut, bajra, rice, ragi, barley, pulses and cotton.

(*ii*) ***North Karnataka Plateau and western Maharashtra.*** Here jowar is followed by bajra, ragi, barley, rice, groundnut and pulses.

(*iii*) ***North Maharashtra and Madhya Pradesh.*** Crop combination found here is that of jowar, pulses, wheat, cotton and rice.

(*iv*) ***Telangana and Chandrapur.*** Rice and plusses are the main crops in addition to jowar.

4. Maize. Maize is the first ranking crop in the following two regions :

(*i*) ***South-east Rajasthan and contiguous areas of Madhya Pradesh and Gujarat.*** This area is known for wheat, rice, groundnut, gram, fodder and pulses in combination with maize.

(*ii*) ***Himachal Pradesh and hills of Kashmir.*** Apart from maize, this region grows plantation crops on the hill slopes and rice in the valleys.

5. Bajra. This is the first ranking crop of large parts of Rajasthan, Kachchh region of Gujarat, and some parts of Uttar Pradesh and Haryana. Wheat fodder and pulses are grown in combination with bajra.

6. Ragi. This is the first ranking crop of South Karnataka and Dharmapuram district of Tamil Nadu. The other crops grown in combination with ragi are rice, pulses, groundnut, jowar and coconut.

7. Barley. This is the first ranking crop of Lahul-Spite and Kinnaur districts of Himachal Pradesh. Jai and wheat are grown in combination with barley in these districts of higher mountain ranges.

8. Cotton. Cotton is grown as the first ranking crop in eastern and northern parts of Maharashtra, eastern parts of Gujarat and some parts of Madhya Pradesh. This is primarily based on the black cotton soil(regur of these areas). The other crops grown in combination with cotton are jowar, bajra, groundnut and fodder.

9. Groundnut. This is the first ranking crop of Anantpur-Cuddapah and Chittoor districts of Andhra Pradesh and Kathiwar region of Gujarat. Jowar, bajra and some other dry crops are grown in combination with groundnut.

10. Tea. Tea is the first ranking crop on the hill slopes of Darjeeling district of West Bengal and Nilgiri district of Tamil Nadu. Tea represents more or less monoculture in Darjeeling but it is associated with coffee and vegetables in Nilgiri.

11. Pulses. Pulses comprise the first ranking group of crops in comparatively elevated areas south of the Ganga river and in the north-eastern parts of Rajasthan. These are also the first ranking crops in some parts of Odisha, Telangana and Andhra Pradesh.

Factors affecting Crop Combinations

Most parts of India are characterised by 3-4 crop combination although 7 crop combinations are also very common. The factors which affect crop combinations in different parts of the country include physiography, soil fertility, amount of rainfall, weather conditions, irrigation and priorities of the farmers. Increase in irrigation facilities in arid and semi-arid areas has considerably changed the crop combinations in large parts of the country. The number of crops included in crop combinations is limited in areas of extremely dry, extremely wet, extremely cold and extremely hot climate. Other factors remaining the same, areas receiving 30-100 cm annual rainfall have higher crop diversity as compared to the other areas. Crop diversity is also large in hilly areas of the Himalayas.

LAND CAPABILITY

Land capability takes into account the existing fertility and productivity at the current level of technology and the potentiality of land for production of crops on the basis of physical and chemical characteristics of the soil. (Shafi 2006 : 485). In order to understand land capability, it is essential to conduct *land capability survey* which gives direct information in connection with the soil potentiality of different areas. The land *capability classification map* is one of the basic documents for preparing any development plan for agriculture. Land capability classification investigates into the physical characteristics of the land, its soil qualities and farm management qualities. In view of food shortages, it is very essential to make an inventory of the soil resources to ascertain which uncultivated land can be brought into production and which cultivated soils can be made to produce more than what they do at present. Land capability has to be surveyed in view of the fact that some areas are more fertile than others. **L.D. Stamp** expressed the view, during his Land use Survey of Britain in 1930-31, that it is more important to know about the land capability rather than present status of land use.

There is basic difference between land classification and land capability. Under 'land classification', land is divided into different categories. Land capability, on the other hand involves a scientific appraisal of several factors, of which physiography, climate and physical as well chemical characteristics of soils are important. In addition, some social and economic factors are also considered. Maps based on land capability surveys are helpful in identifying the problem and the potential areas. It gives information about those areas which can provide higher level of production by using modern technology and by arranging for better administration.

In a developing and over-populated country like India, it is of utmost importance to know how much increase in farm production can be achieved by improving technological inputs. Land capability classification is of great help in assessing the capability of different soils and to take proper steps to remove the deficiencies. Land capability survey was devised by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for delimiting land capability regions of Australia. Subsequently such surveys were conducted in European and Aglo-American countries and in some of the Third World countries. The United States Department of Agriculture (1951) has recognised eight classes, with a primary division into land suited to cultivation and land not suited to cultivation. *Hill* and *Partilance* presented land capability classification of Ontario State of Canada in 1960 which aimed at preparing a social plan for land use.

In India soil survey was conducted with the primary aim to achieve land classification on the lines adopted by the U.S. Department of Agriculture. But this system was more suited to the American

conditions and did not yield the desired results in Indian conditions. Consequently, various workers and organizations tried to evolve a land capability or suitability classification that is suited to the conditions and planning purposes in a developing country like India. One such example was an attempt made in India by the All India Land-Use Survey Organisation in 1960. Many inadequacies in the Soil Survey were removed in the subsequent years and revised Soil Survey Manual was published in 1970. The All India Soil and Land Use Survey Organization (1970) has identified eight different land-use capability classes with a broad classification into :

(*i*) land suitable for cultivation, and (ii) land not suitable for cultivation; these are presented here in summary form :

Land suitable for cultivation :

Class I. Very good cultivable land with no special difficulty in farming.

Class II. Good cultivable land which needs protection from erosion or floods, drainage improvement, and conservation of irrigation water.

Class III. Moderately good cultivable land where special attention has to be paid to erosion control, conservation of irrigation water, intensive drainage, and protection from floods.

Class IV. Fairly good land suited for occasional or limited cultivation needs intensive erosion control, intensive drainage, and very intensive treatment to overcome soil limitations.

Land not suitable for cultivation :

Class V. Very well suited for grazing but not for arable farming, needs protection from gulying.

Class VI. Well suited for grazing or forestry but not for arable farming.

Class VII. Fairly well suited for grazing or forestry, but not for arable farming.

Class VIII. Suited only for wild life, recreational facilities and protection of water supplies.

Evidently, the suitability classification given above is valuable for the assessment of land productivity. It is a classification in terms of the limitations of soils for agricultural land use. It is also an interpretive grouping according to capability. Its utility for development plan can be enhanced if due consideration is given to the physical factors.

DRY FARMING

As its name indicates, dry farming is practised in the dry parts of India. The western half of India is characterised by cry climate where arid and semi-arid conditions prevail. The average annual rainfall in these areas is less than 75 cm and the isohyet of 75 cm annual rainfall marks its eastern boundary. The area of dry farming extents from Kashmir in the north to Kanniyakumari in the south with a small gap in Himachal Pradesh and Jammu region of Jammu and Kashmir. The Bay of Bengal monsoons are almost exhausted when they reach western part of Uttar Pradesh, Haryana, Punjab and Rajasthan and cause little rainfall. The northern parts of Jammu and Kashmir are almost out of reach of monsoon winds and Ladakh region is known as cold desert. South of the Tapi river upto Kanniyakumari, the whole region is in the rain shadow area of the Western Ghats and receives less than 75 cm annual rainfall from the Arabian sea monsoons. Map in **figure 20.7** shows that dry farming area comprises a continuos belt-encompassing whole of Rajasthan, Punjab and Haryana, and large parts of Gujarat, western parts of Madhya Pradesh, and Uttar Pradesh, Vidharbha and Marathwada regions of Maharashtra, plateau region of eastern Karnataka, Rayalseema and Telangana and large parts of Tamil Nadu except coastal areas north of Ramnathpuram. Apart from the main belt the north eastern parts of Jammu and Kashmir are also known for dry farming. It is estimated that dry farming is practised on 31.7 million hectares which accounts for about 22.% of the total agricultural land of the country.

Salient Features of Dry Farming

(*i*) **Dry Climate.** As mentioned earlier, dry farming is done in dry areas of the country where annual rainfall is less than 75 cm. The eastern parts of this belt receiving nearly 70 cm of annual rain are areas of sub-humid climate which are deficient in humidity for about 8 months in the year. Areas with 25-50 cm of annual rainfall have semi-arid climate which suffer from deficiency in humidity throughout

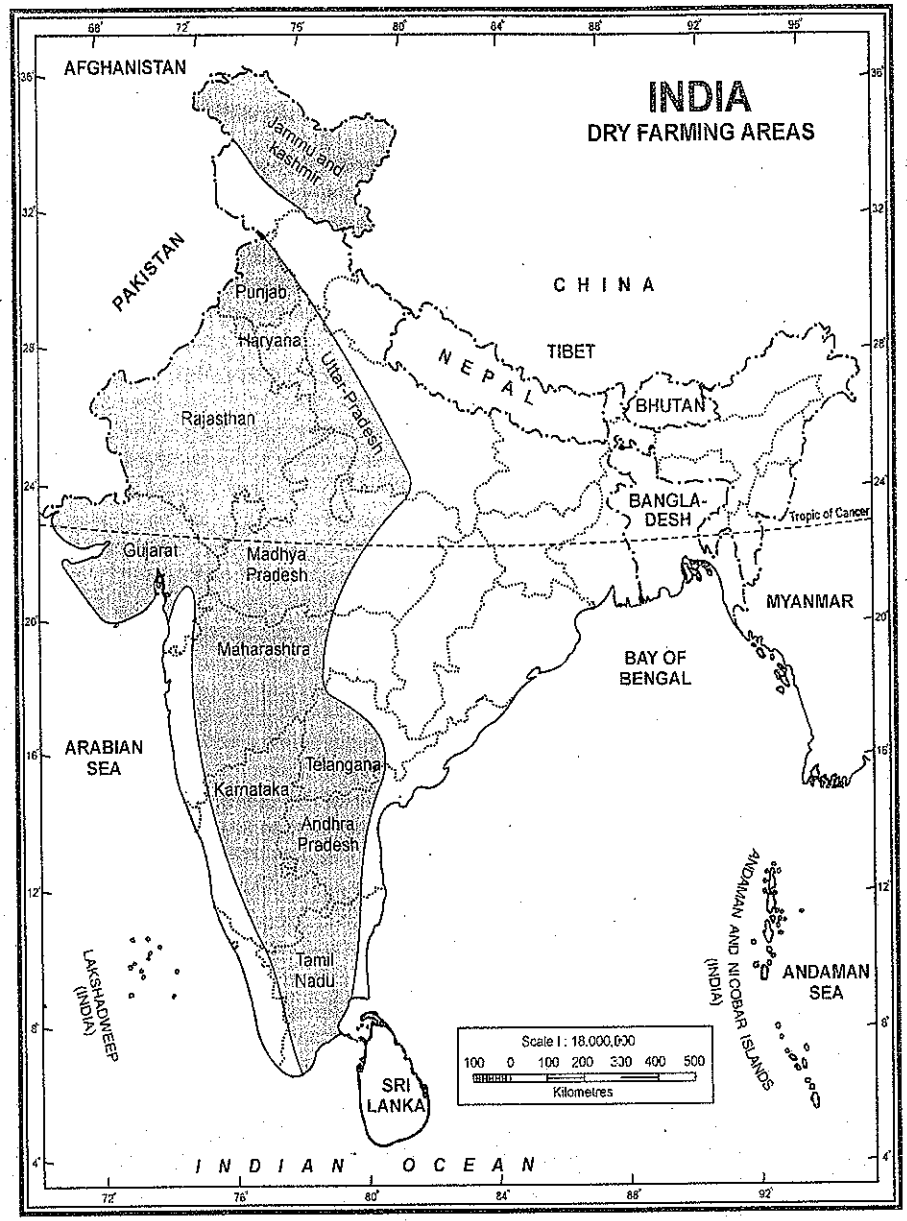


FIG. 20.7. India : Dry Farming Areas

the year. Jaisalmer and Barmer districts of Rajasthan receive less than 25 cm of annual rainfall and are completely dry areas.

It is now abundantly clear that these areas suffer from the problem of scarcity of rainfall and shortage of water is a perpetual problem. In addition, variability of rainfall is very high which varies from 20 to 60 per cent. Rainfall is seasonal and occurs only in 3-4 months, leaving 8-9 months almost completely dry. Moreover, rainfall is erratic and unreliable. Late arrival or early retreat of the monsoons increase unreliability of rainfall. Break in the monsoon is also harmful for the crops. There is almost complete crop failure in the event of a drought.

(*ii*) **Lack of Irrigation.** Most areas of dry irrigation lack in irrigation and have to depend on rainfall. Punjab, Haryana and western parts of Uttar Pradesh have canal and tubewell irrigation facilities. However, keeping in view the change in the cropping pattern (introduction of rice cultivation) and high level of agricultural intensity, irrigation facilities in these areas are found to be inadequate. Rajasthan does not have any major river flowing through its territory and ground water is brackish. There is, thus, not much scope of canal and tube well irrigation. The Indira Gandhi Canal, taken from confluence of Satluj and Beas in Punjab, has provided irrigation facilities to western parts of Rajasthan. This has led to increase in agricultural productivity and change cropping pattern. Most parts of South India are made up of hard rocks and lack in ground water resources. Sinking of tube wells is also difficult in hard rocks. As a result of these geographical conditions, tanks are the major source of irrigation. These tanks dry up during the dry season and fail to provide water when the crops need it the most.

(*iii*) **Subsistence Agriculture.** Dry farming is mainly practised by small and marginal farmers who work in the field along with their family members. The agricultural production is just sufficient to feed the family members of the farmer and there is not much surplus for sale in the market. These farmers lack financial resources and are not able to buy modern inputs like better seeds, fertilizers and farm machinery. They have to face a hunger, starvation and unemployment whenever there is any drought.

Methods of Dry Farming

(*i*) Field is ploughed repeatedly in order to conserve moisture in the soil. This process is necessary especially during the raining season so that rain water is properly utilized.

(*ii*) Soil fertility is reduced when cultivation is continued for a number of years. This problem becomes serious particularly in the background of farmer's inability to make use of fertilizers and manures. In order to solve this problem, land is left as fallow land. It helps in recuperation of soil fertility.

(*iii*) Pulverisation of soil is done before sowing. This process converts soil into small particles which permits easy flow of water in the soil and plant roots find ample opportunity to grow in strength and support the plants.

(*iv*) Hoeing, weeding and pruning are done at regular intervals. Hoeing allows air to enter the soil space and helps in plant growth. It is generally done before sun-rise so that night dew can enter soil and provide moisture to plants. Through weeding, unwanted plants in the fields are removed and pressure on the soil to feed the plants is reduced. Pruning removes unwanted parts of the plants and wanted plants find ample opportunity to grow.

(*v*) Land is usually covered with straw to reduce evaporation of the soil moisture and to control soil erosion by wind.

(*vi*) In order to improve their income level, the farmers keep themselves engaged in allied agricultural activities such as livestock keeping and dairying.

Significance of Dry Farming

Dry land is an agriculturally dominant region wherein more than two-thirds of the total population (against national average of 55%) depend on agriculture. Here agriculture occupies 65% of the total area while 2.9% of the total geographical area is occupied by permanent portures. Although this region is plagued with a large number of problems like scanty rainfall, inadequate irrigation, lack of basic inputs like better seeds, fertilizers, and farming machinery etc., as well as widespread poverty among the farmers, yet this region accounts for 85% of pulses production of the country. Pulses comprise a great source of protein in a vegetarian country like India. This region also produces 75% oilseeds, 80% maize, and 95% jowar and bajra of India. About 40% foodgrains of India are also produced by this type of agriculture. There has been some change in the cropping pattern of this region. Farmers have started to give priority to main foodgrains like wheat and rice which has adversely affected the production of pulses and oilseeds. India has to spend huge amounts of foreign exchange on the import of oilseeds.

Problems

Following are the main problems of dry zone agriculture :

(*i*) Rainfall is scarce, erratic, unreliable and uncertain which makes this region susceptible to floods, droughts and famines.

(*ii*) Large areas are covered by sandy soil which lack in nutrient materials for soil fertility.

(*iii*) The area is prone to soil erosion, particularly erosion by wind.

(*iv*) Yields are low and crops are susceptible to pests and diseases.

(*v*) Due to lack of moisture and inadequate irrigation facilities it is difficult to use HYV seeds and new technologies.

(*vi*) Majority of the farmers are poor and cannot afford costly inputs like better seeds, fertilizers, farm mechanies, etc.

(*vii*) Large areas of dry farming lack basic infrastructural facilities like market, transport, storage, refrigeration etc. The farmers are forced to opt for distress sale in the absence of these facilities and fail to get remunerative prices for their products.

Development Strategies

Following development strategies may be undertaken for developing dry farming.

1. Conservation and Optimum use of Water Resources. The greatest problem faced by dry farming is scarcity of water for which water conservation and optimum use of water resources is of paramount importance. Water present in the soil can be saved by deep and surface ploughing. Deep ploughing is suitable for kharif crops because it breaks deep layer of the soil where rain water can easily percolate. Besides, it is useful for sowing and weeding. Surface ploughing is useful for rabi crops because it plays an important role in conserving the soil moiture.

Wastage of water through run off can be avoided by contour bunding, embankments and dams. Efforts should also be made to arrange for rain water harvesting for which government and non-government organisations can be of greater help.

2. Checking Soil Erosion. Soil erosion by strong winds is a serious problem in areas of dry farming because loose particles of soil are easily blown by wind. Several strategies can be adopted to solve this problem. Important strategies include planting trees in rows so that they can act as obstruction to the blowing wind, making sand dunes stable by plantation and ploughing along he contours.

3. Drought Resistant Crops. As far as possible, drought resistant crops should be encourage so that effect of drought condition is minimised. Early maturing crops can also be helpful in this regard. Better quality seeds of maize, wheat, barley, mustard and some pulses have responded very well to arid and semi-arid conditions in these areas.

4. Use of Weedicides and Pesticides. Proper arrangement should be made to use weedicides and pesticides to save the crops from weeds, pests and diseases. However, care should be taken to replace these chemicals by eco-friendly bio-technical materials.

5. Proper areal distribution of crops. Proper areal distribution of crops can go a long way in increasing the farm productivity and safeguard against vagaries of climate. For example, crops requiring more moisture such as rice should be grown in lower parts of catchment areas of tanks and reservoirs. Cotton should be confined to areas of more dependable rainfall and areas where sprinkle irrigation is available. Crops like sunflower, mustard etc. should be popularised in areas of scarce rainfall.

6. Diversification of Crops. It is always better to opt for crop diversification rather than choosing a few selected crops. This can solve the twin problem of uncertainty of weather and soil degradation. If one crop is destroyed due to unsuitable weather condition, the other crop may compensate for the loss. For example, legumes can be grown along with foodgrains. Legumes add nitrate to the soil.

7. Use of Manures. Majority of the farmers in dry farming areas are poor and cannot afford to purchase costly chemical fertilizers. Under such a condition, the farmers should be encouraged to use cow dung and other biological manures. This will economise agricultural inputs and also save environment from pollution.

8. Alternative land use planning. Following two alternative land use planning strategies are suggested to avoid crop failure and to increase income of the farmers :

(*i*) Encourage agro-forestry and devote large areas to legumes.

(*ii*) Develop graze lands and social forestry in marginal lands and in cultivable wastes.

Government Schemes. The Government has initiated the following schemes to develop dry farming.

1. It forms an important part of the 20 point programme.

2. Identification of 4,609 micro-watersheds has been done for comprehensive and systematic development covering an area of about 35,45,000 hectares. Each micro-watershed covers an area of about 1,000 hectares. The programme includes scientific management of rain water, land development, use of drought resistant seeds, plantation of trees, and development of animal husbandry and allied activities. As many as 46 model watersheds have been identified for development as focal points.

3. A pilot project, taken up with the assistance of the World Bank, envisages the development of identified watersheds of about 25 to 30 thousand hectares in Madhya Pradesh, Maharashtra, Andhra Pradesh, Telangana and Karnataka.

4. Crops requiring less moisture such as maize, sunflower, soyabean, mustard and coarse grains, are being promoted in rain shadow areas of Karnataka.

5. A national waterlogging, development plan was initiated during the Seventh Five Year Plan in 99 selected districts of 16 states.

6. Agro-forestry, agro-horticulture and silvipasture etc. have been initiated by the government for alternative land use systems.

AGRICULTURAL REGIONALISATION

India is a vast country with varied physical and socio-economic features which give rise to different types of agriculture in different parts of the country. Therefore, it is desirable that an agricultural regional study should be undertaken to understand the whole garment of agriculture in India. *Agricultural region is defined as an area which depicts homogeneity with respect of agricultural land use and cropping pattern.* It may be identified on the basis of crops and livestock and the ecological factors which affect these important elements of agricultural An agricultural region depicts broad similarities in the nature of crops, crop combination patterns, methods of cultivation, quality and quantity of inputs and orientation of the farming activities. Such a region is generally used as a device for selecting and investigating regional groupings of the complex agricultural phenomena found in different parts of the country. Agricultural region is not static but a dynamic concept which changes in space and time. The introduction of rice cultivation in Punjab and Haryana and that of wheat cultivation in the lower Ganga plain as a consequence of the Green Revolution are example of such changes.

Agricultural regions have the following four characteristics features :

(*i*) they have location.
(*ii*) their boundaries are not well defined and they have transitional belts.
(*iii*) they may be either formal or functional.
(*iv*) they may be hierarchically arranged.

As mentioned above, agricultural regions do not have sharply defined boundaries. Rather two neighbouring agricultural regions have a transitional zone between them because characteristics of one region give way to those of the other region slowly and gradually. Thus precise delineation of the boundary of agricultural regions is a difficult task for which following techniques may be applied.

(*i*) Empirical Technique
(*ii*) Single-element Technique
(*iii*) Multi-element (Statisical) Technique
(*iv*) Quantitative-cum-Qualitative Technique

(*i*) Empirical Technique. This technique was first of all used by **Oliver E. Baker** for demarcating agricultural belts of the U.S.A. He was able to demarcate the Cotton Belt, the Corn Belt, and the winter as well as the spring wheat belts of the U.S.A. on the basis of the observed data. Since this technique is largely based on the experience of the farmers, it just gives a generalised picture of the cropping

patterns and agricultural regions. This technique was used by a number of scholars like **C.F. Jones, Taylor, Van Valkenberg,** and **G.B. Cressey** for demarcating agricultural regions in different parts of the world. However, the technique has been criticised by a large number of scholars because it is not objective and lacks scientific approach.

(*ii*) **Single Element Technique.** This is an arbitrary technique in which only the first ranking crops are plotted for demarcating agricultural regions. Its main drawback is that it conceals the position and importance of other crops grown in that particular region. It is not of much use in India because most parts of the country grow crops in combination and not in isolation.

(*iii*) **Multi-Element (or Statistical) Technique.** This technique is more objective and scientific because it involves more than one crop. The agricultural regions may be demarcated with the help of the following :

(*i*) Cropping patterns, crop concentration, and crop diversification

(*ii*) Crop combination

(*iii*) Regional patterns of agricultural productivity.

Several scholars like Shafi, Jasbir Singh, Aujer Hussain, Sapre, Deshpande, Tiwari etc. have used this technique for demarcating agricultural regions of India with fairly good results. However, non-availability of reliable data puts constraints for applying this technique.

(*iv*) **Quantitative-cum-Qualitative Technique.** This technique involves consideration of physical, socio-economic, cultural and political factors. The physical traits include (*i*) relief, (*ii*) climate, (*iii*) surface and sub-soil water, (*iv*) soil, (*v*) sub-soil and (*vi*) vegetation. The six functional traits are (*i*) rural population, (*ii*) cultural and religious values, (*iii*) technology, (*iv*) farming operations, (*v*) dependent rural population and (*vi*) degree of commercialisation. In this method also non-availability of reliable data is a big hindrance.

Several scholars have attempted to divide India into agricultural regions of which mention may be made of **E. Simkins** (1926), **D. Thorner** (1956), **L.D. Stamp** (1958), **M.S.A. Randhawa** (1958), **Chen Han Sen** (1959), **O.H.K. Spate** and **A.T.A. Learmonth** (1960), **Ramchandran** (1963), **E. Siddiqui** (1967), **P. Sengupta** and **G. Shasyuk** (1968), **O. Slampa** (1968), **B.L.C. Johnson** (1969 and 1979), **R.L. Singh** (1971) and **Jasbir Singh** (1975). Planning Commission of India has made its own contribution for delineating agro-climatic regions of India. The following section of this chapter gives a brief description of some of the important agricultural regions of India.

AGRO-CLIMATIC REGIONS

Climate is one of the most potent factors which influence the agricultural scenario of a region. It plays an important role in involving crop ecology of a region and is responsible for regional variations in agriculture. Such variations are more prominent in a large country like India where there are large variations in climatic elements. Effects of climatic elements are reflected in crop calendars, crop productivity and cropping patterns in different parts of the country. Several scholars have used climate as the basis of dividing India in agro-climaic regions. Some of the outstanding attempts have been those of Randhawa (1958), Slampa (1968) and Sengupta and Shasyuk (1967). The latest attempt has been made by the Planning Commission of India in 1989 in association with the National Remote Sensing Agency (NRSA) which divide into agro-climatic regions on the basis of commodity of agro-climatic factors like soil type, rainfall, temperature, water resources etc. The development profile for each region is formulated through an optimal mix of land stock management, crop production, animal husbandry, horticulture, forestry and agro-processing activities.

Objectives. The primary objectives of agro-climatic regional planning are to optimise agricultural production, increase in farm income and crate more employment opportunities through scientific utilisation of agricultural and allied resources. Thus the Planning Commission of India laid down four primary objects for agro-climatic regional planning.

These objectives were : (*a*) to attempt a broad demand-supply balance of major commodities at the national level but based on a careful analysis of the potential and prospects of the various zones; (*b*) to maximize the net income of the producers; (*c*) to generate additional employment, particularly for landless labourers, (*d*) to provide a frame-work for scientific and sustainable use of natural resources, particularly land, water and forests in the long run.

Keeping the above mentioned objectives in mind, the Planning Commission divided India into 15 major agro-climatic regions in 1989. These regions are :

1. The Western Himalayas
2. The Eastern Himalayas
3. The Lower Gangetic Plains
4. The Middle Gangetic Plains
5. The Upper Gangetic Plains
6. The Trans Gangetic Plain
7. The Eastern Plateaus and Hills
8. The Central Plateaus and Hills
9. The Western Plateaus and Hills
10. The Southern Plateaus and Hills
11. The East Coastal Plains and Hills
12. The West Coastal Plains and Western Ghats
13. The Gujarat Plains and Hills
14. The Western Dry Region
15. The Islands Region

Table 20.26 gives a synoptic views of the agro-climatic features or the typology of the above mentioned 15 regions.

In addition to resource considerations and land productivity level, relative pressure on land and environmental factors have been considered in framing this typology necessary to identify the zones and providing general guidelines for overall agricultural development.

TABLE 20.26. Zonal Characteristics as Typologies

Sl. No.	Typology	Zone
1.	Rich water and soil resources, high land productivity (major crops), moderate population pressure on land.	Trans-Gangetic Plains (No. 6)
2.	Rich Soil and water resources, medium productivity level and moderate population pressure on land, deteriorating land quality.	Gangetic Plains (No. 5)
3.	Rich water and soil resources, low productivity level, high population pressure on land increasing proportion of problems of soils.	Gangetic Plains (Nos. 3 and 4)
4.	Large Volume of land and water resources, very low productivity of land with predominance of subsistence agriculture, low population pressure, high proportion of problem soils	Eastern and Central Plateaus and Hills (Nos. 7 and 8)
5.	Less favourable soil and water resources, low land productivity, low-medium population pressure, deteriorating environment in respect of soil erosion and water quality.	Western and *southern* Plateaus and Hills (Nos. 9 and 10)
6.	Rich water resources but relatively poor land, medium land productivity, medium-high population pressure, fragile eco-system.	East Coast and West Coast Plains and Hills and Islands (Nos. 11, 12 and 15)
7.	Less favourable land and water resources, low land productivity, low population pressure and fragile eco-system.	Himalayan Regions (Nos. 1 and 2)
8.	Semi-arid to arid conditions, moderately good land quality and productivity, moderate population pressure.	Gujarat Plains and Hills (No. 13)
9.	Arid conditions, large but less fertile soil resources, very low land productivity, low population pressure and fragile eco-system.	Western Dry (No. 14)

Source : *Yojana*, October 1-15, 1990.

TABLE 20.27. Zone-wise Agroclimatic/Geographical Area in India

Zone No.	Regions	Geographical area ('000 sq. km)	Population density (Persons/ sq. km)	Net sown area (%)	Forest area (%)	Per capita cultivable land (ha/person)
1.	West Himalaya	245	62	18.2	45.3	0.195
2.	East Himalaya	274	118	18.7	42.8	0.189
3.	Lower Ganga Plain	69	692	63.8	11.0	0.010
4.	Middle Ganga Plain	164	526	62.8	8.7	0.141
5.	Upper Ganga Plain	143	466	70.1	4.5	0.172
6.	Trans Ganga Plain	116	331	80.9	3.2	0.268
7.	Eastern Plateau	395	136	35.9	35.2	0.323
8.	Central Plateau	370	137	45.0	14.2	0.446
9.	Western Plateau	331	170	59.7	11.8	0.396
10.	Southern Plateau	395	200	48.4	17.1	0.319
11.	Eastern Coast	197	321	43.3	18.7	0.181
12.	West Coast	117	441	37.2	29.0	0.123
13.	Gujarat	196	175	51.4	10.9	0.363
14.	Western Drylands	175	58	47.7	1.2	1.314
15.	Islands	8	29	4.2	88.1	0.210
	India	**3,195**	**215**	**47.0**	**19.3**	**0.260**

Source : *Yojna*, October 1-15, 1990, pp. 4-8.

Table 20.27 gives details of geographical area, population density, net sown area, forest area and per capita cultivable land for all the 15 agro-climatic region.

It may be seen from **table 20.28** that different agro-climatic regions have different cropping pattern and crop specialisation varies from one set of regions to another. For example rice has main concentration in zone 3 (Lower Ganga Plain), 4 (Middle Ganga Plain), 7 (Eastern Plateau) and 11 (Eastern Coast), while concentration of wheat is found in 4 (Middle Ganga Plain), 5 (Upper Ganga Plain), 6 (Trans Ganga Plain) and 8 (Central Plateau). Similarly other crops like jowar, pulses, oilseeds, cotton, sugarcane and fruits and vegetables have their own respective zones of concentration. It may also be seen that crop specialisation is more in certain crops like sugarcane, cotton, jowar, and wheat. The distribution is most widespread in case of rice, pulses, fruits, and vegetables.

A brief description of 15 Agro-climatic regions is given below :

TABLE 20.28 . Cropping Specialisation in the Zones

S. No.	Crop/ croup group	Zones of Concetration	Percentage to total area	Percentage to total production
1.	Rice	3, 4, 7, 11	62.0	55.3
2.	Wheat	4, 5, 6, 8	80.0	86.2
3.	Jowar	8, 9, 10	86.3	87.0
4.	Pulses	6, 8, 9	66.6	65.5
5.	Oilseeds	8, 9, 10, 13	70.0	70.3
6.	Cotton	6, 9, 10, 13	92.0	85.3
7.	Sugarcane	4, 5, 9, 10	74.3	72.6
8.	Fruits and Vegetables	3, 4, 5, 12	56.4	60.8

Source : Yojna 1-15, 1990.

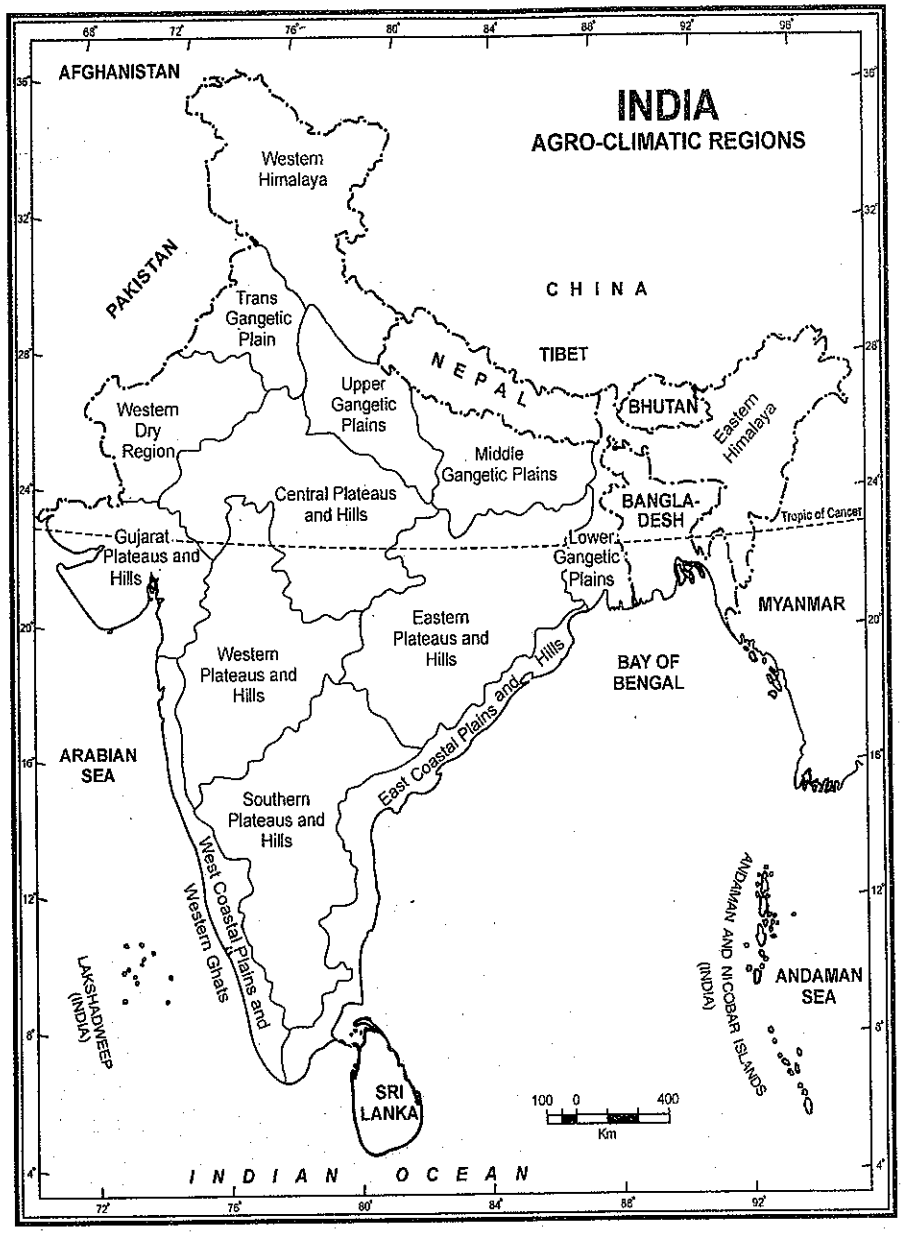


FIG. 20.8. India : Agro-climatic Regions

1. Western Himalaya. The Western Himalayan Region stretches over Jammu and Kashmir, Himachal Pradesh and Uttarakhand. This region has great variations in topography which consists of lofty mountains, deep valleys, steep slopes and a large number of topographical features of local importance. The climate of this region is characterised by mild summer with July average temperature varying from

5°C to 30°C and severe winter with January temperature varying from 0°C to –4°C. The mean annual rainfall varies from 75 cm to 150 cm, except in Ladakh where it is below 30 cm. The valleys like those of Kashmir and Kullu as well as duns like those of Dehra Dun are covered with thick layers of alluvium while hill slopes have thin brown soils. The region is drained by a number of perennial rivers which originate in the snow covered mountain ranges. These include the Ganga and its major tributary the Yamuna and the Indus and its major tributaries like the Jhelum, the Chenab, the Beas and the Satluj. Some of the rivers are utilised as sources of canal irrigation and hydro-electric power. Unfortunately, the increased human interference in the natural set-up of the region has led to overall deterioration of ecological system. Rapid and unplanned construction activities, unscrupulous mining and reckless falling of trees have made the region more prone to floods, droughts, landslides receding glaciers and environmental pollution. The Uttarakhand tragedy of 15-16 June, 2013 is on eye opener in this regard.

Rice, maize, wheat, barley and vegetables are grown in the terraced fields on the hill slopes. But the plantations do not need terracing and are set up along the hill slopes. The region is well known for temperate fruits like apples, peach, pears, almond, walnut etc. The environmental conditions of this region are quite congenial to development of garden and plantation crops and there is much scope for improvement in this regard. Alpine pastures above 2000 m are known as *dhoks* or *margs* which are used by Gujjar and Gaddis for rearing sheep and other animals.

This region requires a more judicious land use planning for increasing farm productivity. There should be rational allotment of land for different purposes like cultivation of crops, horticulture, pastures and forestry. The most suitable recommendations are (*a*) agriculture on land upto 30 per cent slopes, (*b*) horticulture/fodder development on land having slope 30-50 per cent and (*c*) all land over 50 per cent slopes under tree cover.

2. The Eastern Himalaya. This region encompassed the eastern part of the Himalayas consisting of Sikkim, Darjeeling hill area of West Bengal, Assam Hills, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and Meghalaya. It is characterised by rugged topography, steep slopes, thick forests and swift flowing rivers. The climate is sub-humid with annual rainfall over 200 cm. The July and January temperatures vary from 25°C to 30°C and 10°C to 20°C respectively. The soil is red-brown and less fertile. About one-third of the total cultivated area is under shifting agriculture locally known as Jhuming. Rice, maize, potato and fruits (orange, pine apple, lime, lichi, etc.) are the main crops. Tea plantations are found on the hill slops of Assam and Darjeeling.

Shifting agriculture is causing heavy damage to soil and forest resources and there is urgent need to check this type of agriculture and replace it by other forms of agriculture like subsistence type of agriculture. Soil erosion can also be checked by developing terraced cultivation and planting more trees, especially on the hill slopes. Also, there is vast scope for improving infrastructural facilities. There is too much wastage of water by surface run-off. Steps should be taken to check it and water thus conserved should be used for minor irrigation. A programme to grow fruits above 30% slopes in the hills needs to be framed. Supportive activities like sericulture, handicrafts, poultry, piggery, etc. should be encouraged to supplement the income of the farmers. A long-term quality seed production, suiting the ecological conditions of the region, needs to be implemented on priority basis.

3. The Lower Gangetic Plains. This region spreads over eastern part of Bihar, West Bengal (excluding Darjeeling hilly area) and Brahmaputra valley in the Assam. It is made up of rich alluvial soil deposited by big rivers. The Ganga delta is the largest in the world. Most of the area is characterised by extremely gentle slope and oxbow lakes. The area has hot and humid climate where the annual rainfall varies from 100 to 200 cm and January and July temperatures range between 12°C to 18°C and 25° to 30°C respectively. The region has enough storage of ground water and the water table is very high. The region suffers from waterlogging and marshy areas area found over vast stretches of land. Wells and canals are the main sources of irrigation. Hot and humid climate and rich alluvial soils provide ideal conditions for the cultivation of rice and jute crops. In some parts of West Bengal, three successive crops of

rice (Aman, Aus, and Baro) are grown in a year. The Hugli basin is world nonowned for jute cultivation. Wheat has become popular as a winter crop as a consequence of the Green Revolution. Maize, pulses, potato etc. are other important crops. The development strategy includes improvement in rice farming, horticulture (banana, mango and citrus fruits), pisciculture, poultry, livestock, forage production and seed supply. A large number of farmers engage themselves in fishing in ponds and reservoirs.

4. The Middle Gangetic Plains. It spreads over eastern part of Uttar Pradesh and whole of Bihar. It is a gently sloping plain which is made up of fertile alluvial soil that has been deposited by the mighty Ganga and its tributaries. This is an area of hot and humid climate where the annual rainfall is 100-150 cm. The temperature ranges from 25°C to 40°C in July and 10° to 25°C in January. The region has vast potential of ground and run-off water from the perennial rivers which is used for irrigation through tube wells and canals. Rice, maize, millets etc. are the main *kharif* crops while wheat, gram, barley, peas, mustard and potato are important *rabi* crops. Mango, guava, lichi, banana etc. are the main fruit crops.

There is vast scope for improvement of agriculture in this region. Efforts should be made to improve the yield of kharif paddy crop which occupies over 40 per cent of the gross cropped area of the region. Diversification of crops by giving more area to vegetables, fruits, and floriculture can yield better results. Dairying, silviculture, agro forestry, and pisciculture can also help a lot in supplementing the income of the farmers.

5. The Upper Gangetic Plains. This plain stretches over the Ganga-Yamuna doab, Lucknow division and Rohilkhand of western Uttar Pradesh and Hardwar and Udham Singh Nagar districts of Uttarakhand. This is more or less a plain area with gentle slope which has been made by fertile soils deposited by the Ganga and its tributaries. This is a region of sub-humid continental climate where the annual rainfall varies from 75 to 150 cm. The temperatures vary between 10°C and 25°C in January and between 25°C and 40°C in July. The soil varies from sandy loam to clayey loam. The area has developed adequate facilities of canal and tube well irrigation. This is an intensive agricultural region where wheat, rice, sugarcane, millets, maize, pulses, gram, barley, oilseeds and cotton are widely grown. Like Punjab and Haryana, this area has taken maximum advantage of the Green Revolution.

This region has great potential for improvement in agriculture and efforts should be made to increase the agricultural productivity of this region. The strategy should include greater emphasis on mixed cropping, horticulture, floriculture, judicious use of irrigation facilities, lining of canals to check seepage, reclaiming saline/alkaline soils, improving cattle breed and bringing more areas under fodder crops.

6. The Trans-Ganga Plain. This plain consists of Punjab, Haryana, Delhi, Chandigarh and Ganganagar district of Rajathan. The plain is made up of highly productive alluvial soils which have been deposited by the rivers draining this region. The climate has semi-arid characteristics where the annual rainfall varies from 40 to 100 cm. Most of the rainfall is received form the south-west monsoons during the summer season but some rainfall is also brought by the western disturbances during the winter season. Being an area of continental climate, the region experiences extremes of temperature which may soar to 45°C during day in May/June and dip to almost freezing point during night in December/ January. However, the average temperatures for January and July vary from 10°C to 20°C and 25°C to 40°C respectively. The perennial rivers draining this region provide ample opportunities for canal irrigation. Besides, the region has lakhs of tube wells. In fact, tube wells irrigate much larger area as compared to canals. Both Punjab and Haryana have some of the highest intensities of agriculture. Wheat, rice, sugarcane, cotton, gram, maize, millets, pulses and oilseeds are the main crops. The area has the distinction of introducing the Green Revolution in India when HYV seeds of wheat and rice were introduced in the mid 1960s. Along with seeds, this area was the first to adopt other modern methods of farming like fertilizers, irrigation and farm mechanisation. However, the region is facing serious problems waterlogging, salinity, alkalinity and soil degradation due to over irrigation by canals. The region is also facing a serious crisis of falling water table due to over exploitation of ground water through tube-wells.

Although this is the highly productive part of the country with respect to agriculture, yet it can be made more productive if some corrective measures are taken. Wadia (1996 : 100) has suggested the following measures :

(*i*) diversion of 5 per cent of rice-wheat area to other crops like maize, pulses, oilseeds, and fodder.

(*ii*) development of genotypes of rice, maize and wheat with inbuilt resistance to pests and diseases.

(*iii*) promotion of horticulture besides pulses like tur and peas in upland conditions.

(*iv*) cultivation of vegetables in the vicinity of industrial clusters.

(*v*) supply of quality seeds of vegetables and planting materials for horticulture crops.

(*vi*) development of infrastructure for transit godowns and processing to handle additional fruit and vegetable production.

(*vii*) implementation of policy and programmes to increase productivity of milk and wool.

(*viii*) development of high quality fodder crops and animals feed by stepping up area under fodder production by 10 per cent.

7. The Eastern Plateaus and Hills. The region includes the Chotanagpur plateau, Rajimchal Hills and Chhattisgarh plains. It consists of red and yellow soils with occasional patches of laterites and alluviums. Most of the soils are not very productive. Fertile soils are found only in the Mahanadi basin. The region receives annual rainfall varying from 75 cm to 150 cm. The mean January and July temperatures range from 10°C to 25°C and 25°C to 40°C respectively. The region is deficient in surface water due to non-perennial streams and ground water due to hard and impermeable rocks. The agriculture is mainly rain-fed in which rice, maize, millets, *ragi*, gram, oilseeds, tobacco, potato, etc. are the main crops. Fallowing is the common practice in areas lacking irrigation.

This area needs improvement in agriculture. The strategy for this may include larger use of HYV seeds, cultivation of high value crops like oilseeds, pulses, vegetables, improvement of indigenous breeds of cattle and buffaloes, water-harvesting and water-shed development, soil conservation, renovation of old tanks and excavation of new tanks and rehabilitation of degraded forest land.

8. The Central Plateaus and Hills. Most of this region spreads over eastern part of Madhya Pradesh and adjoining parts of Rajasthan and includes Bundelkhand, Baghelkhand, Bhander plateau, Malwa plateau and Vindhyanchal hills. The region is characterised by semi-arid climatic conditions where the annual rainfall varies from 50 to 100 cm. The mean January and July temperatures are 10°C to 25°C and 25°C to 40°C respectively. The soils are mixed red, yellow and black in which crops like millets, wheat, gram, pulses, oilseeds, cotton, sunflower etc. are grown. Water scarcity is the main problem of this region. Among the main strategies for improving agriculture are water conservation through devices like sprinklers and drip system, opting for dry farming, crop diversification, dairy development and poultry farming.

9. The Western Plateaus and Hills. The region spreads over the southern part of Malwa plateau and the Deccan plateau of Maharashtra. This is a region of black soil known as *regur*. The region is characterised by semi-arid climate with average annual rainfall varying from 25 cm to 75 cm. The January and July temperatures range from 5°C to 25°C and 25°C to –40°C respectively. Irrigation facilities lack badly and only a little over 12% of the cropped area enjoys irrigation facilities. Therefore, most of the crops have to depend on rainfall and mostly drought resistant crops are grown. Jowar, cotton, sugarcane, rice, bajra, wheat, gram, pulses, potato, groundnut, oilseeds are the main crops. Agricultural production can be increased by adopting water saving devices like sprinkle irrigation, drip system, water harvesting, replacing low value crop by high value crop, providing market and storage facilities, developing dairy and poultry farming.

10. The Southern Plateaus and Hills. It includes southern Maharashtra, Karnataka, Telangana, Andhra Pradesh and northern Tamil Nadu. The area has semi-arid climate with annual average rainfall of 50-100 cm. Temperatures for January and July are 13°C to 21°C and 25°C to 40°C respectively. Since the rainfall is less and the temperatures remain high throughout the year, this is essentially an area of dry farming where millets, pulses, oilseeds, coffee, tea, cardamom are the main crops. Development of poultry, dairy farming, horticulture, restoration of tank irrigation, use of water saving devices and diversion of jowar/bajra/ragi to groundnut/ sesamum/sunflower can improve the situation.

11. The East Coastal Plains and Hills. This region extends all along the eastern coast from Baleshwar in Odisha to Kanniyakumari in Tamil Nadu. Its northern part is known as Northern Circar and southern part is called Coromandal coast. It has been formed by the depositonal work of rivers like Mahanadi, Godawari, Krishna and Cauvery and the deltas of these rivers are the chief characteristic features of this region. The region has sub-humic marine climate where the annual rainfall varies between 75 cm and 150 cm. Since the climate of this coastal area is influenced by the Bay of Bengal, there is not much difference between summer and winter temperatures. Here, the January and July temperatures vary from 20°C to 30° and 25°C to 35°C respectively. The soils are alluvial, loam and clay. These soils suffer from the serious problem of alkalinity. The main crops are rice, jute, tobacco, sugarcane, maize, millets, pulses, groundnut, and oilseeds.

The main strategies for agricultural development in this region are discouraging mono-culture of rice and encouraging crop diversification, replacing coarse grains by high value crops like pulses and tobacco, increasing cropping intensity, cultivation of spices like pepper and cardamom, proper use of water resources and improving tank irrigation system, treating areas suffering from alkalinity and water logging and increasing potential of animals and fisheries.

12. The West Coastal Plains and Western Ghats. This region extents from the Tapi estuary in the north to Kanniyakumari in the south and covers coastal areas of Maharashtra, Karnataka and Kerala. Its northern part is known as Konkan and southern part is called Malabar. The Sahyadri range running in north-south direction is also included in this region. South-west monsoons originating in the Arabian Sea strike against the Western Ghats and cause heavy rain. The average annual rainfall exceeds 200 cm. The mean January and July temperatures are 18°C to 30°C and 26C to 32°C respectively. Therefore the climate of this region may be termed as hot and humid. Rice, coconut, oilseeds, sugarcane, millets, pulses and cotton are the main crops. Slopes of the Western Ghats are famous for plantation corps.

The strategies for development include devoting more area to high value corps like spices, pulses, fruits and coconut, improvement in drainage, sinking of dug wells, improvement in infrastructure, and promotion of prawn culture in brackish waters.

13. The Gujarat Plains and Hills. This region encompasses the plains and hills of Kathiawar and the fertile valleys of Mahi and Sabarmati rivers. This is an arid and semi-arid region where the average annual rainfall varies from 50 cm to 100 cm. The amount of rainfall increases from west to east. January and July temperatures are 15°C to 30°C and 25°C to 42°C respectively. Different types of soils are found in this region. For example, soils are regur in the plateau region, alluvial in the coastal plains and yellow to red in the Jamnagar area. Groundnut, cotton, rice, millets, oilseeds, wheat and tobacco are the main crops. Wheat is the main rabi crop in irrigated areas. Kachchh is a dry area and is not much suitable for agriculture. The whole region is famous for production of oilseeds.

The development strategies should include surface and ground water management, rain-water harvesting, dry land farming, agro-forestry development, wasteland development and development of fishing and acquaculture in coastal zone and river deltas.

14. The Western Dry Region. This region stretches over the western part of Rajasthan (west of the Aravali range) which spreads over the waste desert of Marwar and the Mewar hills. This is totally an arid region where the annual rainfall does not exceed 25 cm. The January temperature ranges between 5°C and 20°C (and sometimes even touches the freezing point) which soars to over 40°C in July. Most of the region is sandy desert and is characterised by sand dunes. Luni river flows through the Jodhpur basin. Rainfall is scarce and erratic and famines and droughts are very common. Bajra, jowar and moth are the chief *kharif* crops while wheat and gram are grown in the *rabi* reason. However, livestock rearing is the main occupation of the people. Camel, goat and sheep are the main animals. Irrigation by the Indira Gandhi canal has changed the cropping pattern and raised the income levels of the farmers.

The development strategies should include enhancement in irrigation, promoting use of fertilizers and better seeds, increasing yields of fruits like date, palm, watermelon and guava and improving pastoral system.

15. The Islands Region. This region includes Andaman and Nicobar Islands in the Bay of Bengal and Lakshadweep Islands in the Arabian Sea. Being near the equator and surrounded by see on all sides, these islands have typically uniform equatorial climate where the average annual rainfall exceeds 200 cm and January and July temperatures are 25°C and 30°C respectively. The soils vary from sandy along the coast to clayey loam in valleys and lower slopes. Rice is the main crop which is followed by maize, jowar, bajra, pulses and plantation crops like arecanut, cassava, turmeric etc. Nearly half of the cropped area is under coconut. A large part of area is covered by forests and agriculture is in a backward state.

The main development strategies should lay more emphasis on crop improvement, water management and fisheries. The farmers should be encourage to take two crops of rice in a year by adopting modern methods of agriculture. Old less productive coconut trees should be replaced by young and more productive trees.

Agro-Ecological Regions of India

The concept of 'agro-ecological regions' is a modified and improved version of 'agro-climatic regions'. Several scholars have tended to use these two terms in the same way but there is basic and distinct difference between the two. Food and Agriculture Organisation (FAO) classified the difference between these two terms in 1983 and stated that agro-climatic region is a land unit in terms of major bio-climatic and length of growing period and which is climatically suitable for certain range of crop cultivation. On the other hand, agro-ecological region is a land unit carved out of agro-climatic region when superimposed on land form and soil condition that acts as modifier of length of growing period. Therefore, there may be a few agro-ecological regions within an agro-climatic region, depending on soil condition. This approach has been used for the purpose of delineating agro-ecological regions of India.

Methodology. For preparing agro-ecological region map, the soil-scap (soil map) is superimposed on bio-climatic map. On the resultant map, the growing period map is incorporated by using Geographical Information System (GIS) technology.

For demarcating agro-ecological regions of India, the agro-climatic regions of the country have been sub-divided on the basis of soil types. Thus the maso regions are obtained and the length of growing period (LGP) has been superimposed on them. By using this method, India has been divided into 20 agro-ecological regions (**Fig. 20.9**) and 60 agro-ecological sub-regions. A brief description of 20 agro-ecological regions is given below :

1. The Western Himalayan Cold and Dry Region. Located in the north-eastern part of Jammu and Kashmir, this region is out of reach of the south-west monsoon and receives less than 20 cm annual rainfall. The region has very severe winters due to its high altitude. Thus this region is known as **cold desert.** This region is not very useful for cultivation because the growing period here is less than 90 days.

2. The Western Plain Kachchh and part of Kathiawar Peninsula Region. This is hot and dry region where the annual rainfall is less than 40 cm. In the vast area of Jaisalmer, Barmer and Bikaner, the annual rainfall is less than even 20 cm. Similarly Kachchh and Kathiawar areas also receive scanty rainfall and have dry climate. The isohyet of 25 cm annual rainfall divides the entire region into two parts *viz.* (*i*) dry desert (Masusthali) and (*ii*) semi-arid transitional zone. The summer temperature soars to over 40°C as a result of which it is known as hot and dry region. The area has vast stretched of sandy and saline soils which are not much suited to agriculture. Land use data for 12 western districts of Rajasthan from 1951-52 to 1971-74 had shown that most of the area is unfit for cultivation and about 50 per cent of the land is either fallow or waste land. Limitation for cultivation can be appreciated by the fact that growing period here is less than 90 days. The Indira Gandhi canal has created problems of waterlogging, salinity and alkalinity.

3. The Deccan Plateau Hot Arid Region. This region has red and black soils. This region receives scanty rainfall because it is located in the rain-shadow area of the Western Ghats. However, black soil is

quite fertile and supports agriculture wherever tank irrigation is available. The growing period is less than 90 days due to scanty rainfall.

4. The Northern Plains and Central Highlands including Aravalis. This is a hot semi-arid ecoregion where its annual rainfall varies from 40 to 70 cm. The Northern Plain area has alluvial soil but the soils of the Central Highlands and the Aravali region have been derived from the decay and decomposition of the parent rocks. Here the growing period varies between 90 and 150 days.

5. The Central Mawa Highlands, Gujarat Plains and Kathiawar Peninsula. This is also a hot and semi-arid region where the annual rainfall is 40 to 60 cm. The summer temperatures are very high due to which this region has been termed as hot and semi-arid area. The region has medium to deep black soils which are capable of giving high yields if sufficient water is available. Here also the growing period varies between 90 and 150 days.

6. The Deccan Plateau. It lies in the rain shadow area of the Western Ghats in the states of Maharashtra and Karnataka and receives about 60 cm annual rainfall. It is termed as hot and semi-arid region due to high temperature during the summer season. This region is blessed with rich fertile black soil which is ideal for cotton cultivation. The growing period varies from 90 to 150 days.

7. The Deccan (Telangana) Plateau and the Eastern Ghats. This is also located in the rain shadow area of the Western Ghats and receives less rainfall. Most of it lies in Telangana and Andhra Pradesh. This hot and semi-arid region has red and black soils which are used for agriculture with the help of irrigation. The region has a growing period varying from 90 to 150 days.

8. The Eastern Ghats, Tamil Nadu Plateau and Deccan (Karnataka). This is also a hot and semi-arid region where red and loamy soils are found. Agriculture is based on tank irrigation. Growing period is 90-150 days.

9. The Northern Plain. Located in the south of the Western Himalayas, this flat plain has been formed by depositional work of the rivers draining through the region. It stretches from North Punjab in the west to Bihar in the east. The average annual rainfall is 50 cm in the west which increases to 100 cm in the east. The climate of this region is hot and sub-humid due to high temperature during the summer season. The region is blessed with rich alluvial soils. Wheat in the west and rice in east are the main crops. Several other crops are also grown depending o the local conditions. The growing period varies from 150 to 180 days.

10. The Central Highlands (Malwa, Bundelkhand and Eastern Satpura). This is a hot and sub-humid region with black and red soils. Most of this region is in Madhya Pradesh and Vidarbha region of Maharashtra. Irrigation is required for successful growth of crops. The growing period is between 150 and 189 days.

11. Eastern Plateau (Chhattisgarh). Major part of this region lies in Chhattisgarh and has hot and sub-humid climate. The region has red and yellow soils and is well known for rice cultivation. In fact this region has earned the destination of *rice bowl of India* due to its intensive rice cultivation. The growing period in this region varies from 150 to 180 days.

12. The Eastern (Chotanagpur) Plateau and Eastern Ghats. This agro-ecological region includes major part of the Chotanagpur plateau of Jharkhand and the Eastern Ghats area of Odisha. With the annual rainfall of about 150 cm, this region has hot and sub-humid climate. The red and laterite soils of this region are not much suitable for agriculture although it has a long growing season from 150 to 180 days.

13. The Eastern Plain. This agro-ecological region is in the north-east of the Northern Plain and stretches over northern parts of Uttar Pradesh and Bihar. The northern part of this region consists of Bhabar and Tarai. The whole region has been formed by the depositional work of the perennial rivers originating in the snow cover Himalayas. There is plenty of fertile alluvial soil which has provide a solid base to agriculture in this region. The region has a long growing period of 180 to 210 days which enables farmers to take two crops per year.

14. The Western Himalayas (Warm sub-humid to humid). This agro-ecological region lies between the Western Himalayan cold arid region in the north and the North Plain region in the south and stretches over Uttarakhand, Himachal Pradesh and

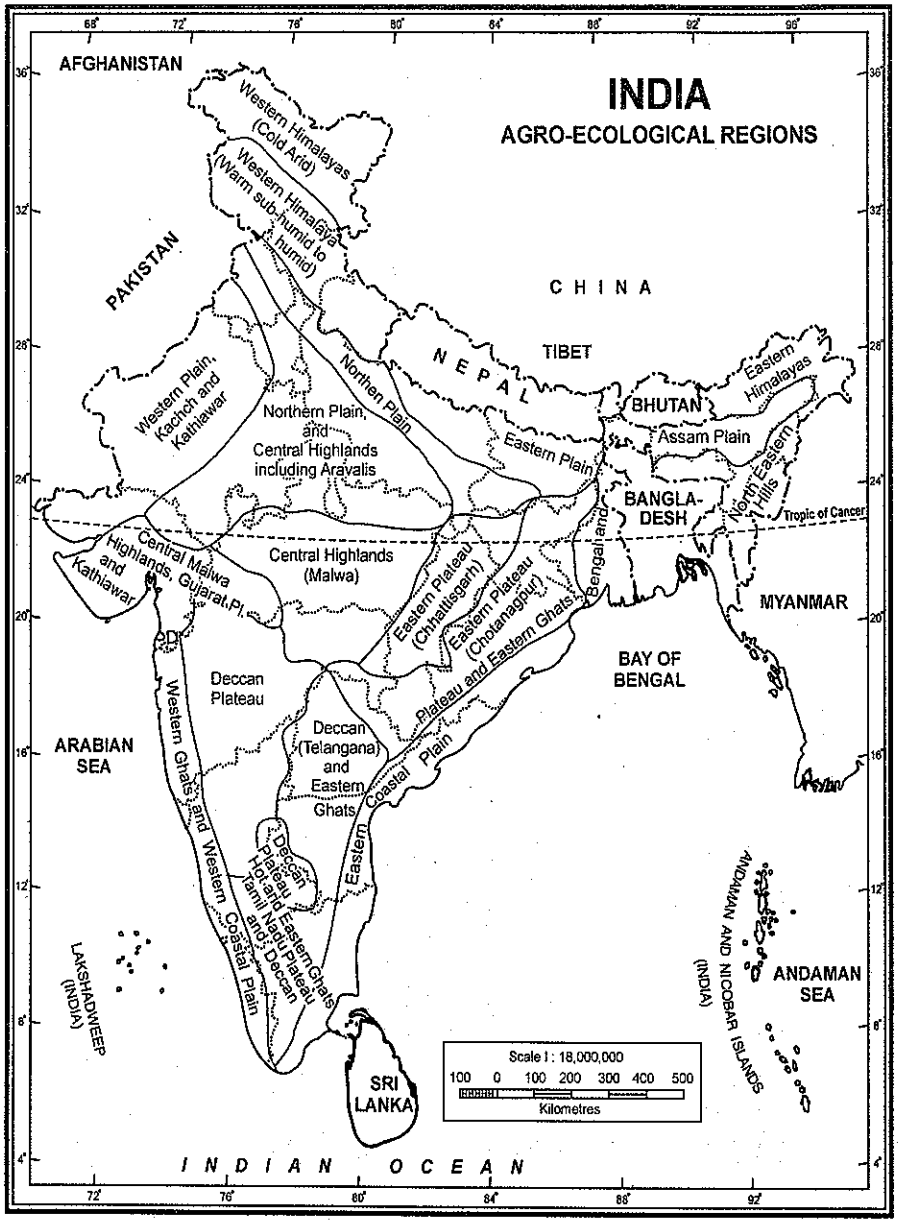


FIG. 20.9. India : Agro-Ecological Region

south-eastern part of Jammu and Kashmir. It is different from the first region because that region is cold and arid whereas this region has warm sub-humid to humid climate. It also includes perhumid ecoregion. Agriculture in this region is not much developed in spite of long growing season of 180-210 days. This is due to rugged topography of the area. However, the ecological conditions of this region are very congenial to orchards and plantation crops. Consequently, a large variety of temperate fruits are grown here. Brown and podzole soils give natural support to fruit cultivation in this region.

15. The Bengal and Assam Plain. This region includes the entire plain area of West Bengal and the Brahmaputra valley of Assam. The area receives about 150 cm annual rainfall from the south-west monsoons originating in the Bay of Bengal. The climate of this region is termed as hot sub-humid to humid (inclusion of perhumid). These climatic conditions coupled with rich fertile alluvial soils deposited by the rivers provide solid base to rice cultivation in this region. The Ganga-Brahmaputra delta is world famous for jute cultivation. Long growing period of 180-210 days provide ample scope for more than one crop.

16. The Eastern Himalayas. It includes Sikkim, Arunachal Pradesh and hilly areas of Assam. It is warm perhumid ecoregion with brown and red soils. The growing period over 210 days.

17. The North-Eastern Hills (Purvanchal). It spreads over the hills of Nagaland, Manipur, Tripura and Meghalaya. With average annual rainfall of 150-250 cm, this is the region of warm perhumid climate. Although the region has a long growing period of over 210, the red and laterite soils do not support much agriculture. Most of the area is covered by forests.

18. The Eastern Coastal Plain. It spreads over vast area along the east coast of the country from Subarnarekha river in the north to Kanniyakumari in the south. This coastal plain runs parallel to the direction of the south west monsoon originating in the Bay of Bengal and does not receive much rainfall. Therefore, this area has hot sub-humid to semi-arid climate. Big rivers like Mahanadi, Godavari, Krishna and Cauvery have formed large deltas of fertile alluvial soils. These deltas are famous for rice cultivation. There are large variations in agricultural calendar because the growing period varies from 90 to 210 days.

19. The Western Ghats and Western Coastal Plain. The Western Ghats run parallel to the west coast of India in a north-south direction and offers an effective obstruction in the way of the south-west monsoons originating in the Arabian sea. This results in copious rainfall of over 200 cm in the western coastal plains and on the western slopes of the Western Ghats. Thus this is an area of hot humid per-humid climate. It has laterile and alluvium soils. Heavy rains and alluvial soils coupled with long growing season of 90 to 210 days provide suitable conditions for rice cultivation.

20. The Islands of Andaman and Nicobar and Lakshadweep. The islands of Andaman and Nicobar are located in the Bay of Bengal and those of Lakshadweep are in the Arabian sea where hot humid to perhumid climate is found. These islands have red loaming and sandy soils and the growing period is over 210 days.

REFERENCES

Acharya, S.S. and N.L. Agarwal (1987) : *Agricultural Marketing in India,* Oxford and IBM Publishing Co., New Delhi.

Ahmed, A. and M.F. Siddiqui (1967) : *Crop Association Patterns in the Luni Basin,* Geographer, 14, pp. 69-80.

Andeson, J.R. (1970) : *A Geography of Agriculture,* WMC Brown Co., Dubuqu, Iowa.

Appu, P.S. (1996) : *Land Reforms in India : A Survey of Policy Legislation and Implementation,* Vikas, New Delhi.

Appu, P.S. (1975) : "Tenancy Reforms in India", *Economic and Political Weekly,* Special Number, August, 1975, pp. 1339-75.

Awasthi, U.S. (2004) : *Fertilizer—Pragmatic Views, Concerns,* The Hindu Survey of Indian Agriculture, 2004 Kasturi and Sons Ltd., Chennai, pp. 145-146.

Banerjee, Abhijit V. and Maitreesh Ghatak (1996) : Empowerment and Efficiency : *The Economics of Tenancy Reform,* Minco MIT and Harvard University.

Banerjee, Bireswar (1991) : *Models of Agricultural Development : The Indian Experience* in Jayamala Diddee (*ed.*), *Emerging Trends in Indian Geography,* Rawat Publication, Jaipur.

Bansil, P.C. (1977) : *Agricultural Problems in India,* Vikas Pub., New Delhi.

Basu, D.N. and G.S. Guha (1996) : *Agro-Climatic Regional Planning in India,* Vol. 1, Concepts and Application, New Delhi.

Bergmann, T. (1983) : Co-operation in India : Selected aspects in A.M. Khusro (ed.) *Readings in Agricultural Development,* Allied Publishers, Bombay.

Bhalla, G.S. (2004) : *Globalisation and Indian Agriculture, State of the Indian Farmer : A Millennium Study*, Vol. 19, Academic Foundation, N. Delhi.

Bhalla, G.S. (2006) : *Condition of Indian Peasantry*, National Book Trust, New Delhi.

Bhalla, G.S. (2007) : *Indian Agriculture Since Independence*, National Book Trust, New Delhi.

Bhalla, G. S., Alag, Y. K. (1979) : *Performance of Indian Agriculture*, Sterling, New Delhi.

Bhalla, G.S. and Gurmail Singh (2001) : *Indian Agriculture : Four Decades of Development*, Sage, New Delhi.

Bhandari, Suparas (2004) : *Insurance—Assuring Livelihood Security*, The Hindu Survey of Indian Agriculture, 2004, Kasturi and Sons Ltd., Chennai, pp. 170-171.

Bhatia, Kumar (2004) : *Seed Industry—Achieving Varietal diversity*, The Hindu Survey of Indian Agriculture, 2004, Kasturi and Sons Ltd., Chennai, pp. 161-163.

Bhatia, S.S. (1965) : "Patterns of Crop Concentration and Diversification in India", *Economic Geography*, Vol. 41, pp. 40-56.

Bhatia, S.S. (1967) : "A New Method of Agricultural Efficiency in Uttar Pradesh, *Economic Geography*, Vol. 43, pp. 244-260.

Blyn, G. (1966) : *Agricultural Trends in India*, Philadelphia.

Brezeale, E.L. and W.T. McGeorge, "Influence of Atmospheric Humidity on Root Growth," *Soil Science*, 76 (1953), pp. 361-365.

Buck, J.L. (1967) : *Land Utilization in China* (Volume I), Nankin, University of Nankin.

Chang, Jen-Hu (1968) : *Climate and Agriculture : An Ecological Survey*, Aldine Publishing Co. Chicago.

Coppock, J.T. (1964) : "Crop Livestock and Enterprise Combinations in England and Wales", *Economic Geography*, Vol. 40, pp. 65-81.

Coppock, J.T. (1968) : Changes in land use in Great Britain, in *Land Use and Resources : Studies in Applied Geography* (London Institute of British Geographers), Special Publication, No. 1.

Coppock, J.T. (1971) : *An Agricultural Atlas of England and Wales*, G. Bell and Sons, London.

Dandekar, V.M. (1994) : The Indian Economy, 1947-92, Vol. I on *Agriculture*, Sage, New Delhi.

Dantwala, M.L. (1959) : "Small Farmers not Small Farmers", *Indian Journal of Agricultural Economics*, 15, pp. 57-58.

Dantwala, *et al.* (1973) : *Agricultural Development since Independence*, Oxford University Press, New Delhi.

Dantwala, M.L. and L.B. Dorde (1965) : "The Economic Cultivator, *Indian Journal of Agricultural Economics* (1945-65), Selected Readings.

Dantwala, M.L. ***et al.*** (eds.) (1986) : *Agricultural Development since Independence*, Oxford University Press, New Delhi.

Dantwala, M.L. (1996) : *Dilemmas of Growth* in Pravin Visaria et al. (eds.) Sage, New Delhi.

Dayal, E. (1967) : "Crop Combination Regions : A Case Study of the Punjab Plains", *Tijdschrift Voor Econ.* En Soc. Geografic. Vol. 58, pp. 39-47.

Dhawan, B.D. (1990) : *Studies in Minor Irrigation with Special Reference to Ground Water*, Commonwealth Publishers, New Delhi.

Dikshit K.R. (1973) : "Agricultural Regions of Maharashtra" *Geographical Review of India*, Vol. 35, pp. 387-391.

Edwards, G.A.B. (2004) : *Farm Mechanisation—Enhancing ploughing efficiency*, The Hindu Survey of Indian Agriculture, 2004, Kasturi and Sons Ltd., Chennai, pp. 149-151.

Eitenne, G. (1968) : *Studies in Indian Agriculture*, Bombay.

Enyedi, G.Y. (1964) : *Geographical Types of Agriculture*, Budepest, Applied Geography in Hungary.

Framji, K.K. (1974) : "Review of Waterlogging and drainage problems and their solutions in India; *International Commission on Irrigation and Drainage Bulletin of January*, 1974, pp. 36-40.

Gasson, R. "Occupation Chosen by sons of Farmers", *Journal of Agricultural Economics* 19 (1968), pp. 317-326.

Government of India (1985-86) : *All India Report on Agricultural Census, 1985-86*, Department of Agriculture and Cooperation, New Delhi.

Government of India (2012 and 2013) : Agricultural Statistics at a Glace, Ministry of Agriculture.

Government of India : *Economic Survey 2010-11*, 2011-12, 2012-13, 2013-14 issues.

Government of India : *A Reference Annual*, 2011, 2012, 2013, 2014 issues.

Government of India (1996) *Implementation of Land Reforms*, Planning Commission, New Delhi.

Government of India (1998) : *Agro-Climatic Regional Planning* : *An Overview*, Planning Commission, New Delhi.

Government of India : Survey of Land Holdings in India, Various Rounds NSSO.

Gragor, Howard F. (1970) : *Geography of Agriculture : Themes in Research*, Prentice Hall, London.

Gulati, Ashok and Sudha Narayan, (2003) : *The Subsidy Syndrom in Indian Agriculture*, Oxford University Press, New Delhi.

Gupta, P. Sen and Sadasyuth, G. : *Economic Regionalisation of India : Problems and Approaches*, Census of India 1961, Monograph Series Vol. I, No. 8 (1968), New Delhi.

Hassis, B. : "*Innovation adoption and Indian Agriculture—the High Yielding Varieties.*

Hildreth, A.C. *et al.* : "Effects of Climatic factors on sowing plants." Water : *The United States Department of Agriculture, Yearbook* 1941, Washington.

Hussain, M. (1972) : "Crop Combination Regions of Uttar Pradesh : A study in Methodology," *Geographical Review of India*, 34, pp. 134-156.

Hussain, M. (1976) : "A new approach to the agricultural productivity regions in the Satluj-Ganga Plains of India." *Geographical Review of India*, 36, pp. 230-236.

Indian Council of Agricultural Research (1970) : Handbook of Agriculture, New Delhi.

Kendall, M.G. : "The Geographical distribution of crop productivity in England", *Journal of Royal Statistical Society*, 169 (1939) pp. 24-28.

Khan, W. and R.N. Tripathy, *Intensive Agriculture and Modern Inputs, Prospects of Small Farmers*, A Study in West Godavari District, Hyderabad Institute of Community Development, 1972.

Khusro, A.M. : "Returns to Scale in Indian Agriculture", *Indian Journal of Agricultural Economics*, 19 (1964), pp. 52-53.

Khusro, A. M. (1973) : (*ed.*) *Economics of Land Reforms and Farm Size in India*, Macmillan, New Delhi.

Klages, K.H.W. (1958) : *Ecological Crop Geography*, Macmillan, New York.

Kochhar, P.L. (1967) : *Plant Ecology, Genetics and Evolution*, Atma Ram and Sons, New Delhi.

Kahlon, A.S. and D.S. Tyagi (1983) : *Agricultural Price Policy in India*, Sage, New Delhi.

Kohi, R.L. (1958) : *Marketing of Agricultural Products*, Macmillan, New York.

Land Reforms : *Defects in Agrarian Structure as Obstacles to Economic Development* (1951), United Nations Publications.

Millor, J.W.&R. Ahmed (1988), *Agricultural Price Policy for Developing Countries*, Johns Hopkins University Press, Ballimore and London.

Mamoria, C. B. (1970) : *Agricultural Problems in India*, Kitab Mahal, Allahabad.

Mohammed, A. (1978) : *Studies in Agricultural Geography*, Rajesh Publication, New Delhi.

Morgan, W.B. and R.J.C. Munton (1971) : *Agricultural Geography*, Methven, London.

Munton, R.J.C. (1969) : *The Economic Geography of Agriculture in Trends in Geography*, U. Cooke and James H Johnson (ed.), Pergamon, London.

NABARD (2001) : *Report on High Power Expert Committee on Rural Credit.*

NABARD (2001) : *Handbook on Kisan Credit Card Scheme*, Bombay.

Nadkarni, M. V. (1991) : *The Crisis of Increasing Costs in Agriculture. Is there any way out ?* in Nadkarni *et al.* (*ed.*), *India, the Emerging Trends.*

Nanavati, M.B. and Anjana, J.J. (1970) : *The Indian Rural Problem*, ISAE, Bombay.

Nayak, G. : *Fertilizer Consumption*, Economic Times, New Delhi, May 6, 1993.

Oldenburg, Phillip (1990) : Land Consolidation as Land Reforms in India, *World Development*, 18(2).

Paroda, R.S. (2008) : Rainfed Farming : *Strategy for Productivity Growth. THSOIA* pp. 47-49.

Randhawa, M.S. (1958) : *Agriculture and Animal Husbandry in India* ICAR, New Delhi.

Rao, A. P. (1967) : *Size of Holding and Productivity*, Economic and Political Weekly, 11 Nov., 1967.

Rao Hanumantha, C.H. (1975) : *Technological Change and Distribution of Gains in Indian Agriculture*, Macmillan, New Delhi.

Rao Hanumantha, C.H. (1979) : *Farm Mechanisation* in M. Shafi (ed.) *Agricultural Development of India*, Bombay.

RBI (1990) : *A Review of the Agricultural Credit System in India :* Report o the Agricultural Credit Review Committee, Bombay.

Sapre, S.G. and V.D. Deshpande (1964) : "Inter-district Variations in Agricultural Efficiency in Maharashtra State, *Indian Journal of Agricultural Economics* 19, pp. 242-252.

Sen, Abhishwar (1958) : "Influence of Climatic Factors on Salinity of Indian Soils", *Indian Journal of Agricultural Science* 28, pp. 67-71.

Sharma, B.L. (1996) : *Sustainable Agricultural Development* in Majid Husain *et al.* (ed.), *Environmental Management in India*, Manak Publications, New Delhi.

Sharma, D.P. and Desai, U.V. (1980) : *Rural Economy of India*, Vikas, New Delhi.

Shafi, M. "Measurement of Agricultural Efficiency in Uttar Pradesh", *Economic Geography* 366 (1960) pp. 296-30.

Shafi, M. "Measurement of agricultural productivity of the Great Plains" *The Geographer* 19 (1972), pp. 4-13.

Shafi, M. "Perspective of Measurement of Agricultural Productivity" *The Geographer* 21 (1974) pp. 6-8l.

Shafi, M. (2006) : *Agricultural Geography,* Pearson Education, Delhi.

Sharma T.C. (1972) : "Patterns of Crop Land use in Uttar Pradesh", *The Deccan Geographer,* Vol. 10, pp. 1-7.

Sharma T.C. Trends in Cropping Intensity in Karnataka : A Regional Profile, *Transactions Journal of the IIG,* Vol. 19, No. January-June, pp. 17-30.

Sharma T.C. (1999) : *Technological Change in Indian Agriculture,* Rawat Publications, Jaipur.

Sharma, V.K. "Water balance in the Haryana, Punjab Plain—A Climatological Approach, *National Geographical Journal of India,* 20 (1974), pp. 145-159.

Singh Amarjit and A.N. Sadhu (1986) : *Agricultural Problems in India,* Himalaya Publishing House, Bombay.

Singh G.B. (1979) : *Transformation of Agriculture,* Vishal Publications, Kurukshetra.

Singh Jasbir. "A new technique for measuring agricultural productivity in Haryana (India), The *Geographer* 19 (1972) pp. 15-33.

Singh Jasbir (1974) : *An Agricultural Atlas of India,* Vishal Publication, Kurukshetra.

Singh Jasbir and S.S. Dhillon (1984) : *Agricultural Geography,* Tata McGraw Hill, New Delhi.

Singh, Surendra (1994) : *Agricultural Development in India : A Regional Analysis,* Kaushal Publications, Shillong.

Singh Surjit and Vidhya Sagar (2004) : *Agricultural Credit in India,* State of the Indian Farmer, Ministry of Agriculture, Academic Evaluation, New Delhi.

Singh V.R. "A method for analysing agricultural productivity, *Transactions* 1 (1979) pp. 39-46.

Subramaniam, A.R. (1991) : *Agroclimatic Studies in India* in Jaymala Diddee *(ed.), Emerging Trends in Indian Geography,* Rawat Publications, Jaipur.

Seymons, L. (1967) : *Agricultural Geography,* B. Bell, London

Tata S.N. (ed) (1980) : *Handbook of Agriculture,* ICAR, New Delhi.

The Hindu (2012) : Survey of Indian Agriculture.

Thorner, D. (1956) : Rationale of Regional Variations of Agrarian Structure in India, *Indian Journal of Agricultural Economics,* pp. 46-52.

Weaver, J.C. "Crop Combination regions in the middle West" Geographical Review XLIV (1954), pp. 176 and 181.

Green Revolution

INTRODUCTION

Green Revolution owes its origin in the finding of new dwarf variety of wheat seed by **Dr. Norman Earnest Borlaug**. He was incharge of Wheat Development Programme in Mexico in the 1950s and was the genetic architect of the dwarf wheat. Earlier, he and Dr. Hassar had conducted, in the late 1940s, most relentless breeding programme choosing the best of wheat genes in the world. His efforts at breeding a suitable dwarf variety were crowned with success by 1951 in Mexico and that country became self-sufficient in food by 1956. Later on, the Japanese wheat variety NORIN-10 was crossed with the Mexican improved varieties and the first break through came in 1961 when the Mexican farmers could obtain yields as high as 7,000 kg per hectare which was about $2^1/_2$ times the previous varieties. Green Revolution in rice was triggered off by intense upsurge in rice research resulting from the establishment of International Rice Research Institute (IRRI) at Manila. Some work on rice had been done in Taiwan also.

Although seeds of the Green Revolution were sown in early 1950s in Mexico, the term Green Revolution was first used by the then Administrator of the U.S. AID, **William S. Gadd** on 8 March, 1968 in Washington D.C. when he addressed the Society for International Development on the subject *Green Revolution—Accomplishments and Apprehensions.*

In India, the seeds of Green Revolution were first field tested in the drought year of 1964-65. They were introduced to the Indian scientists by **Dr. Borlaug** in 1963. He had predicted in 1961 that India could double her wheat production in one decade. India received 100 kg seeds each of four dwarf and semi-dwarf varieties. These seeds were planted in different soils in Delhi, Ludhiana, Pusa and Kanpur. The yield was over 4,000 kg per hectare which was about four times the yield of local varieties. These varieties were released for general cultivation after experimentation, multiplication and demonstrations by Indian scientists in about 100 different farmers' fields. In 1966, about 16,000 tonnes of seeds were imported for cultivating about 4 lakh hectares of land. High Yielding Varieties Programme (HYVP) was introduced in the kharif season of 1966. The production of foodgrains in 1967-68 was 25 per cent higher than that of 1966-67. This increase was more than the increase recorded in the preceding 16 years of plan period. This unprecedented increase in production was nothing less than a revolution and it was termed as *Green*

Revolution. In the words of **Dr. Hassar**, *The Green Revolution is the phrase generally used to describe the spectacular increase that took place during 1968 and is continuing in the production of foodgrains in India*. Unfortunately, Green Revolution left its impact only in Punjab, Haryana and Western U.P. in respect of wheat production and Andhra Pradesh and Tamil Nadu in respect of rice production. There seems to be no valid reason why other states cannot follow suit and get the benefit of Green Revolution. Sudhir Sen was quite justified when he said, *The Green Revolution is not a misnomer nor is it a fancy phrase; it is already much a reality. It has not only solved the food problem of India and other developing countries but it has brought the solid assurance that the problem can be solved. It has given them a breathing space in a period of spiralling population, to come to grips with the problem and set their economic house in order*.

INTENSIVE AGRICULTURE DEVELOPMENT PROGRAMME (IADP)

Popularly known as Package Programme, the IADP was taken up in 1961 and it paved the way to an *Adoption Breakthrough* for *Green Revolution* in India. It aimed at diffusing technical know-how, credit and agricultural technology to step up agricultural production in selected districts so that it may have demonstration effect. In the words of **R.N. Chopra**, "It was a historic decision which yielded solid results. The relevance of IADP experiment (1961-64) arises from the fact that it provided a crucial and much needed 'adoption breakthrough"—adoption of modern techniques of agricultural growth which, when coupled with the epoch-making '*biological breakthrough*, gave birth to the Green Revolution in India". The pilot project was launched first in 7 districts of 7 different states. Out of these, four were rice producing, two wheat producing and one millets producing. The districts were Shahabad in Bihar, Thanjavur in Tamil Nadu, Aligarh in U.P., West Godavari in Andhra Pradesh, Ludhiana in Punjab, Raipur in Chhattisgarh and Pali in Rajasthan. Later 8 more districts were selected for this programme. The programme was a grand success and it created new dynamism in the stagnant countryside. It was extended to a total of 114 districts in 1964-65. According to **C. Subramaniam**, "It is one of the miracle stories of modern development that the allegedly backward tradition-bound Indian farmer has been so responsive to new technology. This has been in a large measure due to the poineering efforts of the IADP through which the package approach to agriculture was introduced." It is worth mentioning that 64 per cent of the growth in the output of foodgrains in the IADP districts was due to capital and knowledge (HYV seeds, fertilizers and pesticides, etc.) — *viz*., factors other than land and labour inputs.

COMPONENTS OF THE GREEN REVOLUTION

Following are the 12 components of the Green Revolution :

1. High Yielding Varieties (HYV) of seeds.
2. Irrigation (*a*) surface and (*b*) ground.
3. Use of fertilizers (chemical).
4. Use of insecticides and pesticides.
5. Command Area Development (CAD).
6. Consolidation of holdings.
7. Land reforms.
8. Supply of agricultural credit.
9. Rural electrification.
10. Rural roads and marketing.
11. Farm mechanisation.
12. Agricultural universities.

Some of the above mentioned components have already been discussed in the earlier chapters and will need little description, while some other components will be discussed in detail here.

It must be noted that majority of the components do not act in isolation, rather they are closely inter-related and heavily dependent upon one another. For example, HYV seeds are highly responsive to use of fertilizers and are equally vulnerable to pest attacks and growth of useless weeds. Their full potential cannot be developed without the requisite supply of water. The shorter maturing period enables the farmers to obtain more than one crop in a year from the same piece of land. This would require hastening of the harvesting operations so that land is quickly prepared for the second crop. This will require mechanisation of farming. In order to make optimum use of the farm inputs, the farmer must know the *why, where, what, when and how much* of each for which there is ample scope.

1. High Yielding Varieties (HYV) of seeds. According to **R.N. Chopra**, "The high yielding variety seeds are major input of agricultural production under the Green Revolution technology. Their main characteristic is increased responsiveness to chemical fertilizers, their period of maturing is short, it helps double cropping; their short stems can easily carry fertilizer load, resist wind damage, their large leaf surface helps the process of photosynthesis." According to **Sunil Kumar Munsi**, "The HYV seeds were perhaps the single most important input in the Indian Green Revolution. All other inputs were linked with HYV." **M.S. Swaminathan** has remarked that apart from erasing the 'begging bowl' image of our country, the most important gain has been the saving of forests and land, thanks to the productivity improvement associated with high yielding varieties. The development of HYV seeds of wheat in 1960s and those of rice in 1969-70 laid the foundation for Green Revolution in India. Bandhu Das Sen has rightly remarked that they play the role of modernisers of agriculture like engines of change, capable of transforming a traditional farmer into a commercial producer. They act as part of steam engine (for industrial revolution) to ignite an agrarian revolution in poor countries. Thus the HYV programme brought about a major change—a transformation affecting almost every aspect of Indian agriculture. In words of Dantwala, "widespread adoption of HYVs has helped to step up cereal production, stimulated investment and substantially increased the use of modern inputs." The Pearson Commission Report hailed it as *one of the authentic marvels of our time*. Its most important effect was to be seen in the attainment of self-sufficiency in cereals, which enabled us to have a break from the *ship-to-mouth* situation and move forward ahead of population.

Details of seed production, distribution and use have been given in Chapter 20 and need not be repeated here.

2. Irrigation. Irrigation is the second most important component of Green Revolution technology after HYV seeds. Assured and regular supply of sufficient water to crops not only adds to production, it also assures stability in production. Indian rainfall being unreliable, irregular and seasonal, there is urgent need to expand irrigation potential to meet the requirements of the Green Revolution strategy. Irrigation is a pre-condition for successful introduction of HYV seeds even in areas of heavy rainfall. The success in use of HYV seeds lies in availability of water at the right time and in the right quantity for which **B.B. Vohra** had laid more emphasis on ground water rather than on surface water. The ground water gives the advantage of *push-button* irrigation, made possible by a pumpset or a tube well and is completely under farmer's own control. Appreciating the role of ground water in the success of Green Revolution, Vohra has preferred to call it the *Ground Water Revolution*. However, there is serious threat of depletion of ground water due to over-exploitation when the rate of drawl of ground water is higher than the rate at which it is replenished. In many districts of Haryana and Punjab, the ground water exploitation is very high.

The available potential, the growth and utilization of irrigation in India has been discussed at length in earlier chapters and need not be repeated here.

3. Use of Fertilizers (Chemical). The use of chemical fertilizers has been the third most important input of Green Revolution after HYV seeds and irrigation, *rather the three are tied together*. In fact use of HYV seeds needs heavy dose of irrigation and fertilizers to give high yields. Since the entire culturable land has already been brought under plough and there is practically no scope for bringing any new areas under cultivation, further increase in foodgrains production can be achieved only by multiple-cropping which heavily leans on the *trio* of the basic inputs, *viz*. HYV seeds, irrigation and chemical fertilizers.

To encourage balanced fertilizer use and make fertilizers available to farmers at affordable prices, the Central Government determines and notifies the selling price of urea as well as decontrolled P&K fertilizers. The current selling prices of urea and P&K fertilizers are less than the cost of production, the difference between the selling price and the cost of production as assessed by the government is borne as subsidy.

Although the use of fertilizers has considerably increased over the years, this increase is more prominent in areas where Green Revolution has shown its impact. In 1970, southern India was leading in consumption of fertilizers, but later on northern India, particularly, Punjab, Haryana and Uttar Pradesh, became the main consumers.

In spite of the fact that India is the third largest consumer of chemical fertilizers in the world, after the China and U.S.A., per hectare consumption still remains low compared to the world averages. This means that there is still large scope for using chemical fertilizers, increasing the yields and converting the dreams of Green Revolution into reality.

Details of production, distribution, import and utilization have been given in Chapter 20.

4. Use of Insecticides and Pesticides. Though intensive use of irrigation and fertilizers under the Green Revolution technology has increased the farm production, it has also given birth to the problem of pests, insects, weeds, rodents, etc. The monoculture promoted by the Green Revolution technology is more vulnerable to the insects and pests. These pests, weeds and diseases are to be checked by proper doses of insecticides, pesticides and weedicides. Pest surveillance should be an integral part of crop production. The first disease surveillance in this country related to wheat diseases in 1966-67 followed by ad hoc rice survey and surveillance of pests and diseases in 1970, 71 and 72. According to annual report of Ministry of Agriculture (1983-84), over 30 million hectares of cropped area in the country is affected by various pests and diseases, taking an annual toll of 5 to 25 per cent of the agricultural production. There has been a tremendous increase in the use of different types of biocides in the areas under plant protection. The regional distribution makes it clear that areas with Green Revolution technology are the main consumers of pesticides. For example, Punjab, Haryana, Andhra Pradesh and Tamil Nadu consumed over 60 per cent of the country's pesticides in 2013-14.

5. Command Area Development (CAD). Command Area Development Programme is a centrally sponsored scheme which was launched in January 1975. Its aim was to bridge the gap between potential created and utilized in selected major/medium irrigation projects of the country for optimising agricultural production from the irrigated land. The programme covers the following components :

(*i*) *On-farm development (OFD)* works which include soil surveys, land shaping, construction of field channels, field drains, farm roads, re-alignment of field boundaries (where possible consolidation of holdings should also be combined), introduction of *warabandi* to ensure equitable and assured supply of water to each and every farm holding, supply of all inputs and services including credit and strengthening of extension services.

(*ii*) Selection and introduction of suitable cropping pattern.

(*iii*) Development of groundwater to supplement surface water.

(*iv*) Development and maintenance of the main and intermediate drainage system.

(*v*) Modernisation, maintenance and efficient operation of the irrigation system upon the outlet of one cusec capacity.

Initially, 60 major and medium irrigation projects were taken up under CAD programme, covering a Culturable Command Area (CCA) of about 15 million hectares. After inclusion of new projects, deletion of completed projects and clubbing of some projects, there are now 149 projects under implementation. The programme was restructured and renamed as Command Area Development and Water Management (CADWM) programme with effect from 1st April, 2004. The scheme had been implemented as State-Sector Scheme during XI Five Year Plan (2008-09 to 2011-12).

6. Consolidation of Holdings. Small and fragmented land holdings have been one of the main obstacles in the progress of agriculture in India. Consolidation of holdings has been introduced to solve this problem. A detailed discussion on the reducing size of holdings, their fragmentation and consolidation thereof, has been given in Chapter 20.

7. Land Reforms. Immediately after Independence, it was felt that land reforms must be brought in to improve the agricultural situation in the country. Absentee landlordism, tenancy-at-will and share cropping could not help in inculcating interest among the farmers to make investments in farm inputs and adopt new farm technology. In 1947 half of India was under *Zamindari System* in which 80 per cent of the land was in the hands of the absentee landlords. The *Zamindar* used to exploit the farmers who used to till the land. Soon after Independence, the slogan of *land to the tiller* was raised and steps were taken for the abolition of the Zamindari. Consequently, tenants became owners of land. They started taking interest and pains to increase the farm production. *Raitwari* system prevailed in Madras, Bombay, Assam and Punjab. Under this system the peasant was the owner of land and paid rent directly to the Government. The rent was usually half of the net produce. A fixed amount of rent was to be paid irrespective of the condition of the crops. In the event of crop failure the peasant was obliged to pay rent by incurring debt against mortgage. Ultimately the land passed into the hands of the money lender who had no real interest in cultivation. *Mahotwari* was another system in which a chosen peasant (*Lambardar*) was responsible for depositing the rent varying from 40 to 70 per cent of the produce. These systems were to be abolished in the interest of better agricultural performance. Another measure taken by the government was the enforcement of land ceiling act. Under this act a farmer cannot own more land than the ceiling limits. This resulted in the re-distribution of surplus land which proved beneficial to lakhs of landless farmers. After obtaining the ownership rights, farmers worked whole-heartedly on their farms and this led to a tremendous increase in agricultural production. Dr. Randhawa has beautifully summed up the benefits of land reforms. According to him, "A stable and restructured rural base with an equitable tenurial system paved the way to Green Revolution and can be accredited with its blooming to the present stage."

8. Supply of Agricultural Credit. In the words of R.N. Chopra "Credit is the most crucial input in all agricultural developmental programmes. The other inputs *viz*., technology, HYV seeds, fertilizers, pesticides, irrigation water and machinery—all depend on the availability of credit". A large percentage of Indian farming community consists of small and marginal farmers who do not have their own resources to invest in agriculture. They depend upon agricultural credit to carry on most of their agricultural operations. Earlier they used to get loan from the moneylender who used to charge very high rate of interest. Now Cooperatives, Commercial Banks and Regional Rural Banks extend loans to farmers on easy terms. The role played by diferent agencies in extending loan to farmers has been discussed in Chapter 20.

9. Rural Electrification. Rural electrification is one of the essential inputs in modern agricultural system. Electricity makes a significant contribution to development of agriculture. It is a cheap source of energy which can be used for lifting water by tubewells/pumpsets, processing and preserving agricultural produce, sprinkler irrigation and so many other farm operations. The development of ground water, so vital for Green Revolution, requires uninterruped supply of elctricity at cheaper rates.

Realising the importance of electricity for the proper growth and development of agriculture, a massive programme of rural electrification was taken up immediately after Independence. At the time of Independence only 1,300 villages had been electrified and only 6,400 energised pump sets were working in the entire country. Currently more than 95 per cent of the villages are electrified.

Haryana was the first state to electrify all its 6,759 villages in 1970. Punjab, Kerala, Andhra Pradesh, Karnataka, Gujarat, Himachal Pradesh, Tamil Nadu, J and K, Maharashtra and Nagaland have 97 to 100 per cent villages electrified.

10. Rural Roads and Marketing. Rural roads and marketing have already been discussed in Chapter 20. They constitute an important segment of infrastructure to improve agricultural productivity under the Green Revolution programme. Rural roads are very essential for connecting the villages to the neighbouring markets and villages. Unfortunately, there is still a big gap between the requirement and availability of village roads. Road network upto town level is fairly satisfactory. The weakest point is that of rural roads.

Marketing is essential for progressive agriculture. Regulated markets enable the farmer to sell his agricultural produce and to purchase farm implements and tools, fertilizers, pesticides and other agricultural inputs as well as goods of every day use. The farmer can go to the market with his produce, sell it and on

his return journey he can bring the goods required for agriculture or in every day life. In this way the farmer can save on his return transport and avoid unnecessary waste of time, energy and money. Ideally speaking the market place should be within a distance of 5 km from the village. In the words of Leo E. Holman, "Marketing is the part and parcel of a modern productive process, the part at the end that gives point and purpose to all that had gone before. Benefits from mechanisation can be minimised if corresponding improvements are not made in the marketing system."

11. Farm Mechanisation. Much success of the Green Revolution depends upon farm mechanisation. Mechanisation saves a lot of human labour and quickens the farm operations, thereby adding to the farm efficiency and productivity. For a detailed account of farm mechanisation see Chapter 20.

12. Agricultural Universities. Agricultural universities and other agricultural institutes are primarily engaged in agricultural research and passing on the research findings to the farmers. A good deal of research and extension work done by these universities has paid rich dividends in the agricultural field. Success of Green Revolution largely depends upon the work done by these universities. Punjab, Haryana and Uttar Pradesh, are the best examples of such a progress.

IMPACT OF GREEN REVOLUTION

Like other developing countries, Green Revolution has influenced the economy and way of life in India to a great extent as is evident from the following points :

1. Increase in Agricultural Production. The introduction of Green Revolution in 1967-68 has resulted in phenomenal increase in the production of agricultural crops especially in foodgrains. From 1967 onwards, the *Green Revolution* aimed at bringing about a *Grain Revolution*. Among the food grains too, it is the wheat crop which drew maximum benefit from Green Revolution. The production of wheat increased 23.8 million tonnes in 1970-71 to 95.8 million tonnes in 2013-14 thereby recording over four time increase. while the overall increase in the production of foodgrains was about 2.5 times in the corresponding period. On account of this reason, it is said that the Green Revolution in India is largely the *Wheat Revolution*. The area production and yield of foodgrains were 115.10 million hectares, 72.35 million tonnes and 62.9 kg/hectare in 1965-66. The corresponding figures rose to 126.2 million hectares, 264.4 million tonnes and 2095 kg/hectare in 2013-14.

2. Diffusion of Rice and Wheat Cultivation to non-traditional areas. Since the success of the Green Revolution depends on the basic inputs like better seeds, fertilizers and irrigation, it has led to diffusion of crops, particularly two major food-crops *viz.* rice and wheat, to the areas hitherto unknown for their cultivation. For instance, West Bengal and Bihar had been traditional producers of rice and had the distinction of being called as 'rice heartland'. But the virtues of the Green Revolution have helped in spreading rice cultivation to semi-arid areas of Punjab, Haryana and western part of Uttar Pradesh, thereby changing the cropping pattern of these areas. This feat has been achieved primarily due to increase in irrigation facilities supplemented by availability of better seeds and fertilizers. However, contribution of enterprising farmers cannot be under-estimated. Besides, rice cultivation has become popular in vast areas in South India which were producing very little or not rice before 1965-66 (**Fig. 21.1**). The area production and yield of rice were 35.47 million hectares, 30.59 million tonnes and 862 kg/ha in 1965-66 and the corresponding figures increases to 43.9 million hectares, 106.3 million tonnes and 2419 kg/ha in 2013-14.

Similarly wheat cultivation has spread to vast areas in eastern Uttar Pradesh, Madhya Pradesh, Rajasthan, and some parts of Maharashtra, Gujarat and West Bengal. Although diffusion of wheat cultivation started from its heartland right with the beginning of the Green Revolution in the mid 1960s, yet the major part of diffusion in Uttar Pradesh, Madhya Pradesh, Rajasthan, Gujarat, Bihar and West Bengal was observed in 1970s (**Fig. 21.2**).

The area, production and yield of wheat were 12.57 million hectares, 10.40 million tonnes and 827 kg/ha in 1965-66 which rose to 31.3 million hectares, 95.8 million tonnes and 3,059 kg/ha in 2013-14 respectively. Thus, area, total production and yield per hectare recorded 2.4, 9.0 and 3.5 times increase respectively between 1965-66 and 2013-14. This is a great achievement indeed. However, much more has

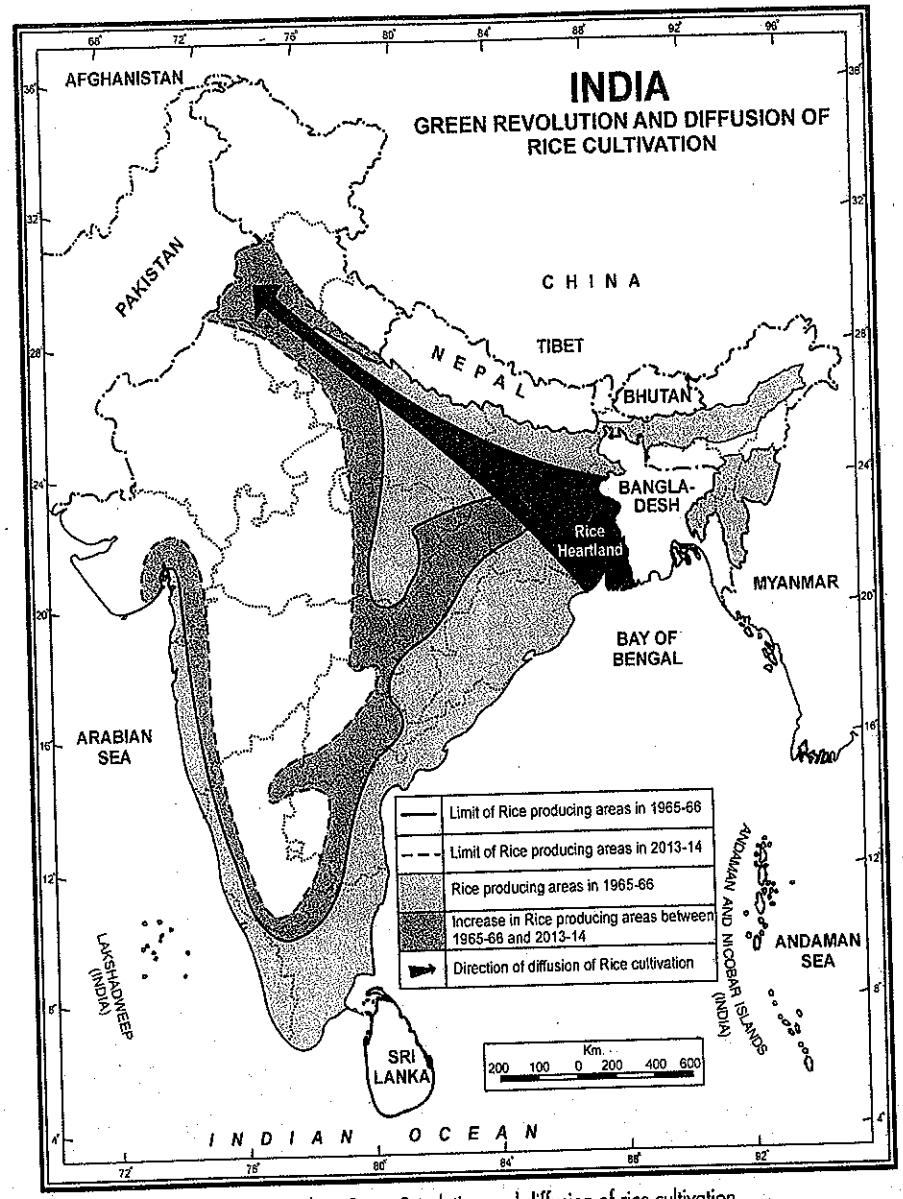


FIG. 21.1. India : Green Revolution and diffusion of rice cultivation.

to be done to meet our growing demand for foodgrains.

3. Prosperity of Farmers. With the increase in farm production the earnings of the farmers also increased and they became prosperous. This has, especially, been the case with big farmers having more than 10 hectares of land.

4. Reduction in import of foodgrains. The main benefit of Green Revolution was the increase in the production of foodgrains, as a result of which there

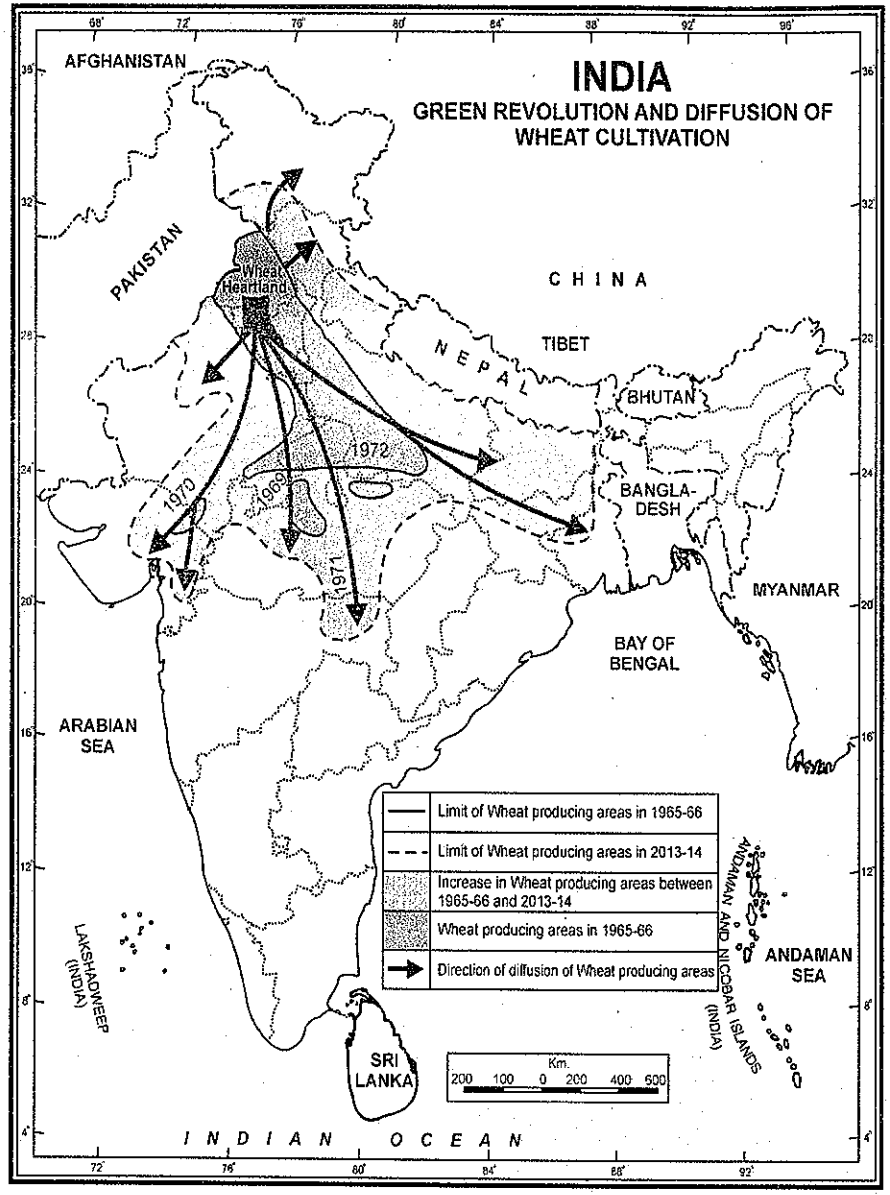


FIG. 21.2. India : Green Revolution and diffusion of wheat cultivation

was a drastic reduction in their imports. We are now self-sufficient in foodgrains and have sufficient stock in the central pool. Sometimes we are in a position to export foodgrains also. The per capita net availability of foodgrains has also increased from 408.1 grams per day in early 1966 to the level of 510.8 grams in 2013, this inspite of the rapid increase in population. In the words of **Dantwala**, *Green Revolution has given a breathing time. As a result, there will be relief from anxiety of food shortage and the planners will concentrate more on Indian planning.*

5. Capitalistic Farming. Big farmers having more than 10 hectares of land have tended to get the maximum benefit from Green Revolution technology by investing large amount of money in various inputs like HYV seeds, fertilizers, machines, etc. This has encouraged capitalistic farming.

6. Ploughing back of profit. The introduction of Green Revolution helped the farmers in raising their level of income. Wiser farmers ploughed back their surplus income for improving agricultural productivity. This led to further improvement in agriculture. According to a study conducted by Punjab Agriculture University, Ludhiana farmers plough back about 55 per cent of their income for agricultural progress.

7. Industrial Growth. Green Revolution brought about large scale farm mechanisation which created demand for different types of machines like tractors, harvestors, threshers, combines, diesel engines, electric motors, pumping sets, etc. Besides, demand for chemical fertilizers, pesticides, insecticides, weedicides, etc. also increased considerably. Consequently, industries producing these items progressed by leaps and bounds. Moreover, several agricultural products are used as raw materials in various industries. These industries are known as *agro based industries*. Textile, sugar, vanaspati, etc. are some outstanding examples of agro based industries.

8. Rural Employment. While on one hand, large scale unemployment was feared due to mechanization of farming with the introduction of Green Revolution technology in India, there was an appreciable increase in the demand for labour force due to multiple cropping and use of fertilizers. According to Gobind Thukral, "Green Revolution has generated lakhs of new jobs in Punjab. Almost 15 lakh poor people from the impoverished regions of Bihar, eastern Uttar Pradesh and Odisha work here. They not only earn their bread and butter, but take back home new ideas and technology". As per findings of Bhalla and Chadha in respect of Punjab, "The drive towards mechanization was caused mainly by the scarcity of labour and relatively high wage rate especially during peak agricultural operations." During the early years of the Green Revolution, a large number of farm labourers had migrated from Bihar and eastern Uttar Pradesh to Punjab where they found better opportunities of earning a livelihood. However, reverse trend has been observed during 2010s as a large number of labourers from these areas are going back to their home state because they are now finding employment opportunities there caused by overall development including impact of Green Revolution.

9. Change in the Attitude of Farmers. The Indian farmer had remained illiterate, backward and traditional and had been using conventional methods of cultivation since the earliest times. But Green Revolution has brought about a basic change in his attitude towards farming. The way he has readily adopted the Green Revolution technology has exploded the myth that the Indian farmer is basically tradition bound and does not use new methods and techniques. Wolf Ladejinsky has rightly concluded that, "Where the ingredients for new technology are available, no farmer denies their effectiveness. The desire for better farming methods and a better standard of living is growing not only among the relatively small number of affluent farmers using the new technology, but also among countless farmers still from outside looking in."

DEMERITS OR PROBLEMS OF GREEN REVOLUTION

Green Revolution is a unique event in the agricultural history of Independent India. This has saved us from the disasters of hunger and starvation and made our peasants more confident than ever before. But it has its own inherent deficiency segments. Ever since its inception, the income gap between large, marginal and small farmers has increased, gap between irrigated and rainfed areas has widened and some crops have benefited more than the others, sometimes even at the cost of other crops. *It is neither product-neutral nor region-neutral and leaves uneven effects of growth on products, regions and classes of people.* This has given birth to a plethora of socio-economic problems. According to **Radha Krishna Rao**, "The spiraling prices of fertilizers, the tendency to use them frequently and the stagnant wheat and rice yields in Punjab and Haryana have combined to confirm that Green Revolution has reached ripened old age". The

fatigue of the Green Revolution is already visible. Still the main lacuna in the Green Revolution is that up till now it is an unfinished task. Some of the demerits or problems of Green Revolution are briefly discussed as under :

1. Inter-Crop Imbalances. The effect of Green Revolution is primarily felt on foodgrains. Although all foodgrains including wheat, rice, jowar, bajra and maize have gained from the Green Revolution, it is wheat which has benefited the most. It has wrested areas from coarse cereals, pulses and oilseeds. The HYV seeds in latter crops have either not been developed so far at all, or they are not good enough for farmers to risk their adoption. Consequently, their cultivation is fast becoming uneconomic and they are often given up in favour of wheat or even rice. The result is that an excess of production in two main foodgrains (wheat and rice) and shortages in most others today prevail side by side. Major commercial crops like cotton, jute, tea and sugarcane are also almost untouched by the Green Revolution. This is not good for a balanced growth of Indian agriculture. Central Government has taken some steps to remove these imbalances.

2. Regional Disparities. Green Revolution technology has given birth to growing disparities in economic development at inter and intra regional levels. It has so far benefited only 40 per cent of the total cropped area and 60 per cent is still untouched by it. The most affected areas are Punjab, Haryana and western Uttar Pradesh in the north and Andhra Pradesh and Tamil Nadu in the south. The major benefit in these two regions has been with respect to increase in wheat and rice cultivation respectively (**Fig. 21.3**). It has hardly touched the Eastern region, including Assam, Bihar, West Bengal and Odisha and arid and semi-arid areas of Western and Southern India. In short, it failed to take care of areas like rainfed, hilly, coastal, dry and arid zones of the country which could be developed for production of exportable items like fruits, honey, mushroom, milk, meat, etc. In short, Green Revolution affected only those areas which were already better placed from agricultural point of view. Thus the problem of regional disparities has further aggravated as a result of Green Revolution. The ratio between the lowest and highest yield-rates among the states for the 1975-78 period amounted to 1 : 3.2 in paddy, 1 : 3.7 in wheat, 1 : 3.4 in cereals, 1 : 3.2 in pulses, 1 : 3.2 in food grains, 1 : 3.0 in oilseeds, 1 : 3.2 in sugarcane, 1 : 4.9 in cotton and 1 : 1.6 in jute. Study of some sample surveys recently conducted by the Indian Agricultural Statistics Research Institute (IASRI) revealed that the single most important factor is the '*input differential*" which alone can explain extreme yield variations even under similar physical and cultural conditions. According to a study by Bhalla and Alagh, 69 districts with a relatively high productivity levels account for 20 per cent of the cultivated area and 36 per cent of output, consume 44 per cent of fertilizers, employ 50 per cent of tractors and 45 per cent of irrigation pumps and have 38 per cent of India's gross irrigated area.

Regional disparities in crop yields can be reduced by evolving suitable disease resistant high-yield strains of paddy for most eastern parts and by developing irrigation facilities and a suitable dry farming technology for the arid and semi-arid western and southern regions.

3. Increase in Inter-Personal Inequalities. It has been observed that it is the big farmer having 10 hectares or more land, who is benefited the most from Green Revolution because he has the financial resources to purchase farm implements, better seeds, fertilizers and can arrange for regular supply of irrigation water to the crops. As against this, the small and marginal farmers do not have the financial resources to purchase these farm inputs and are deprived of the benefits of Green Revolution Technology. There were about 1,37,757 thousand holdings in India in 2010-11 out of which only 0.7 per cent exceeded 10 hectares in size. Francine R. Rankel has concluded from his study of Ludhiana (Punjab), West Godavari (Andhra Pradesh), Thanjavur (Tamil Nadu), Palghat (Kerala) and Bardhaman (West Bengal) that the greater beneficiaries are those farmers who own 10 to 12 hectares of land. Similar conclusion was drawn by **G.R. Saini** from his study of Ferozepur (Punjab) and Muzaffarnagar (U.P.). **G.S. Bhalla** and **G.K. Chadha** have found out that Green Revolution has benefited the farmers in general but one-third of them are small farmers with 2.5 acres (about one hectare) of land and are living below poverty line. Another 24.0 per cent of the farmers own 2.5 to 5.0 acres (1-2 hectares) of land and they are also living below poverty line. The land holdings

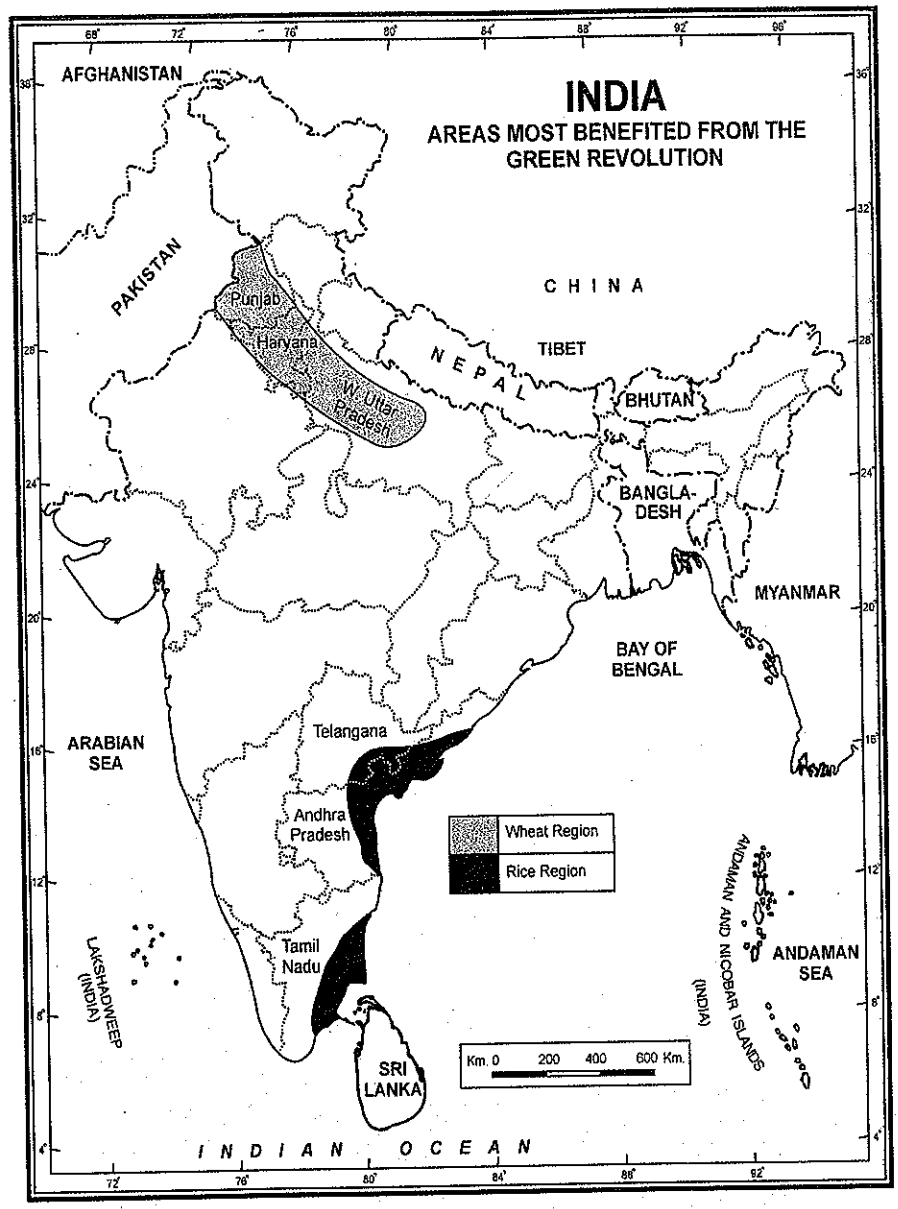


FIG. 21.3. Areas most benefitted from the Green Revolution

are generally small in rice producing areas and the economic position of the farmers living in those areas is extremely miserable. In short, Green Revolution has *made the rich richer and rendered the poor poorer resulting in wide-spread social and economic tensions.*

4. Unemployment. Except in Punjab, and to some extent in Haryana, farm mechanization under

Green Revolution has created widespread unemployment among agricultural labourers in the rural areas. The worst hit are the poor and the landless people.

5. Other Problems. Agriculture under Green Revolution has not grown at a rate which was expected in the beginning. The differential rates of growth of different crops and their regional variations have already been discussed. Some scholars have expressed serious doubts about the capability of HYV seeds itself. Analysing the role played by *miracle seeds* in the Green Revolution, Vandana Shiva says that the term HYV is a *misnomer*. In actuality, these seeds are highly responsive to certain key inputs such as fertilizer and irrigation and as such they should have been called highly *responsive* varieties. Shiva says that there is increasing evidence that the indigenous varieties could also be high yielding given the required doses of inputs. According to Shiva, "the inevitability of the Green Revolution option was built on neglecting the other avenues for increasing production that is more ecological such as improving mixed cropping systems, improving indigenous seeds and improving the efficiency of use of local resources." **Vandana Shiva** further comments that "having destroyed nature's mechanisms for controlling pests through the destruction of diversity, the 'miracle seeds' of the Green Revolution became mechanisms for breeding new pests and creating new diseases". In a case study of Punjab, **M.K. Sekhon** and **Manjeet Kaur** of P.A.U. Ludhiana have warned against the excessive use of groundwater, chemical fertilizers and pesticides. This will lead to large scale depletion of groundwater and will adversely affect the health of soil.

ECOLOGICAL IMPLICATIONS OF GREEN REVOLUTION

Apart from its socio-economic implications, Green Revolution has left a deep impact on various ecological aspects in different parts of the country. Some of the major ecological problems created by Green Revolution are soil salinity and alkalinity, waterlogging, desertification, soil erosion and degradation, deforestation, depletion of underground water, environmental pollution and health hazards. Some of the problems like soil salinity, water-logging desertification and soil erosion and degradation have already been described in Chapter 7 on soil, while some other problems are briefly discussed as under :

Deforestation. More cultivable land is needed to increase agricultural production and forests are the main victims as trees are felled recklessly to make more land available for agriculture. This leads to large scale deforestation which has its own ill effects on environment and ecology. Forests have been destroyed over vast areas in the northern plain of India to make room for agriculture. Punjab and Haryana, the Granary of India' are almost completely devoid of forests. These two states have 3.09 and 3.59 per cent of the total area under forests respectively. Uttar Pradesh is slightly better with just over 5 per cent of its area under forests. This has happened largely due to our quest for a more land to grow more food grains particularly wheat and rice.

Depletion of Underground Water. Success of Green Revolution primarily depends on the intensive use of HYV seeds which requires high input of irrigation. In semi-arid areas of Punjab, Haryana and western part of Uttar Pradesh, wheat cultivation largely depends on irrigation. Since canal irrigation is not sufficient to meet the growing demand, farmers depend heavily on tube well irrigation. Introduction of rice cultivation in these areas as a consequence of Green Revolution has put heavy strain on tube well irrigation. Farmers indulge in over exploitation of ground water resources which leads to depletion of ground water and fall in ground water-table. In some parts of north-west India (Punjab, Haryana and Uttar Pradesh) water table is falling at an alarming rate of one meter per year and it has gone critically low. It is apprehended that ground-water will dry up in due course of time if the present trend is not checked immediately.

Environmental Pollution. Success of Green Revolution is primarily based on use of HYV seeds which perform well only if other inputs like chemical fertilizers (NPK), insecticides and pesticides are also used. Fertilizers help in getting higher yields per hectare while insecticides and pesticides are used to save crops from insects, pests and diseases. Care has to be taken to use fertilizers, insecticides and pesticides upto a permitted limit. Indiscriminate use of these chemicals leads to environmental pollution. When insecticides are sprayed on the crops, some part of it enters the surrounding air and pollutes it. Some of the chemicals enter the soil and destroy the micro-organisms. These micro-organisms are vital to maintain the fertility of the soil. Some of the chemicals enter water, are dissolved in it, and pollute both surface as well as ground water. Thus, it can be easily said that whereas chemical fertilizers, insecticides and pesticides have saved us from hunger and starvation, it has given birth to serious problems of environmental pollution.

Noise Pollution. Farm mechanisation is one of the important inputs for success of Green Revolution. Increasing use of tractors, harvesters, threshers, crushers etc. make lots of noise and disturb rural peace and tranquillity.

Health Hazards. Indiscriminate use of chemical fertilizers, insecticides and pesticides has resulted in a large number of health hazards. These chemicals pollute air, water and land and cause many ailments. Some of the poisonous chemicals enter our food chain through fruits and vegetables and result in ill health. According to Indian Council of Medical Research, traces of lead, zinc and copper are found in milk and vegetables due to use these chemicals on the crops. In areas of high irrigation intensity by canals and tube wells, in Punjab, Haryana, Rajasthan and western Uttar Pradesh, there are vast tracts of waterlogged areas which provide ideal conditions for mosquito breeding. These mosquitoes cause a large number of ailments including malaria, dengue and chikunguniya.

SECOND GREEN REVOLUTION

As mentioned earlier, the fatigue of the First Green Revolution has become conspicuous and the production as well yields of almost all the crops has reached the plateau stage. Declining productivity of a number of crops due to unsustainable agricultural practices over the years and a galloping rate of population growth have put a severe strain on the food supply situation in the country. The food safety net for our rapidly growing population requires enhanced production and productivity in the form of a Second Green Revolution. In fact, a Second Green Revolution has become imperative keeping in view the tardy growth of food grains in proportion to the population growth. Further, special attention is required for achieving higher production and productivity levels in pulses, oilseeds, fruits and vegetables which remained untouched in the First Green Revolution but are essential for our nutritional security. In this regard, achieving high production of poultry, meat and fisheries is also essential. The First Green Revolution also ignored certain areas like rainfed, hilly, coastal and arid zones which could be developed for producing fruits, milk and meat. Thus, a number of shortcomings have been noticed in the First Green Revolution and it is right time to strive for the Second Green Revolution. Even Norman Barlaug, the chief architect of the First Green Revolution noted upon receiving the 1970 Nobel Peace Prize, that the Green Revolution represented only a **"temporary success."**

The Second Green Revolution differs from the First Green Revolution because in the First Green Revolution the main emphasis was on increasing the production of food grains, often without much caring about environment and ecology. The Second Green Revolution on the other hand, refers to practising sustained agriculture. In order for development to be sustainable it must meet the needs of the present without compromising the ability of future generations to meet their own needs." (Brundtland Commission on Environment and Development, 1987). Thus sustainable agriculture involves protecting natural resources from becoming increasingly degraded and polluted, and using production technologies that conserve and enhance the natural resource base of crops, forests, in land and marine fisheries.

As of now, the outlook for a Second Green Revolution seems uncertain because most of the increase in food supplies has to come from currently cultivated land as all the land fit for cultivation has already been brought under plough using the current level of technology. Therefore raising the level of productivity will require new technologies and better farming practices. Besides green technologies will have to be specially focussed on dry land agriculture and to benefit small and marginal farmers. Improving soil health by taking care of physical, chemical and biological characteristics of soil is equally important. Also of vital concern are water harvesting, water conservation and sustainable and equitable use of water. Besides, there is need to pay more attention to issues such as access to affordable credit and to life

and crop insurances reform. Equally important are development and dissemination of appropriate technologies and improved opportunities, infrastructure and regulations for marketing of agricultural products. Thus India is at a juncture where further reforms are urgently required to achieve greater efficiency and productivity in agriculture for sustaining growth.

Strategies for Second Green Revolution

Following strategies have been suggested for success of Second Green Revolution :

(*i*) **Micro-irrigation System.** All ground water and surface schemes having Culturable Command Area (CCA) upto 2,000 hectares individually are known as minor irrigation schemes. These include dug-wells, private shallow tube-wells, deep public tube-wells, boring and deepening of dug-wells and small surface water development works through diversion schemes, storage schemes and lift irrigation. The government has accepted the recommendations of the task force on micro-irrigation and has planned to make heavy investment in this field.

Micro-irrigation technology enables optimal synergies of three components of Green Revolution—improved seeds, water and fertilizers. It helps in direct and concentrated application of water to root zones of crops, through specially designed emitters. Some countries have already started using this technology for optimum use of water resources thereby improve their productivity. In India, the task force on micro-irrigation has recommended an increase of area under micro-irrigation from the current 1.3 million hectares to 69 million hectares.

(*ii*) **Organic Farming.** Ill effects of progress based on synthetic agrochemicals under Green Revolution have been documented several times by a large number of competent authorities. Their adverse effects on environment and public health are almost universally known now. The cost involved in minimising these effects is supposed to be enormous. Increasing consciousness about conservation of environment as well as health hazards caused by agrochemicals has brought major shift in consumer preference towards food quality, particularly in higher strata of society. Consumers are increasingly looking forward to safe and hazard free organic food. Globally, demand for organic food is increasing at the rate of 20-25 per cent per annum. Worldwide, over 130 countries produce certified organic products in commercial quantities. It is high time that India discards synthetic agrochemicals and opt for organic farming.

(*iii*) **Precision Farming.** As mentioned earlier, agriculture is the backbone of Indian economy and provides food to teeming millions. But the million dollar question is, how long our agriculture will be able to feed the fast growing population at the current level of technology. Agricultural technology available to us at the time of Independence could not have met our food requirements without First Green Revolution. Similarly, the present technology will not be able to produce sufficient food and other agricultural products in the coming future. Thus we will have to develop new technologies which can revolutionize our agricultural productivity and meet the growing demand for agricultural products.

The term "Precision Farming" and "Precision Agriculture" is capturing the imagination of the people concerned with the production of food, feed and fiber. It promises the scenario of increasing productivity, decreasing production costs and minimizing the adverse effects of farming on environment.

Precision farming is able to provide a new solution by using a systems approach for issues of the present day agriculture. The basic issue is to achieve balanced productivity with environmental concerns. The new approach is based on advance information technology which includes describing and modeling variations in soil and plant species, and integrating agricultural practices to meet site specific requirements. Its primary aim is to increase economic returns, reduce energy inputs and decrease adverse effect of agriculture on environment.

(*iv*) **Green Agriculture.** It is a system of cultivation which is based on integrated pest management, integrated nutrient supply, and integrated natural resource management systems. It does not exclude the use of minimum essential quantities of mineral fertilizers and chemical pesticides. It is widely practised and promoted in China and is likely to pick up in India in the near future.

(*v*) **Eco-agriculture.** Eco-agriculture has been defined as an approach that brings together agricultural development and conservation of biodiversity as explicit objectives in the same landscape. Its primary aim is to reinforce the mutual relationship between agricultural productivity and conservation of nature. It is capable of bringing together the most productive elements of modern agriculture, new ecological insights and knowledge of local people who have lived in harmony with nature for thousands of years.

(*vi*) **White Agriculture.** This system of agriculture is based on a substantial use of microorganisms, particularly fungi. The concept of white agriculture originated in China in 1986 and is picking up in India. In this contest, white refers to the white-coated scientists and technicians who perform high tech processes to produce food directly from micro-organisms or use them to improve green agriculture.

IMPORTANT CONSIDERATIONS FOR SECOND GREEN REVOLUTION

- More attention of the government and non-government organisations is needed towards agriculture.
- Benefits of research and development must reach the farmers at the ground level for increasing yields and agricultural production.
- Improvement of marketing by strengthening infrastructure.
- Soil health enhancement.
- Better irrigation and water conservation strategies.
- Access to affordable credit.
- Private public partnership and decentralization of partnership by the poor farmers in the development programmes.
- Food security to people living below poverty line (BPL), small and marginal farmers and landless labourers through the following three pronged strategy.
  - (*a*) Increase in income and agriculture wage by increasing farm productivity.
  - (*b*) Provision of additional off-farm and non-farm employment.
  - (*c*) Effective and strong public distribution system (PDS).
- Assured and remunerative marketing for farm products.

The future of the Indian agriculture largely depends upon our ability to increase the productivity, particularly of small holdings without much damage to environment and ecology so that the object of sustainable development is achieved. *Transforming green revolution into evergreen revolution using one or more than one method described above will usher in a win-win situation both for agriculture and ecosystems.* Extending the benefit of science and technology to areas and farmers that were ignored during the First Green Revolution combined with other facilities can enable us to achieve sustainable food security to all Indians.

Realising the gravity of situation with respect to agricultural production, population growth and food security, and appreciating the limitations of the First Green Revolution, the Government of India has initiated steps to usher in the Second Green Revolution. The Approach Paper to the Eleventh Five Year Plan (2007-12) has highlighted a holistic framework and suggested the following strategies to raise agricultural productivity :

1. Doubling the rate of growth of irrigated area.
2. Improving water management, rainwater harvesting, and watershed development.
3. Making efforts to reclaim degraded land and focusing on soil quality.
4. Bridging the knowledge gap through effective extension of information technology
5. Laying more emphasis on crop diversification and giving importance to high value outputs, *e.g.* fruits, vegetables, flowers, herbs and spices, medicinal plants, bamboo, biodiesel, but with adequate measures to ensure food security.
6. Providing easy access to credit at affordable rate of interest.
7. Improving the infrastructure and functioning of markets.
8. Refocusing on land reforms issues.
9. Laying emphasis on the cultivation of pulses including hybrid varieties.

10. Focusing on the development of area specific seeds and their application.
11. Paying more attention to rainfed areas, drought-prone crops, and drought resistant, and those amenable to biotechnological application.

Bringing Green Revolution to Eastern India (BGREI). This is a sub-scheme of Rashtriya Krishi Vikas Yojna (RKVY) which was started in 2010-11. Its primary aim is to improve the rice based cropping system in the eastern states with the objective of increasing crop productivity through promotion of recommended agricultural technologies and package of practices. Presently this sub-scheme covers seven states of east India. These states are Assam, Bihar, Chhattisgarh, Jharkhand, Orisha, Eastern Uttar Pradesh and West Bengal. Focused efforts with scientific back-up approach led to record estimated production of 58.5 million tonnes of rice in implementing states during 2012-13 against average of 48.8 million for 2006-07 to 2010-11 (**Table 21.1**).

TABLE 21.1. Production of rice in seven eastern states under BGREI (Lakh tonnes)

State	Normal (2006-07 to 2010-11)	2010-11	2011-12	2012-13
1. Assam	38.63	47.37	45.16	45.81
2. Bihar	43.40	31.20	71.63	73.43
3. Chhattisgarh	56.26	61.59	60.28	66.68
4. Jharkhand	24.27	11.10	31.31	33.33
5. Odisha	69.89	68.28	58.67	74.82
6. Uttar Pradesh	117.60	119.92	140.22	141.26
7. West Bengal	143.29	130.46	146.06	149.72
Total for seven States	488.29	469.74	552.73	584.45
All India	948.61	959.70	1,053.01	1,042.16

Sources : India : A Reference Annual, 2014, p. 72.

REFERENCES

Bardhan, K. Pranab. "Green Revolution and Agricultural Labourers, *Economic and Political Weekly,* Vol. 5, Nos. 29-31, July, 1970.

Bayliss Smith, Tim P and Sudhir Wanmali (*eds.*) (1984) : *Understanding Green Revolution*, Cambridge University Press, Cambridge.

Bhalla, G.S. (2007) : *Indian Agriculture Since Independence,* National Book Trust, New Delhi.

Bhalla G.S. and Alagh, Y.K. (1979) : *Performance of Indian Agriculture : A Districtwise Study*, Sterling Publishers, New Delhi.

Bhalla, G.S. and Chadha, G.K. (1983) : *Green Revolution and the Small Peasant : A Study of Income Distribution among Punjab Cultivators.* Concept Publishing Company, New Delhi.

Chakravarti, A.K. : "Green Revolution in India." Annals of the A.A.G., Vol. 63, 1973, pp. 319-30.

Chopre, R.N. (1986) : *Green Revolution in India : The Relevance of Administrative Support for its Success : A Study of Punjab, Haryana, U.P. & Bihar,* Intellectual Publishing House, New Delhi.

Dantwala *et al. (eds)* (1986) : *Agricultural Development Since Independence*, Oxford & IBH, New Delhi.

Dasgupta, Biplab. (1980) : *The New Agrarian Technology and India.* The Macmillan Co. of India Ltd., Chennai.

Farmer, B.H. (*ed.*) (1974) : *Green Revolution?* Macmillan Press, London.

– –, (*ed.*) (1980) : *Green Revolution in India*, Macmillan Press, London.

Frankel, Francine, R. (1971) : *India's Green Revolution : Economic Gains and Political Costs*, Princeton University Press, New Jersey.

Gilbert, Eleine : *Green Pastures*, India Today, 30 April, 1984, New Delhi.

Govenment of India (2012 and 13) : Agricultural Statistics at a glance.

Govenment of India (2012-13 and 2013-14) : Economic Survey.

Govenment of India (2007-12) : Eleventh Fie Year Plan.

Govenment of India (2014) : India : A Reference Annual.

Jain, N.C. : *Towards a Greener Revolution*, The Hindustan Times, 14-10-96.

Kumar Sharan (2008 : *Towards a Second Green Revolution* Science Reporter, National Institute of Science Communication and Information Resources (NISCAIR), CSIR, New Delhi.

Ladejinsky, W. : "Ironies of India's Green Revolution", *Foreign Affairs,* Vol. 48, 1970, pp. 758-768.

Ladejinsky, Wolf : *How Green is the Green Revolution?* Economic and Political Weekly, Vol. 8, No. 52, December 29, 1973.

Leo, E. Holman. (1969-70) : *Improving the Handling of Grain in Modern Wholesale Market,* The Ford Foundation, New Delhi.

Munsi, Sunil Kumar (1994) : *Sustainability in Indian Agriculture and the Dunkel Proposals* in Mohammad Shafi and Mehdi Raja (*ed*). *Geography of Environment*, Rawat Publications, Jaipur.

Ramakrishnan, P.S. (2004) : *Ecology and Sustainable Development*, National Book Trust, New Delhi.

Randhawa, M.S. (1974) : *Green Revolution—A Case Study of Punjab,* Vikas Publications, New Delhi.

Rao, Hanumantha C.H. (1980) : *Technical changes and Distribution of Grains in Indian Agriculture,* Macmillan, New Delhi.

Rao, Radha Krishan : *Green Revolution Goes Grey*, The Hindustan Times, 23-03-95, New Delhi.

Saini, G.R. : *Green Revolution and Distribution of Farm Incomes,* Economic and Political Weekly, 27 March, 1976.

Sekhon, M.K. and Kaur, Manjeet (1996) : *Green Revolution in Punjab : Other side of the Coin in Agricultural Situation in India.* Vol. I, Feb. 1996, Directorate of Economics & Statistics, Deptt. of Agriculture & Cooperation, Ministry of Agriculture.

Sen, Bandhu Das : (1974) : *Green Revolution in India — A Perspective*, Wiley Eastern Pvt. Ltd., New Delhi.

Sen, Sudhir (1974) : *A Richer Harvest*, Tata McGraw Hill, New Delhi.

– –, (1975) : *Reaping the Green Revolution*, Tata McGraw Hill, New Delhi.

Shafi, Mohammad (2006) : Agricultural Geography, Pearson Education, New Delhi, Ch. 12.

Sharma, H.S. and Srikumar Chattopadhyay (1998) (eds.) : *Sustainable Development, Issues and Case Studies,* Concept Publishing Company, New Delhi.

Sharma, T.C. (1997) : "How Green is the Green Revolution in Karnataka" ? A Regional Study, *Transactions* Journal of the IIG Vol. 19, No. 1, January, Pune.

Sharma, T.C. and Coutinho, O. (1989) : *Green Revolution Gaps : A Geographical Analysis*, Rawat Publications, Jaipur.

Shiva, Vandana (1991) : *The Violence of Green Revolution*, Third World Network, Malaysia.

Singh, D.P. : *The Impact of Green Revolution on the Poor,* Agricultural Situation India, Vol. 75, No. 5, August 1980.

Singh, Jasbir (1974) : *Green Revolution in India : How Green is it* ? Vishal Publishing, University Campus, Kurukshetra.

Subramaniam, C. (1979) : *A New Strategy in Agriculture,* Vikas, New Delhi.

Swaminathan, M.S. : *Keeping the Green Revolution green.* The Hindustan Times, 21-7-96.

Thukral, Govind : *Fruits of the Green Revolution,* The Hindustan Times, 1-6-95.

Venkateswaran (1983) : *Dynamics of Green Revolution in India* : Agricole Publishing Academy, New Delhi.

Vohra, B.B. (1975) : *Land and Water Management Problems in India,* Department of Personnel and Administrative Reforms, New Delhi.

Vyas, V.S. "Green Revolution—A Promise and Problems", Industrial India, Annual Number, 1969, p. 35.

Wolf Ladejinsky, "How Green is India's Green Revolution ?" Economic and Political Weekly, 29 December, 1993, p. A-134.

Major Crops

With varied types of relief, soils, climate and with plenty of sun-shine and long growing season, India is capable of growing almost each and every crop. Crops requiring tropical, sub-tropical and temperate climate can easily be grown in one or the other part of India. Indian crops can be divided into following categories.

1. Food Crops. Rice, Wheat, Maize, Millets—Jowar, Bajra, Ragi; Pulses—Gram, Tur (Arhar).

2. Cash Crops. Cotton, Jute, Sugarcane, Tobacco, Oilseeds, Groundnut, Linseed, Sesamum, Castorseed, Rapeseed, Mustard, etc.

3. Plantation Crops. Tea, Coffee, Spices—Cardamom, Chillies, Ginger, Turmeric; Coconut, Arecanut and Rubber.

4. Horticulture. Fruits—Apple, Peach, Pear, Apricot, Almond, Strawberry, Walnut, Mango, Banana, Citrus Fruits, Vegetables.

FOOD CROPS

Agriculture forms the back-bone of Indian economy and food crops form the back bone of Indian agriculture. Food crops cover about three-fourths of the total cropped area in the country and contribute to about half of the total value of agricultural production. No part of the country is without food crops. They are grown in all parts of the country either as a sole crop in or combination with other crops. The importance of food crops grows with the growth of population because these crops provide the basic and essential food for man.

RICE

Rice is the most important food crop of India covering about one-fourth of the total cropped area and providing food to about half of the Indian population. This is the staple food of the people living in the eastern and the southern parts of the country, particularly in the areas having over 150 cm annual rainfall. There are about 10,000 varieties of rice in the world out of which about 4,000 are grown in India.

Rice is life for thousands of millions of people. In Asia alone, more than 2,000 million people obtain 60 to 70 per cent of their calories from rice and its products. Recognising the importance of this crop, the United Nations General Assembly declared 2004 as the "International Year of Rice" (IYR). The theme of

IYR—"*Rice is life*" reflects the importance of rice as a primary food source, and is drawn from an understanding that rice-based systems are essential for food security, poverty alleviation and improved livelihood.

Conditions of Growth

Rice is grown under varying conditions in India from 8° to 30° N latitude and from sea level to about 2,500 metre altitude. It is a tropical plant and requires high heat and high humidity for its successful growth. The temperature should be fairly high at mean monthly of 24°C. It should be 20°-22°C at the time of sowing, 23°-25°C during growth and 25°-30°C at the harvesting time. The average annual rainfall required for rice is 150 cm. It is the dominant crop in areas of over 200 cm annual rainfall and is still an important crop in areas of 100-200 cm rainfall. The 100 cm *isohyet* forms the limit of rice in rainfed areas. In areas receiving less than 100 cm annual rainfall, rice can be grown with the help of irrigation, as is done in Punjab, Haryana and western U.P. About 40 per cent of rice crop in India is raised under irrigation. However, it is the temporal distribution of rainfall, rather than the total amount of annual rainfall which is more decisive. The rainfall should be fairly distributed throughout the year and no month should have less than 12 cm of rainfall. Lesser amount of rainfall is required as the harvesting time approaches. The fields must be flooded under 10-12 cm deep water at the time of sowing and during early stages of growth. Therefore, the fields must be level and have low mud walls to retain water. This peculiar requirement of rice makes it primarily a crop of plain areas. Rice grown in well watered lowland plain areas is called ***wet*** or ***lowland rice***. In hilly areas, the hill slopes are cut into terraces for the cultivation of rice. Such a cultivation in which the hill slopes are cut into terraces is called ***terraced cultivation***. The supply of water to the hill terraces is not as much as in the plain areas and the rice grown in hilly areas is called ***dry*** or ***upland rice***.

Rice can be grown on a variety of soils including silts, loams and gravels and can tolerate acidic as well as alkaline soils. However, deep fertile clayey or loamy soils which can be easily puddled into mud and develop cracks on drying are considered ideal for raising this crop. Such soil requirements make *it dominantly a crop of river valleys, flood plains, deltas and coastal plains and a dominant crop there*. High-level loams and lighter soils can be used for quick maturing varieties of rice. Black lava soil is also useful for rice cultivation.

Rice culture is not much suited to mechanisation and is called ***'hoe-culture'***. Most of the work in preparing the seed-bed, in broadcasting seeds, or in transplantation of plants from nurseries to the fields, in harvesting and in winnowing operations is done by human hand. Thus it is a *labour intensive cultivation* and requires large supply of cheap labour for its successful cultivation. It is, therefore, primarily grown in areas of high population density which provide abundant labour and at the same time, offer ready market for its consumption. In most rice producing states, labour is locally available but in Punjab and Haryana, rice cultivation mainly depends upon the migrant labourers from Bihar and eastern U.P.

According to **G.B. Cressey** *rice needs plenty of heat, plenty of rain, plenty of alluvium and plenty of labour to provide plenty of food for plenty of people. There is no other food crop which is so plentiful as rice in India.*

Methods of Rice Cultivation

Following methods of rice cultivation are practised in India.

1. Broadcasting method. Seeds are sown broadcast by hand. This method is practised in those areas which are comparatively dry and less fertile and do not have much labour to work in the fields. It is the easiest method requiring minimum input but its yields are also minimum.

2. Drilling method. Ploughing of land and sowing of seeds is done by two persons. This method is mostly confined to peninsular India.

3. Transplantation method. This method is practised in areas of fertile soil, abundant rainfall and plentiful supply of labour. To begin with, seeds are sown in nursery and seedlings are prepared. After 4-5 weeks the seedlings are uprooted and planted in the field which has already been prepared for the purpose. The entire process is done by hand. It is, therefore, a very difficult method and requires heavy inputs. But at the same time it gives some of the highest yields.

TABLE 22.1. Rice Cropping Seasons in India

Crop	Local name	Sowing	Harvesting	Percentage of area	Percentage of Production
Autumn (Kharif)	Aus or Kar	May-June	Sept-Oct.	39.4	43.97
Winter (Rabi)	Aman, Sali or Karthika	June-July	Nov.-Dec.	54.2	48.79
Summer (Spring)	Boro or Dalua	Nov.- Dec.	March-April	6·4	7·24

4. Japanese method. This method includes the use of high yielding varieties of seeds, sowing the seeds in a raised nursery-bed and transplanting the seedlings in rows so as to make weeding and fertilizing easy. It also involves the use of a heavy dose of fertilizers so that very high yields are obtained. The Japanese method of rice cultivation has been successfully adopted in the main rice producing regions of India.

Rice Cropping Seasons

Rice is grown almost throughout the year in hot and humid regions of eastern and southern parts of India where two to three crops in a year are not uncommon. But in the northern and hilly parts of the country, the winters are too cold for rice cultivation and only one crop is grown in those areas. **Table 22.1** gives the period of sowing and harvesting the rice crop.

Production

India is the second largest producer and consumer of rice in the world after China and accounts for 17.95 per cent of the world's total rice production. **Table 22.2** gives the trends in production of rice for selected years. A look at this table shows that there has been considerable increase in production, area and yield of rice in India.

In a span of about six decades from 1950-51 to 2013-14, the area, production and yield have increased by about one and a half times, five and three and a half times respectively. It is interesting to note that the rate of increase in production is much higher than the rate of increase in area under rice cultivation. This is due to the increase in yields as a result of better inputs and farm practices. Thus, there has been a modest gain in extent of cultivated area but a substantial gain in yield and production. Increased irrigation facilities in drier areas, reclamation of waterlogged soils and introduction of new high-yielding strain crops (particularly in Punjab, Haryana and Tamil Nadu) made this possible. There was a record production of 106.3 million tonnes in 2013-14. Yield also reached at a high level of 2,419 kg/hectare.

In spite of the spectacular progress, our yield of 2,419 kg per hectare (2013-14) is much lower compared to 6,548 kg in China, 7,537 kg in U.S.A., 6,511 kg in Japan and 6,878 kg in Republic of Korea. This means that there is still vast scope for increasing production. This will have to be done by increasing yields because scope for increasing area under rice crop is negligibly small.

TABLE 22.2. Area Production and Yield of Rice in India

Year	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Area (Million hectares)	30.81	34.13	37.59	40.15	42.69	44.71	43.91	45.54	41.92	42.86	44.01	42.41	43.9
Production (Million tonnes)	20.58	34.58	42.22	53.63	74.29	84.98	96.69	99.18	89.09	95.98	105.4	104.40	106.3
Yield (kg/hectare)	668	1013	1123	1336	1740	1901	2102	2178	2125	2239	2393	2462	2419

Source : (*i*) Agricultural Statistics at a glance, 2013, pp. 66-67.
(*ii*) Economic Survey 2013-14, Statistical Appendix, pp. 17, 18, 19

Distribution

Rice is grown in varying degrees in almost all parts of the country excepting higher parts of the Himalayan ranges exceeding 2,500 metres in altitude, Marusthali part of Rajasthan, Kachchh-Saurashtra, Malwa and Marathwada regions due to various geographical constraints. The premier rice producing areas include the lower and the middle Ganga Plains, the east and the west Coastal Plains, the Brahmaputra valley and parts of the Peninsular plateau. Punjab, Haryana and Uttar Pradesh have assumed considerable importance after the introduction of the Green Revolution. **Table 22.3** gives vital data about the statewise distribution of rice among the major producers.

It is clear that about half of rice production in India is contributed by four states namely W. Bengal, Uttar Pradesh, Punjab and Andhra Pradesh. The other major producers are Odisha, Bihar, Chhattisgarh, Assam, Tamil Nadu, Haryana, Karnataka, Jharkhand, Madhya Pradesh, Maharashtra, Gujarat and Kerala in order of importance.

1. West Bengal. West Bengal is the largest producer of rice in India contributing about 14.33 per cent of the total rice production from 12.8 per cent of the rice producing area of the country. Rice occupies three-fourths of the total cropped area in the lower Ganga Plains. Suitable climatic conditions and large scale alluvial deposits have helped in the cultivation of rice on such a scale. Over two-thirds of the production comes from Medinipur, Bardhaman, North and South Twenty Four Parganas, Bankura, Birbhum and West Dinajpur districts. The other producing districts are Haora, Hugli, Jalpaiguri, Coochbehar and Malda. As many as three crops called ***aman***, ***aus*** and ***boro*** are grown in a year. They account for about 78 per cent, 20 per cent and 2 per cent of the total production respectively.

TABLE 22.3. State-wise Area, Production and Yield of Rice in India (2012-13)

Sl. No.	State	Area		Production		Yield (kg/ hectare)
		Million hectares	%age of all India	Million tonnes	%age of all India	
1.	West Bengal	5.43	12.80	14.96	14.33	2,755
2.	Uttar Pradesh	5.86	13.82	14.41	13.80	2,459
3.	Punjab	2.85	6.72	11.37	10.89	3,989
4.	Andhra Pradesh including Telangana	3.49	8.23	10.91	10.45	3,126
5.	Odisha	4.03	9.50	7.64	7.32	1,896
6.	Bihar	3.25	7.66	7.34	7.03	2,258
7.	Chhattisgarh	3.78	8.91	6.61	6.33	1,749
8.	Assam	2.24	5.28	4.56	4.37	2,036
9.	Tamil Nadu	1.58	3.73	4.40	4.21	2,785
10.	Haryana	1.22	2.88	3.98	3.81	3,262
11.	Karnataka	1.27	2.99	3.28	3.14	2,583
12.	Maharashtra	1.55	3.65	3.04	2.91	1,961
13.	Jharkhand	1.35	3.18	3.03	2.90	2,244
14.	Madhya Pradesh	1.88	4.43	2.78	2.66	1,479
15.	Gujarat	0.70	1.65	1.50	1.44	2,143
16.	Kerala	0.20	0.47	0.53	0.51	2,650
	Others	1.73	4.08	4.06	3.89	@
	All India	**42.41**	**100.00**	**104.40**	**100.00**	**2,462**

@—Since area/production is low in individual states, yield rate is not worked out.
Source : Agricultural Statistics at a glance, 2013, p. 68.

2. Uttar Pradesh and Uttarakhand. Uttar Pradesh has recorded unprecedented progress in the production of rice during the last five decades. Earlier this state used to produce only 6 to 8 per cent of the country's rice but according to 2012-13 figures, Uttar Pradesh had 13.82 per cent of the country's rice producing area and accounted for 13.80 per cent of the total rice production of the country, thus occupying the second place among the top rice producing states. About one-fourth of the total cultivated area of the state is devoted to rice cultivation. The unusual interest shown by the farmers in the rice culture; supported by the easy availability of HYV seeds, fertilizers and uninterrupted supply of irrigation are the chief factors responsible for this progress. As many as 50 districts of the state are producing rice out of which 7 are major producers. The main producing districts are Dehra Dun, Gorakhpur, Bareilly, Muzaffarnagar, Kheri, Faizabad, Barabanki, Banda, Varanasi, Nainital, Pilibhit, etc.

3. Punjab. Punjab is traditionally a wheat producing state but the enterprising farmers of Punjab have made full use of package technology including perennial irrigation water by canals and tube wells, HYV seeds and fertilizers. This has resulted in widespread change in the cropping pattern of Punjab and the state has become the third important producer of rice in spite of its small size. Punjab now gives over 3,989 kg/hectare which is the highest yield for any state of India. It is far above the other traditional rice producing states and more than one and a half times the average yield of the country. Since 1953-54, Punjab has recorded an annual growth rate of over 12 per cent as against only 2.8 per cent for the country as a whole. As many as 12 districts of Punjab are producing rice but major part of production comes from Patiala, Firozepur, Ludhiana, Sangrur, Amritsar, Faridkot and Jalandhar.

4. Andhra Pradesh and Telangana. With over 10 per cent of the rice production and about 8.23 per cent of the rice area of the country, Andhra Pradesh is the fourth largest producer of rice in India. About one-fourth of the total cropped area of the state is under rice cultivation. The Godavari-Krishna Delta and the adjoining coastal plains form one of the most outstanding rice producing tracts of the country. The yields and production have increased considerably with the introduction of *Package Technology* (Green Revolution). In 2012-13, Andhra Pradesh recorded yield of 3,126 kg/hectare against India's average of 2462 kg/hectare. This is the third highest yield in India after that of Punjab (3,989 kg/ha) and Haryana (3,262 kg/ha). About 20 districts of Andhra Pradesh and Telangana are producing rice out of which West Godavari, East Godavari, Krishna, Guntur, Srikakulam, Nellore, Prakasam, Anantapur, Warangal and Chittoor are the major producers. In fact West Godavari, East Godavari and Krishna are three most important rice producing districts not only of Andhra Pradesh but of the whole of India and account for over 7 per cent of the total rice production of the country. In the neighbouring state of Telangana, Karimnagar, Nizamabad, Mehbubnagar, Nalgonda and Medak are important rice producing districts.

5. Odisha. Odisha produces over 7 per cent rice of India. Although about two-thirds of the total cropped area of Odisha is devoted to rice, the total production is low due to low yield of only 1,896 kg/hectare. Over 90 per cent of the state's rice comes from Sambalpur, Koraput, Ganjam, Cuttack, Puri, Bolangir and Mayurbhanja.

6. Bihar. Bihar has slipped from fourth position in 1990-91 to sixth position in 2012-13 among the rice producing states of India. This is partly due to increase in production in other states and partly due to carving of new state of Jharkhand out of Bihar. Although Bihar has 7.66 per cent of the rice area of the country and about two-thirds of the cultivated area of the state is under rice cultivation, the state produces only 7.03 per cent of the total rice of India. This is due to low average yield of only 2,258 kg per hectare against 2,462 quintals per hectare for the country as a whole. About 25 districts of Bihar are producing rice but the main producing districts are Rohtas, Bhojpur, Purnea, Paschim Champaran, Purab Champaran, Aurangabad, Gaya, Bhagalpur, Patna and Gopalganj.

7. Chhattisgarh. Chhattisgarh basin drained by the Mahanadi and its tributaries is the main rice producing region in this state. Although Chhattisgarh accounts for about 9 per cent of the rice area of the country, this state produces only 6.3 per cent of the country's total rice. This is primarily due to low yields of rice in this state. In fact the average yield of rice in Chhattisgarh is 1,749 kg/hectare only which

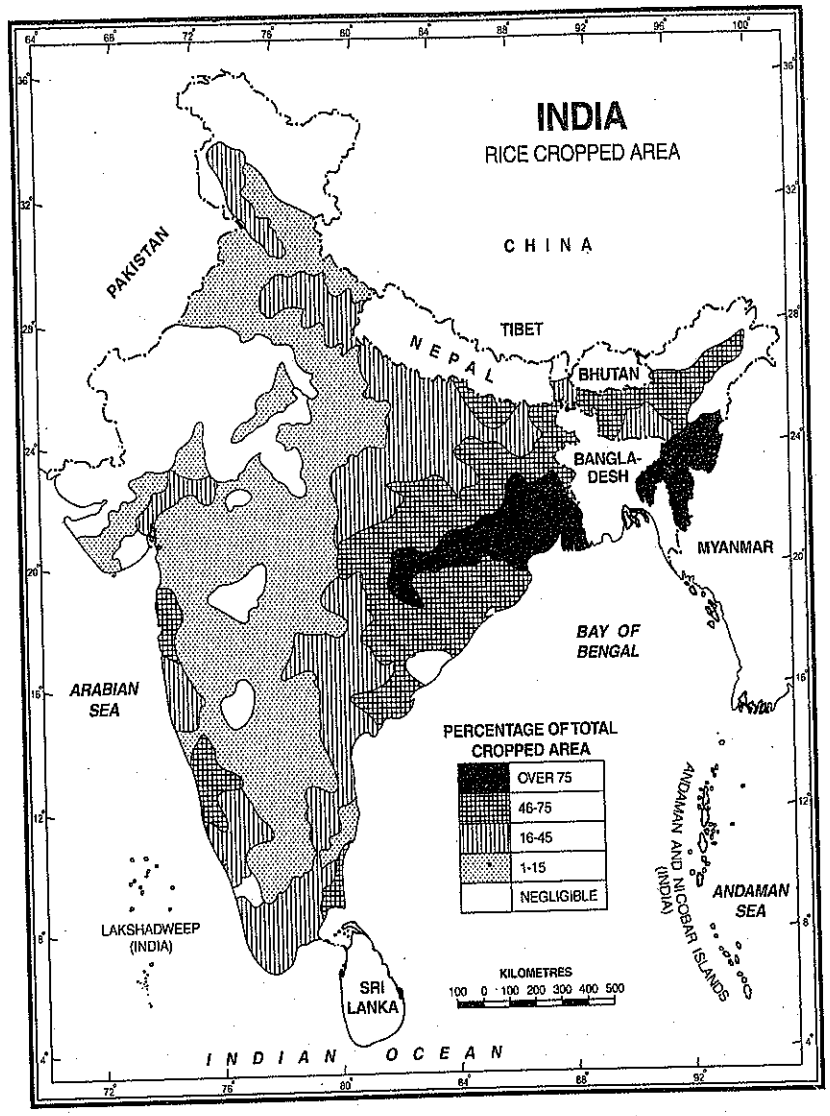


FIG. 22.1. India : Rice cropped area

happens to be one of the lowest in the country. Bastar, Durg, Raigarh, Sarguja, Rajnandgaon, Kankar, Dantewara, Bilaspur, Janjgir, etc. are the main rice producing districts.

8. Assam. Rice is grown on three-fourth of the cropped area of Assam. Most of the rice is produced in the Brahmaputra, Surma, and Barak valleys. Some rice is produced on the hill slopes by terraced cultivation. Kamrup, Sibsagar, Goalpara, Darrang, Nowgong and Cachar are the main producing districts.

9. Tamil Nadu. Although Tamil Nadu produces only 4 per cent rice of India, the state has the distinction of giving high yield of 2,785 kg/hectare. This is mainly due to the effect of Green Revolution

under which HYV seeds, fertilizers and irrigation facilities have been made available to the farmers. About 37 per cent of the cropped area of this state is under rice cultivation. Thanjavur in the Cauvery delta is the second largest rice producing district of the country which produces about 2.8 per cent rice of India and accounts for about 25 per cent rice produced by the state. South Arcot Vallalar, North Arcot Ambedkar, Nellai Kattabomman (Tirunelveli), Tiruchirapalli, Perumpidugu, Muthuraiyar, Coimbatore, Ramnathpuram and Salem are the other important rice producers.

10. Haryana. Like Punjab, Haryana is traditionally a wheat producing state. But the cropping pattern has undergone an unprecedented change due to large scale extension of irrigation and provision of HYV seeds and chemical fertilizers, coupled with the progressive outlook of the Haryana farmers. Only a few years ago Haryana was not on the rice map of India but rapid progress during the last five decades has enabled Haryana to occupy an important place among the rice producing states of India. Haryana has a high yield of 3262 kg per hectare which is the second highest after that of Punjab. Kurukshetra, Karnal, Ambala, Kaithal, Panipat and Yamunanagar are the important rice producing districts.

11. Karnataka. Karnataka has made rapid progress in rice cultivation during the last few years. In Karnataka, rice is mainly grown in the valleys of the Wainganga, the Tungabhadra and the Cauvery and in the northern red soil areas. Tumkur, Dakshina Kannada, Shimoga, Mandya, Uttar Kannada, Mysore, Raichur and Kodagu are the main producers.

12. Maharashtra. Rice is grown in the Konkan coastal area, on the Ghats and in some eastern parts. Chandrapur, Raigad, Thane, Bhandara, Kolhapur, etc. are important rice producing districts.

13. Jharkhand. This state produces about three per cent rice of India. Ranchi, Paschim Singhbum, Purb Singhbum, Lohardaga and Gumla are the chief rice producing districts.

The other producers include Madhya Pradesh, Gujarat, Kerala, North Eastern hill states (Tripura, Manipur, Arunachal Pradesh, Mizoram, Sikkim), Himachal Pradesh, Jammu & Kashmir and Goa.

Trade

Large producers of rice are its large consumers also and there is little surplus for trade. However some interstate trade is carried on and about ten per cent of the total production enters trade. Punjab, Haryana, Tamil Nadu, Andhra Pradesh and Uttar Pradesh are surplus states and supply rice to deficit states like West Bengal, Maharashtra, Gujarat, Kerala and Delhi.

Even in the face of huge home consumption of rice, it is amusing to note that rice exports from India have grown steadily during the last decade (**Table 22.4**). India now occupies second position in rice exports, next only to Thailand, among the rice trading countries of the world. However, the surplus production scenario has no room for the complacency,

TABLE 22.4. Export of Rice from India

Year	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Basmati											
Quantity ('000 tonnes)	708.79	771.49	1163	1166.57	1045.73	1183.36	1556.41	2016.87	2370.68	3178.18	3456.52
Value ₹ crore	2058.47	1993.05	2823.90	3043.10	2792.81	4344.58	9477.03	10889.60	11354.77	15449.60	19391.31
Other than Basmati											
Quantity ('000 tonnes)	4255.08	2640.57	274.94	2921.60	3702.22	5286.08	931.89	139.54	100.68	3997.72	6663.66
Value ₹ crore	3772.77	4093.08	3615.1	31.78.17	4243.10	7410.03	1687.37	365.3	231.29	8669.13	14416.90

Source : Agricultural Statistics at a glance, 2013, pp. 244-45.

keeping in view the rapid growth of population, per capita availability of 188.8 grams/day as on 17-02-2012 and the vagaries of monsoon. It is estimated that the rice demand will be a whooping 140 million tonnes in 2025. This projected demand can only be met by maintaining steady increase in production over the years. In the post WTO (World Trade Organisation, 1995) era, adequate rice is be produced not only for self-sufficiency but also for export purposes. The exportable surplus of good quality rice is to be produced at the competitive price. Since India has got the comparative advantage in Basmati rices, all efforts are being made to increase the production and productivity.

Table 22.4 shows that export of Basmati rice has steadily increased both in terms of quantity and value of exports. Punjab, Haryana and western Uttar Pradesh produce some of the best qualities of Basmati rice for which there is great demand in the international market. However, exports of rice other than Basmati are not lagging behind.

WHEAT

Next to rice, wheat is the most important foodgrain of India and is the staple food of millions of Indians, particularly in the northern and north-western parts of the country. It is rich in proteins, vitamins and carbohydrates and provides balanced food.

Conditions of Growth

Conditions of growth for wheat are more flexible than those of rice. In contrast to rice, wheat is a rabi crop which is sown in the beginning of winter and is harvested in the beginning of summer. The time of sowing and harvesting differs in different regions due to climatic variations. The sowing of wheat crop normally begins in the September-October in Karnataka, Maharashtra, Andhra Pradesh, Madhya Pradesh and West Bengal; October-November in Bihar, Uttar Pradesh, Punjab, Haryana and Rajasthan and November-December in Himachal Pradesh and Jammu & Kashmir. The harvesting is done in January-February in Karnataka, Andhra Pradesh, M.P., and in West Bengal; March-April in Punjab, Haryana, U.P. and Rajasthan and in April-May in Himachal Pradesh and J&K. The growing period is variable from one agro climatic zone to other that effects the vegetative and reproductive period leading to differences in potential yield. The important factors affecting the productivity are seeding time and methodology, crop establishment and climatic conditions during the growing season.

Wheat is primarily a crop of mid-latitude grasslands and requires a cool climate with moderate rainfall. The ideal wheat climate has winter temperature 10° to 15°C and summer temperature varying from 21°C to 26°C. The temperature should be low at the time of sowing but as the harvesting time approaches higher temperatures are required for proper ripening of the crop. But sudden rise in temperature at the time of maturity is harmful.

Wheat thrives well in areas receiving an annual rainfall of about 75 cm. Annual rainfall of 100 cm is the highest limit of wheat cultivation. The isohyet of 100 cm marks the boundary between wheat growing areas on one hand and rice growing areas on the other. In areas of less than 50 cm annual rainfall, irrigation is necessary for its successful growth. In fact, wheat can be grown in areas with as little as 20-25 cm annual rainfall provided proper irrigation facilties are available. About 5 to 7 waterings are required in irrigated areas depending upon the amount of rainfall. While prolonged drought, especially in rainfed areas, at the time of maturity is harmfull, light drizzles and cloudiness at the time of ripening help in increasing the yield. Frost at flowering time and hail storm at the time of ripening can cause heavy damage to the wheat crop.

Although wheat can be grown in a variety of soils, well drained fertile, friable loams and clay loams are the best suited soils for wheat cultivation. It also grows well in the black soil of the Deccan plateau.

Wheat cultivation is an extensive type of farming which is highly mechanized and requires comparatively less labour. It is mainly grown in the flat alluvial plains of north India.

To sum up wheat requires a combination of factors including *cool climate with moderate rainfall, flat and well drained plain areas, fertile friable loam and heavy inputs in the form of irrigation, HYV seeds, fertilizers and mechanization.*

Production

India is the second largest producer of wheat in

TABLE 22.5. Area, Production and Yield of Wheat in India

Year	1950 -51	1960 -61	1970 -71	1980 -81	1990 -91	2000 -01	2005 -06	2006 -07	2007 -08	2008 -09	2009 -10	2010 -11	2011 -12	2012 -13
Area (Million hectares)	9.75	12.93	18.24	22.28	24.17	25.73	26.48	27.99	28.04	27.75	28.46	29.07	29.86	29.65
Production (Million tonnes)	6.46	11.00	23.83	36.31	55.14	69.68	69.35	75.81	78.57	80.68	80.80	86.87	93.90	92.46
Yield (kg/hectare)	663	851	1307	1630	2281	2708	2619	2708	2802	2907	2839	2988	3140	3118

Source : Agricultural Statistics at a glance, 2013, pp. 69-70.

the world next only to China, and accounts for 12.39 per cent of the total production of wheat in the world.

Wheat is grown on 13 per cent of the cropped area of India. **Table 22.5** shows the production trends of wheat in India.

It is clear from the table that all the three aspects of the crop *i.e.* production, area and yield have recorded rapid growth particularly after the introduction of the Green Revolution strategy in 1967. The production had more than doubled from 11 million tonnes in 1960-61 to 23.83 million lakh tonnes in 1970-71. During the same period the area under wheat had increased by over 41 per cent and yield had increased by 53.6 per cent. The development of new varieties of seeds has brought about a real revolution in wheat production. The phenomena of overall development in wheat farming is still continuing although the pace of progress has slowed down with Green Revolution reaching its mature stage. In spite phenomenal improvement in wheat culture in India, our yield of 3,140 kg/hectare (2003-04) is still very low as compared to that of some other wheat producing countries China, France, Germany, Kazakhstan, Egypt and Italy. It is estimated that yield can be raised upto 4,000 kg/hectare in irrigated areas and upto 2,000 kg/hectare in unirrigated areas by using appropriate location specific technology including better quality seeds, proper fertilizers and control of weeds, pests and diseases. Further, there is vast scope for extending wheat cultivation to non-traditional areas like Assam valley and in Odisha. This can be done by timely harvest of the kharif crops and by reducing the extent of fallow land. West Bengal has already started growing wheat in sufficient quantity.

Distribution

Wheat production is mainly confined to North-Western parts of the country. Table 22.6 gives the distribution pattern of wheat in India.

Uttar Pradesh, Punjab and Madhya Pradesh and Haryana are the four prominent wheat producing states. These states account for over three-fourths of the wheat area and produce about three-fourths of the total wheat production in India. In fact, Punjab, Haryana and the contiguous western parts of U.P. have earned the distinction of being called the '*Granary of India*'. The other major wheat producing states are Rajasthan, Bihar and Gujarat.

1. Uttar Pradesh. Uttar Pradesh is the largest wheat producing state of India accounting for about one-third of area and production of wheat of the country. In 2012-13, this state produced 30.3 million tonnes of wheat. Fine alluvial soil deposited by the mighty Ganga and its several big and small tributaries and a close network of canals, supplemented by large number of tube wells have helped U.P. to occupy the top position. More than half of the wheat area lies in the Ganga-Ghagra doab. Next in importance is the Ganga-Yamuna doab. These two doabs account for about 75 per cent wheat of U.P. About 55 districts of Uttar Pradesh produce wheat out of which 43 are the important producers. Saharanpur, Muzaffarnagar, Meerut, Moradabad, Rampur, Budaun, Etawah, Hardoi, Bahraich, Kheri, Gonda, Basti, etc. are the main producing districts. However, wheat production to the east of Varanasi declines due to high rainfall and heavy soils.

2. Punjab. Although very small state as compared to Uttar Pradesh, Punjab has emerged as a very important producer of wheat in India. The Green Revolution strategy has helped Punjab in making rapid strides in wheat production. In fact, *Punjab has drawn maximum benefit from Green Revolution and in Punjab too it is the wheat crop which has been benefited the most.* The excellent irrigation system

TABLE 22.6. Area, Production and Yield of Wheat in India (2012-13)

State	Area		Production		Yield
	Million hectares	%age of all India	Million tonnes	%age of all India	(kg/ hectare)
1. Uttar Pradesh	9.73	32.82	30.30	32.77	3114
2. Punjab	3.52	11.87	16.11	17.42	4577
3. Madhya Pradesh	5.30	17.88	13.13	14.20	2477
4. Haryana	2.50	8.43	11.12	12.03	4448
5. Rjasthan	2.82	9.51	8.95	9.68	3174
6. Bihar	2.22	7.49	5.38	5.82	2423
7. Gujarat	1.05	3.54	3.14	3.40	2990
8. West Bengal	0.32	1.08	0.91	0.98	2844
9. Maharashtra	0.59	1.99	0.88	0.95	1492
10. Uttarakhand	0.36	1.21	0.84	0.91	2333
11. Himachal Pradesh	0.36	1.21	0.54	0.58	1500
12. Jammu and Kashmir	0.30	1.01	0.42	0.45	1400
13. Jharkhand	0.16	0.54	0.27	0.29	1688
14. Karnataka	0.23	0.78	0.17	0.18	739
15. Assam	0.05	0.17	0.06	0.06	1200
Others	0.14	0.47	0.24	0.26	@
All India	**29.7**	**100.0**	**92.5**	**100.0**	**3118**

@ Since area/production is low in individual states, yield rate is not worked out.

Source : Agricultural Statistics at a glance, 2013, p. 71.

provided by a close network of canals and the tube wells is supplemented by light rainfall associated with the *western disturbances*. The fertile alluvial soil brought by the rivers of the Indus system is ideal for wheat production. Over and above, the Punjab farmer is very enterprising and is always willing to adopt the new farm technologies. Punjab accounts for about 17.42 per cent of the wheat production and 11.88 per cent of wheat area of India.

This state gives the highest yield of 4577 kg/ha. In 2012-13, Punjab produced 16.11 million tonnes of wheat, thus occupying second position among the major wheat producing states of India. Punjab has 12 leading wheat producing districts. Jalandhar, Ludhiana, Sangrur, Bhatinda, Amritsar, Firozepur, Faridkot, Mansa, Kapurthala, Fatehgarh Sahib, Rupnagar and Patiala are the main producing districts. The state has a large surplus and contributes a lot of wheat to the central pool.

3. Madhya Pradesh. Madhya Pradesh is the third largest wheat producing state and accounts for over 14 per cent of the total production of India. The state has nearly 5.3 million hectares of land under wheat cultivation. This is an indication of low yield which is only 2477 kg/hectare. Steps have to be taken to increase the yield so that the state occupies a prestigious position among the wheat producing states of India. Sagar, Vidisha, Tikamgarh, Morena, Sehore, Gwalior, Guna, Satna, Bhind and Chhatarpur are important wheat producing districts.

4. Haryana. The physical and human conditions for wheat cultivation in Haryana are the same as those prevailing in Punjab, although to a lesser degree. The impact of Green Revolution is clearly visible in Haryana also. Presently, Haryana accounts for about 8.43 per cent of the wheat area of India and produces over 12 per cent of the total wheat of the country after that of Punjab. The yield 4448 kg/hectare is the

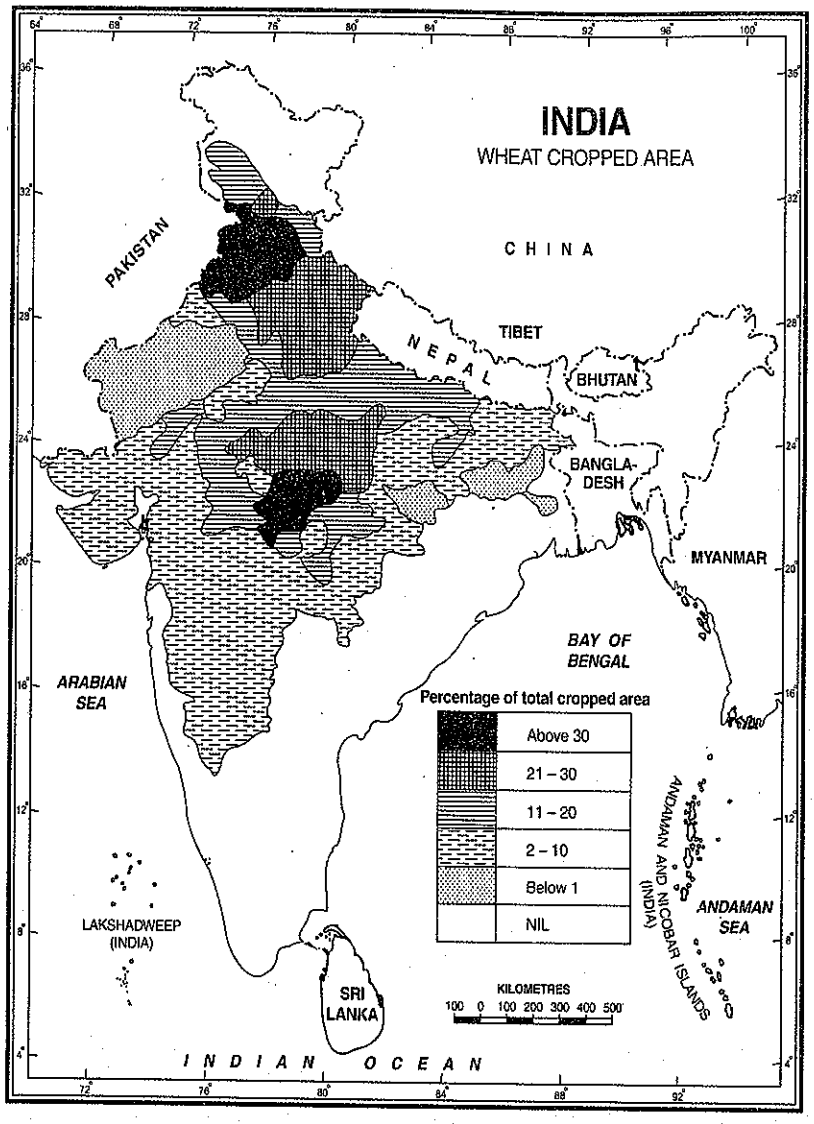


FIG. 22.2. India : Wheat cropped area

second highest in the country after that of Punjab. Karnal, Kurukshetra, Ambala, Kaithal, Panipat, Sonipat, Rohtak, Jind, Hisar, Sirsa, Fetehbad and Gurgaon are important producing districts.

5. Rajasthan. Vast stretches of sandy desert, scarcity of rainfall and paucity of irrigation facilities have been restricting wheat cultivation in Rajasthan since long. But some of the irrigation projects initiated after Independence, especially the Indira Gandhi Canal, have brought about considerable improvement in the cropping pattern of the state. Currently, Rajasthan accounts for 9.68 per cent of the total wheat production and 9.51 per cent of wheat area of India. Over 20 districts are producing wheat and 11 are major producers. Ganganagar, Hanumangarh, Bharatpur, Kota, Alwar, Jaipur, Chittaurgarh, Tonk, Sawai Mandhopur, Udaipur and Pali are important wheat producing districts of Rajasthan.

6. Bihar. Bihar accounts for 5.8 per cent of wheat production and about 7.5. per cent of wheat area of India with a low yield of 2423 kg/hectare. This means that there is need to improve the situation with respect to yields. Most of the wheat is produced in the *North Bihar Plain*. Rohtas, Bhojpur, Saran, Nalanda, Paschim and Purba Champaran, Siwan and Begusarai are the main districts.

Others. Gujarat, West Bengal, Maharashtra, Uttarakhand and Himachal Pradesh are the other important producers of wheat in India. In *Gujarat*, wheat is mainly produced in Mahi and Sabarmati valleys. Mahesana, Junagadh, Bhavnagar, Amreli, Bharuch, Rajkot and Kheda are important wheat producing districts. In *Maharashtra*, wheat is produced in the valleys of the Wardha, Tapi, Godavari, Bhima, Purna and Krishna. *West Bengal* has made significant progress both in area and production of wheat with the introduction of new technology. Most of the production comes from Birbhum, Burdwan, Murshidabad and Nadia districts. In Uttarakhand, most of the wheat production comes from river valleys. In *Himachal Pradesh* wheat is produced mainly in Kangra, Mandi, Sirmaur and Una districts. Srinagar, Baramula, Doda Anantnag, Jammu and Punch are the main producers in *Jammu* and *Kashmir*. Some wheat is also produced in Bijapur, Raichur, Belgaum and Dharwar districts of *Karnataka*.

Trade

About one-third of the total production of wheat enters trade. Punjab, Haryana, Uttar Pradesh, Rajasthan and Madhya Pradesh are surplus states and supply wheat to deficit states like Maharashtra, West Bengal, Bihar and the Union Territory of Delhi. India is both an importer and an exporter of wheat depending on the domestic production and requirement.

MAIZE

Maize is an inferior grain which is used both as food and fodder. Its grain provides food and is used for obtaining starch and glucose. Its stalk is fed to cattle.

Conditions of Growth

Maize can be grown under varied climatic and soil conditions. Maize is mainly a rainfed kharif crop which is sown just before the onset of monsoon and is harvested after retreat of the monsoon. In Tamil Nadu it is a rabi crop and is sown a few weeks before the onset of winter rainy season in Sept. and Oct. It requires 50-100 cm of rainfall and it cannot be grown in areas of more than 100 cm rainfall. In areas of lesser rainfall, the crop is irrigated. For example, more than half of the maize area in Punjab and Karnataka is irrigated. Long dry spell during the rainy season is harmful for maize. Sunshine after showers is very useful for maize. Cool and dry weather helps in ripening of the grain. This crop usually grows well under temperatures varying from 21°C to 27°C, although it can tolerate temperatures as high as 35°C. Frost is injurious to maize and this crop is grown only in those areas where there are about four and a half frost free months in a year. Fertile well-drained alluvial or red loams free from coarse materials and rich in nitrogen are the best soils for its successful growth. Well drained plains are best suited for its cultivation, although it grows in some hilly areas also. The cultivation of maize in India is characterised by *inter-culture i.e.* along with and in pulses, vegetables and oil seeds.

Production

Maize is an important cereal of India and is grown over 4 per cent of the net area sown of the country. There have been large variations in the production of maize in India since Independence. It was only 1.7 million tonnes in 1950-51 which rose to 4.1 million tonnes in 1960-61 and 7.5 million tonnes in 1970-71. Thereafter, variable trends in maize production had been observed till 1995-96. However, production of maize increased rapidly from 9.53 million tonnes in 1995-96 to 22.23 in 2012-13. Thus production of maize in India more than doubled within a short span on nearly one and a half decade. **Table 22.7** gives production figures for maize with respect to some selected years.

Distribution

Table 22.8 shows that two-third of the maize is produced in states of Andhra Pradesh (including Telangana), Karnataka, Bihar, Maharashtra and

TABLE 22.7. Area, Production and Yield of Maize in India

Year	1950 -51	1960 -61	1970 -71	1980 -81	1990 -91	1995 -96	2000 -01	2005 -06	2006 -07	2007 -08	2008 -09	2009 -10	2010 -11	2011 -12	2012 -13
Area (Million hectares)	3.16	4.41	5.85	6.01	5.90	5.98	6.61	7.59	7.89	8.12	8.17	8.26	8.55	8.78	8.71
Production (Million tonnes)	1.73	4.08	7.49	6.96	8.96	9.53	12.04	14.71	15.10	18.96	19.73	16.72	21.73	21.76	22.23
Yield (kg/hectare)	547	926	1279	1159	1518	1595	1822	1938	1912	2335	2414	2024	2542	2478	2552

Source : Agricultural Statistics at a glance, 2013 pp. 81-82.

Rajasthan. In **Andhra Pradesh** and **Telangana**, the plateau region of Telangana and some parts of Seemandhra are well known for maize cultivation. Nizamabad, Medak and Karimnagar are important maize producing districts. More than one-third of the crop is raised irrigated and almost entirely with HYV seeds. **Karnataka** is the second largest producer contributing about 15 per cent of the total maize production of India. This is followed by Maharashtra (10.48). In fact Karnataka, Telengana and Andhra Pradesh have recently emerged as important producers of maize. Belgaum, Chitradurga, Bijapur, Kolar, Bengaluru and Mysore are the important maize producing districts in Karnataka. In In **Maharashtra**, districts of Solapur, Dhule and Osmanabad are important producers. The arid lands of **Rajasthan** are

TABLE 22.8. Distribution of Area, Production and Yield of Maize in India (2012-13)

States	Area		Production		Yield
	Million hectares	%age of all India	Million tonnes	%age of all India	kg/hectare
1. Andhra Pradesh	0.97	11.14	4.81	21.64	4959
2. Karnataka	1.31	15.04	3.43	15.43	2618
3. Bihar	0.69	7.92	2.33	10.48	3377
4. Maharashtra	0.84	9.64	1.82	8.19	2167
5. Rajasthan	0.99	11.37	1.76	7.92	1778
6. Madhya Pradesh	0.85	9.76	1.51	6.79	1776
7. Uttar Pradesh	0.74	8.5	1.23	5.53	1662
8. Tamil Nadu	0.33	3.79	1.19	5.35	3606
9. Gujarat	0.48	5.51	0.84	3.78	1750
10. Himachal Pradesh	0.28	3.21	0.63	2.83	2250
11. Jammu & Kashmir	0.31	3.56	0.51	2.29	1645
12. West Bengal	0.11	1.26	0.42	1.89	3818
13. Jharkhand	0.23	2.64	0.39	1.75	1696
14. Punjab	0.13	1.49	0.23	1.03	1769
Others	0.45	5.17	1.13	5.08	@
India	**8.71**	**100.00**	**22.23**	**100.00**	**2552**

@ Since area/production is low in individual states, yield rate is not worked out.

Source : Agricultural Statistics at a glance, 2013, p. 83.

specially suited to maize cultivation where it is grown in Udaipur, Bhilwara, Dungurpur, Chittaurgarh and Banswara districts. This state gives one of the lowest yields among all the major maize producing states of India. At one stage, **Bihar** was the largest producer of maize but this state has lost much of its importance as a major maize producer in the country. Almost all the districts of the north Ganga plain produce maize but the major production comes from Samastipur, Begusarai, Bhagalpur, Purnea, Purbi Champaran and Siwan districts. The Upper Ganga Plain of **Uttar Pradesh** is an important producer of maize in the state. In Uttar Pradesh, maize is grown in as many as 25 districts but Bulandshahar, Jaunpur, Ghaziabad, Bahraich, Farrukhabad and Gonda are the main producing districts. Tamil Nadu accounts for a bulk over five per cent maize of India. In **Madhya Pradesh,** most of the production comes from Madhya Bharat Pathar, with Indore, Ratlam, Dhar, Mandspur, Dewas, Ujjain and Jhubia as the main producing districts. The geographical conditions are not much favourable for the cultivation of maize and the state gives one of the lowest yield of 1776 kg/ha in India. In **Gujarat**, Mahsana, Banaskantha, Rajkot and Kheda districts in the valleys of the Sabarmati and Mahi rivers are the main producers and together contribute over 55 per cent of the state's production.

The hilly areas of **Himachal Pradesh** are also well suited to maize cultivation. Kangra, Mandi, Sirmaur and Chamba districts occupy an important position in the production of maize.

Among the other producers Odisha, Jammu and Kashmir, Punjab, Chhattisgarh, Jharkhand and West Bengal. In Punjab, cultivation of maize has given place to other kharif crops and its production has drastically fallen from 7 lakh tonnes in 1977-78 to 4.1 lakh tonnes in 2011-12. Still Jalandhar, Kapurthala, Rupnagar, Ludhiana, Amritsar, Faridkot and Patiala are important maize producing districts.

MILLETS

Millets are short duration (3-4 months) warm weather grasses grown in those inferior areas where main food crops like rice and wheat cannot be successfully grown. They provide food for the poor people and fodder for cattle. *Jowar, bajra, ragi, korra, kodon, kutki, sanwa, haraka, varagu, bauti,* and *rajgira* are some of the important millets grown in India.

JOWAR (SORGHUM)

Jowar plays a significant role in feeding the teeming poor millions in the rural areas of India. **Dr. Voelkar** has spoken very highly of nutritive value of jowar as a fodder.

Conditions of Growth

Jowar is grown both as *kharif* as well as a *rabi* crop. As a *kharif* crop, it grows well in areas having mean monthly temperature of 26°C to 33°C. However, the *rabi* crop can be grown in areas where the mean monthly temperature does not fall below 16°C. It requires more than 30 cm rainfall during the growing period and does not grow where the rainfall exceeds 100 cm. Jowar is *par excellence a rainfed crop of dry farming areas where irrigation is not used.* Both excessive moisture and prolonged droughts are harmful for its proper growth. Though it can be grown in a variety of soils including loamy and sandy soils, clayey deep regur and alluvium are the best suited soils for jowar. Most of the crop is grown in plain areas but it can also be raised on gentle slopes upto 1,200 metres height.

Production and Distribution

Jowar has suffered severely at the hands of other favoured crops. The area under jowar increased slightly from 15.57 million hectares in 1950-51 to 18.41 million hectare in 1960-61. Thereafter, it has been fluctuating but the general trend has been towards its reduction. Trends of production area and yields of jowar are shown in **Table 22.9**. India produced 6.18 million tonnes of jowar from 5.33 million hectares of land with an average yield of 862 kg/hectare in 2012-13. Table 22.9 shows the distribution of jowar in India.

It is clear from **Table 22.10** that **Maharashtra** far excels all other states and produces more about 37 per cent of the total jowar production of India. As many as 22 districts of Mahrashtra produce jowar but Osmanabad, Nanded, Yavatmal, Buldhana, Parbhani, Kolhapur, Amravati, and Ahmednagar are important producing districts. In the Maharashtra plateau region, jowar is the staple food of the people and two crops in a year are raised here. First is sown just before the onset of the monsoon and the second is sown after the retreat of the monsoon. In some districts to the south

TABLE 22.9. Production, Area and Yield of Jowar in India

Year	1950 -51	1960 -61	1970 -71	1980 -81	1990 -91	2000 -01	2005 -06	2006 -07	2007 -08	2008 -09	2009 -10	2010 -11	2011 -12	2012 -13
Area (Million hectares)	15.57	18.41	17.37	15.81	14.36	9.86	8.67	8.47	7.76	7.53	7.79	7.38	6.25	6.18
Production (Million tonnes)	5.50	9.81	8.11	10.43	11.68	7.53	7.63	7.15	7.93	7.25	6.70	7.00	5.98	5.33
Yield (kg/hectare)	353	533	466	660	814	764	880	844	1021	962	860	949	957	862

Source : Agricultural Statistics at a glance, 2013, pp. 75-76.

of Pune, as much as 80 per cent of the cultivated area is devoted to jowar. The stalks are usually more than 2 metres long and are used as fodder for the cattle. **Karnataka** with 26.64 per cent of India's jowar production is the second largest producer. Jowar is widely grown in the north-eastern parts of the Karnataka plateau. About 80 per cent of Karnataka's production comes from Dharwar, Bijapur, Raichur, Gulbarga, Belgaum, Chitradurga and Bidar districts. **Madhya Pradesh** is the third largest producer but lags far behind Maharashtra in production contributing only 9 per cent of the total production of India. However, this state has the destination of giving highest yield of 1690 kg/hectare in 2012-13. Ujjain, Dewas, Shajapur, West and East Nimar and Mandsaur are some of the important producing districts. **Andhra Pradesh** along with Telangana has experienced a decrease in area and production of jowar during the last few years. Kurnool, Mahbubnagar, Khammam, Adilabad, Cuddapah, Nalgonda, Medak, Anantapur, Guntur, etc. are the important jowar producing districts in these two states. **Rajasthan's** dry climate

TABLE 22.10. Distribution of Jowar in India (2012-13)

States	Area		Production		Yield
	Million hectares	%age of all India	Million Tonnes	%age of all India	(kg/hectare)
1. Maharashtra	3.04	49.19	1.97	36.96	648
2. Karnataka	1.32	21.36	1.42	26.64	1076
3. Madhya Pradesh	0.29	4.69	0.49	9.19	1690
4. Andhra Pradesh	0.29	4.69	0.43	8.07	1483
5. Rajasthan	0.68	11.00	0.42	7.88	618
6. Uttar Pradesh	0.18	2.91	0.25	4.69	1389
7. Tamil Nadu	0.21	3.40	0.18	3.38	857
8. Gujarat	0.09	1.46	0.12	2.25	1333
9. Haryana	0.06	0.97	0.03	0.56	500
10. Odisha	0.01	0.16	0.00	0.09	490
Others	0.01	0.16	0.02	0.28	@
All India	**6.18**	**100.00**	**5.33**	**100.00**	**862**

@ Since area/production is low in individual states, yield rate is not worked out.

Source : Agricultural Statistics at a glance, 2013, p. 77.

and sandy soil provide favourable conditions for the cultivation of jowar. Kota, Sawai Madhopur, Jaipur, Tonk, etc. are the important jowar producing districts. However Rajasthan suffers from the problem of extremely low yields of 618 kg/hectare. In **Tamil Nadu** jowar is the second most important food crop after rice. Most of the production comes from Coimbatore, Tiruchirapalli, Madurai and Dharmapuri districts. Jowar is grown as a fodder crop in some of the south western parts of **Uttar Pradesh**. In **Gujarat** also, it is grown as fodder in the districts of Surat, Bharuch, Mahsana, and Vadodara.

BAJRA (BULL RUSH MILLET)

Bajra is the second most important millet which is used as food in drier parts of the country. It is also widely used as fodder as its stalks are fed to cattle. In certain areas the stalk is used for thatching purposes.

Conditions of Growth

Bajra is a crop of dry and warm climate and is grown in areas of 40-50 cm of annual rainfall. It seldom grows in those areas where the annual rainfall exceeds 100 cm. The ideal temperature for its growth is 25°-30°C. Bright sunshine after light showers is very useful in early stages of its growth. Bajra can be grown on poor light sandy soils, black and red soils and on upland gravely soils. It is a kharif crop which is sown between May and September and harvested between October and Feb./March. It is sown either as a pure or mixed crop with cotton, jowar and ragi. It is a rainfed crop and is seldom irrigated.

Production and Distribution

There had been wide fluctuations in the production of bajra from a minimum of 2.6 million tonnes in 1950-51 to a maximum of 12.11 million tonnes in 2003-04. The yields have also varied widely from a minimum of 288 kg/hectare in 1951-52 to a maximum of 1,141 kg/hectare in 2003-04. Large scale variations in area under bajra cultivation have also been observed (**Table 22.11**).

More than 85 per cent of India's bajra comes from four states of Rajasthan, Uttar Pradesh, Gujarat and Haryana. These four states also account for about 80 per cent of area under bajra. Rajasthan is the largest producer which accounts for 44.39 per cent of the production and 55.42% of the area under bajra. The leading bajra producing districts are Barmer, Nagaur, Jalore, Jodhpur, Pali, Sikar, Churu, Ganganagar, Hanumangarh, Bikaner, Alwar, Bharatpur, Jaipur, Jaisalmer, Jhunjhunu and Sawai Madhopur. **Uttar Pradesh** produced 1.76 million tonnes (12.5 per cent of India) in 2012-13. The main production comes from Mathura, Agra, Aligarh, Badaun, Moradabad, Etah, Etawah, Bulandshahar, Shahjahanpur, Mainpuri, Pratapgarh, Ghazipur, Farrukhabad, Allahabad and Kanpur. **Gujarat** is the third important producer, where 1.07 million tonnes (12.24 per cent of India's total) of bajra was produced in 2012-13. Most of the crop is grown in sandy tracts with maximum concentration in semi-arid parts of the state. Kachchh, Mehsana, Kheda, Bhavanagar, Amreli, Banaskantha, Surendranagar, Sabarkantha, Jamnagar, Rajkot, Junagadh districts are important producers. **Haryana** produced 0.79 million tonnes (9.04 per cent of total for India) in 2012-13. Most of the production comes from the drier south-western part of the state contiguous to Rajasthan. Mahendergarh, Rewari, Gurgaon, Rohtak and Hissar are important bajra producing districts. **Maharashtra** has shifted from first position in 2002-03 to fifth position in 2012-13 partly due to

TABLE 22.11. Area, Production and Yield of Bajra in India

Year	1950 -51	1960 -61	1970 -71	1980 -81	1990 -91	2000 -01	2005 -06	2006 -07	2007 -08	2008 -09	2009 -10	2010 -11	2011 -12	2012 -13
Area (Million hectares)	9.02	11.47	12.49	11.66	10.48	9.83	9.58	9.57	9.51	8.75	8.90	9.61	8.78	7.20
Production (Million tonnes)	2.60	3.28	5.53	5.34	6.89	6.76	7.68	8.42	9.97	8.89	6.51	10.37	10.05	8.74
Yield (kg/hectare)	288	286	426	458	658	688	802	886	1042	1015	731	1079	1156	1214

Source : Agricultural Statistics at a glance, 2013, pp. 78-79.