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VAJIRAM & RAVI

GENERAL STUDIES INDIAN GEOGRAPHY

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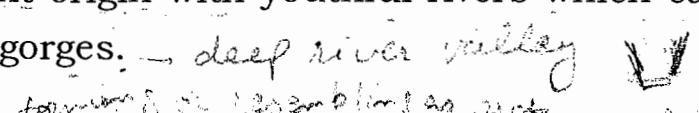
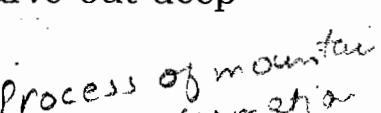
Geography-II

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LANDFORMS OF EXTRA-PENINSULAR INDIA

The Extra-Peninsular region of the Indian Subcontinent comprises the mountainous region of the Himalayas and their extensions into Baluchistan (Pakistan) and Myanmar (i.e. the Arakan Yoma of Burma). It is a region of folded and overthrust mountains of geologically recent origin with youthful rivers which carve out deep and steep-sided gorges.

deep river valley 
forming & continuing as well 
Geological Phases in Origin of Himalayas : The Himalayas are a part of a great arcuate orogenic belt extending from Spain to Indonesia which evolved as a result of repeated deformation of the sedimentary pile that accumulated in a geosyncline i.e. the *Tethys Sea* and its forerunner, the *Proto-Tethys* (the Proto-Tethys existed during the *Paleozoic era*). In fact, the Himalayas, the Alps, the Carpathians, the Zagros, the Sulaimans, the Arakan Yoma and the Indonesian Island Arc, are all part of a complex, physically continuous orogenic belt that originated broadly in the *Cenozoic era*. The Himalayas evolved as part of five phases in the convergence of the Indian plate and the Eurasian plate. The earliest collision took place 75 millions ago the latest phase began 1.8 million years ago.

STRUCTURE AND PHYSIOGRAPHY OF HIMALAYAS :

** width more in west as compared to east*
The Himalayas extend for a length of **2400 km** from the gorges of Indus in Kashmir in the west to Brahmaputra in the east. The width is between **240 km** (in the **east** i.e. Assam) and **500 km** (in the **west** i.e. Kashmir). The Himalayas cover an area of 5 lakh square kms comprising entire Jammu and Kashmir, all Northeastern States and entire Sikkim, Dehradun and Kumaon regions of U.P., parts of Himachal Pradesh and Darjeeling region of

W. Bengal. The Convexity of Himalayas is to the South i.e., towards the Indo-Gangetic plains.

1. **Siwaliks** : These constitute the outermost (towards the Ganga Plains) ranges and foothills. The Siwaliks evolved in the last stage of Himalayan orogeny and hence are youngest in the Himalayan system. These extend from Jammu and Kashmir to Arunachal Pradesh. The average elevation is 1500 m. They are a system of continuous ranges and run for a length of 2400 kms like the Greater Himalayas. The only huge break in the continuity of the Siwaliks is the valley of river Teesta. The Siwaliks are separated from the Lesser Himalayas by the Main Boundary Fault. The Siwaliks were the last ranges to be formed. The Siwaliks are called by different names in different regions like the Daffla, Abhor, Miri and the Mishmi hills in Arunachal Pradesh, the Jammu hills in Jammu and kashmir, and the Darjeeling hills in northen W.Bengal. The Duars are the gaps across the Darjeeling hills. The Duar region of W. Bengal resembles the Terai region of Uttarakhand.

2. **The Lesser Himalayas** : These lie to the north of the Siwaliks and are the second youngest. The Lesser Himalayas also called as Himachals, are separated from the Siwaliks in the south by the Main Boundary Fault. The average elevation is 3000 m and the average width is 60 - 80 km. The Himachals are made up of a series of parallel ranges separated by valleys. The main parallel ranges are : The Lesser Himalayas are well developed in the Western Himalayas and are a system of discontinuous but parallel ranges. At the junction of the Lesser Himalays and the Greater Himalayas, valleys filled with lake deposited sediments occur. These are called the Doons or the Duns. Dehradun, Patli, Chaukhamba, etc. are

the duns in Uttarakhand whereas Udhampur is the dun of Jammu and Kashmir.

The most prominent ranges of the Lesser Himalayas are :

i) The Pir Panjal Ranges : They form the southern boundary of the Valley of Kashmir and extend between Jhelum and Beas. A very prominent fact about the Pir Panjals is that they were the last to be uplifted in the uplift of the Himalayas. The prominent pass across the Pir Panjals are - the Banihal Pass (which has the Jammu - Srinagar highway). The Pir Panjal ranges are cut by rivers Kishenganga (a tributary of Jhelum), the Chenab and Jhelum. The Chamba valley of H.P. lies within the Pir Panjal ranges.

they under went the cycle of evolution uplifting 2 times

ii) The Dhualadhar Ranges : These are the southeast continuation of the Pir Panjals and arise near the peak of Badrinath. Shimla, Dalhousie and Dharamsala are the hill stations on the Dhualadhar range.

iii) The Mussoorie Range : This forms the water divide between Ganga and Sutlej. The Mussoori range extends between Lansdowne and Mussoori. Nainital, Chakrata, etc. are the important hill stations on Mussoori range.

iv) The Nag Tibba Range : This is the continuation of the Dhauladhar range into Nepal.

3. **The Greater Himalayas** : Also called as **Himadris**, and extend from Nanga Parbat (8126 m) in the west to Namcha Barua (7756 m) in the east. The average elevation is 6,100 m.

Dharm rocks
continents

The Greater Himalaya are made up of the **oldest rocks** i.e. the Pre-Cambrian igneous and metamorphic rocks. The **Tethyan Himalayan Zone** occurs within the Greater Himalayas. These constitute the most continuous mountain range of the

world. They have the oldest rocks of all the ranges making up the Himalayan system. The Greater Himalayas boast of 14 of the 28 tallest peaks in the world. The four tallest peaks of the Greater Himalayas are Mt. Everest (8850 m), Kanchenjunga-I (8598 m) and Lhotse-I (8501 m) and Makalu (8481 m). The other prominent peaks are Dhaulagiri (8172 m), Annapurna, Mansalu (8156 m), Everest South Peak and Nanga Parbat (8126 m). The Great Himalayas are cut by some prominent passes like - the Burzil pass, Zozilla Pass (in Jammu and Kashmir), the Bara Lacha La and Shipki Pass in Himachal Pradesh, the Thaga Pass, the Niti Pass and the Liphu Lekh Pass in Uttarakhand the Natu La and Jelep La Passes in Sikkim, and the Raxaul pass and the Jogabani Passes in Bihar. The Greater Himalayas have some very large glaciers which are Rongbuk, Gangotri (30 km long in Kumaon-Garhwal), Zemu and Kanchenjunga, in descending order. The Greater Himalayas are separated from the Lesser Himalayas in the south by the Main Central Thrust (a group of faults).

4. **The Trans - Himalayas :** They occur north and northwest of the Greater Himalayas and are around 40 km wide in the east and west, and around 222 km wide in the central portions. The Trans-Himalayas are made up of the Karakoram, Zaskar and Ladakh ranges.
- i) **The Karakorams :** They form India's frontier with Afghanistan and China. They extend from the Pamir Knot. The average elevation of Karakorams is around 5500 M. The four tallest peaks of the karakorams are :

Mt. Godwin Austen or K² with an elevation of 8611 m, followed by Gasherbrum-I (8068 m), the Broad Peak (8047 m) and then the Gasherbrum-II (8035 m) peak. The prominent passes across the Karakorams are Muztagh pass, the Hispar Pass, the Karakoram pass, the Sia La Pass and the Bilafond la pass. The Karakorams have some very large glaciers and also include the largest glacier outside the polar region i.e., the Siachen glacier, 75 km long. It may also be noted that nearly half of the snow bound area of the Himalayas occurs within the Karakorams. The 4 largest glaciers of the Karakorams are - Siachen, Fedchenko, Hispar, Biafo and Baltoro.

- ii) **The Ladakh Range** : It starts in the west from the confluence of Indus with Shyok. River Indus separates the Ladakh from the Zaskar ranges (which lie to the south of the Ladakh ranges). The tallest peak of the Ladakh range is Rakaposhi and another prominent peak is Gurla Mandhata. The prominent passes across the Ladakh range are Digar La, Chang La and Chorbat. The Soda plains, Aksai Chin, Depsang and Chang Chenmo are plains in the Ladakh ranges. The Rakaposhi – Haramosh ranges and Kailas ranges are extensions of Ladakh range.
- iii) **The Zaskar Ranges** : These lie south of the Ladakh range. River Sutlej cuts through the Zaskar ranges at Shipki pass in H.P. The valley of Kashmir lies between the Pir Panjal ranges (in the south) and the Zaskar ranges (in the north). The tallest peak of Zaskar range is Mt. Kamet.

Himalayas : Regional Make-up:

1. **Kashmir Himalayas** : This region includes the Himalayas of Jammu and Kashmir covering an area of 350,000 sq kms. The region ^{claims} boasts of the largest share of snow and glaciers. Pir Panjals are the dominant ranges and the Kashmir valley is a striking geomorphic unit. Banihal and Pir Panjal are the important passes.
2. **Punjab Himalayas** : This region stretches northwest from Sutlej and extends for 570 km and covers an area of 45,000 sq kms. The northern slopes enclose plateaux with lakes like Mansarovar and Rakas Tal. Zozilla and Bara Lapcha La are the important passes.
3. **Kumaon Himalayas** : This occurs between rivers Sutlej and Kali for a length of 320 kms covering an area of 38,000 sq kms. The important peaks are Kamet, Badrinath, Nanda Devi, Kedarnath and Gangotri. Important lakes are Nainital and Bhim Tal. Ganga and Yamuna are the prominent rivers.
4. **Central Himalayas** : This covers the region between the rivers Kali and Teesta and extends for a length of 800 km, covering an area of 1,16,800 sq kms. The region includes the Sikkim Himalayas (Sikkim), Darjeeling Himalayas (Darjeeling) and Bhutan Himalayas (Bhutan). The important peaks are Mt. Everest, Annapurna, Dhaulagiri, Mansalu, Makalu and Kanchenjunga.
5. **Assam Himalayas** : This region occurs between rivers Teesta and Brahmaputra, extending for a length of 720 km and covering an area of 67,500 sq kms.

The Purvanchal Hills : The hills of Northeast India extending from Arunachal Pradesh to Mizoram constitute the Purvanchal hills and represent the continuation of Himalayas. Through the Purvanchal hills, the Himalayas continue to form the Arakan Yoma ranges in western Burma. The various Purvanchal hills are :

1. **Patkai Bum Range** : Forms the international frontier between Arunahcal Pradesh and Burma. It merges with the Naga hills close to Saramati Peak in the south.
2. **Naga Hills** : These are the main ranges in Nagaland. The tallest peak of Naga hills in Mt. Saramati.
3. **The Manipur Hills** : They form the boundary between Manipur and Burma.
4. **The Barail Range** : This range separates the Naga hills from the Manipur hills. It is mostly in Nagaland. It joins up with Jaintia, Khasi and Garo hills of Meghalaya.
5. **The Mizo Hills** : These lie south of the Manipur Hills and are the main ranges in Mizoram. They are also called Lushai Hills.

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GEOGRAPHY OF PENINSULAR INDIA

Introduction: Peninsular India is a triangular plateau with the apices of the triangle at Broach (Gujarat), Kanya Kumari (Tamil Nadu) and Rajmahal hills (West Bengal). Peninsular India is 1400 km wide (E-W) and 1600 km long (N-S). Peninsular India occupies 16 lakh square kms, half the land of area. It may be noted that the area north of the Tropic of Cancer is twice that of the area south of the Tropic of Cancer. The Narmada - Tapti graben divides the peninsular plateau into Central Highlands and the Southern Plateau and Hills regions. The Central Highlands include the Aravallis, the Malwa Plateau and the Bundhelkhand Plateau. The Southern Plateau and Hills region includes the W. Ghats, the Eastern Ghats, the Satpura Ranges, the Deccan Plateau and the plateaus of south India. The physiography of each of these regions is briefly brought out in the following section.

The Aravallis : These are the oldest fold mountains of India. They are between Palanpur (Ahmedabad) and Delhi. The general elevation is between 400-600 mts. They have lower elevations between Delhi and Ajmer. They extend for 800 kms in a NNE-SSW direction. The Aravallis are remnants of folded tectonic mountains. The average elevation of the Aravallis ranges between 300-800 m. The Aravallis are continuous ranges south of Ajmer. The Aravallis are unbroken between Mewar and Merwara hills. Mt. Abu block (1158 m) is the highest section of the Aravallis and includes the Gurushikar Peak (1722 m), the tallest point of the Aravallis. Mt. Abu is separated from the rest of Aravallis by river Banas. The Borhat Plateau is another high block of the Aravallis. Delhi Ridge in the northernmost range of the Aravallis

and forms the Indo-Gangetic Divide. Mahi and Luni have their birth in the Aravallis and cross them.

The Malwa Plateau: This include most districts of western M.P., the Mewar region of southern Rajasthan and the districts of Dhulia and Jalgaon of Maharashtra. The plateau is made up of diverse rocks including the volcanic basalts of the Deccan Plateau and the oldest Archean or Dharwar rocks of the Peninsular crust. The plateau lies east of Aravallis and west of Vindhyan ranges. It has the basins of river systems that drain into both the Bay of Bengal and the Arabian Sea. Malwa Plateau includes the courses of Betwa, Mahi and the upper course of Chambal. The course of Chambal in Malwa plateau shows the badland topography of gullies and ravines. The Narmada Gorge is a prominent structure of the Malwa plateau. Its average height is 500 m – 250 m above the sea level. It is covered by thick forests. The Malwa plateau includes the upper courses of Sindh, Betwa and Ken rivers, besides the Chambal and its right bank tributaries (Kali and Parbati). Chambal badlands represent a prominent landform of the Malwa Plateau.

The Bundelkhand Plateau: It is between Vindhyan ranges and the Malwa Plateau and south of Yamuna. Its average height is 300-600 m above the sea level. It includes 5 districts of U.P. (Jalaun, Jhansi, Lalitpur, Hamirpur and Banda, 4 districts of M.P. (Chhatarpur, Panna, Tikamgarh and Datia). It is bounded by the Yamuna in the north, the Vindhyan in the south, the Chambal in the northwest and the Panna hills in the southeast. The Bundelkhand region includes the Bundhelkhand plains and the Bundhelkhand – Vindhyan highlands. The Bundhelkhand Plateau is made up of Dharwar igneous and gneissic (metamorphic) rocks of the Archean era. The drainage basins of

top and sloping sides
flat tableland rises abruptly from
with steep edges the surrounding region

Yamuna, Betwa and Ken like within the Bundhelkhand region. The Bundhelkhand region has a series of mesas and buttes. A hill that

The Satpura - Maikala Hills Region : Satpura means seven hills. The seven mountains stretch between Rajpipla hills in the west and Maikala hills in the east. The Satpuras constitute the highest east-west tectonic mountains of Peninsular India. The Satpura range attains its maximum height near Pachmarhi (1350 m). The Maikala plateau reaches its maximum height of 1127 m near Amarkantak. The Mahadev hills are part of the Satpura system. The Mahadev hills include the Pachmarhi ranges. The Maikala hills constitute the eastern section of the Satpura system. The Amarkantak Plateau is within the Maikala hills. While Narmada takes its birth in the Amarkantak Plateau (1127 m), Tapti takes its birth in the Betul plateau of the Satpura hills.

Baghelkhand Region: This lies east of the Maikala hills and south of Son. It is bounded by river Son in the north and the Mahanadi in the south. It includes parts of Chattisgarh, Mirzapur district of U.P. and portions of Jharkhand. It includes the drainage basins of Son and Rihand. The Baghelkhand plateau region includes the Narmada-Son trough and the Maikala, Rewa and Panna plateaus. It is a water-divide between river Son in the north and Mahanadi in the south.

Rajmahal Hills : These are by origin, relict or residual mountains. They define the eastern boundary of the Chotanagpur Plateau. The Rajmahal hills are made up of volcanic rocks. Between the Rajmahal hills and the Garo hills (of Meghalaya) lies the Rajmahal - Garo Gap, via which the Ganga drains into the Bay of Bengal.

The Vindhyan Range: They form an escarpment forming the northern edge of the Narmada-Tapti Trough. The ranges are more or less parallel to the Narmada valley for a length of 1200 kms between Gujarat to Sasaram. The general elevation of the Vindhyan range is 300 to 650 m. In the eastern part, the Vindhyan range forms excellent scarps in the form of the Bharner and the Kaimur hills. The Vindhyan - Kaimur scarp acts as a watershed between the Ganga system in the north and the river systems of South India.

The Chotanagpur Plateau : The second largest plateau of India, the Chotanagpur plateau is a continental plateau. It is the northeast projection of the Indian peninsula. It is made up of the very old igneous and metamorphic rocks of the Dharwar age. The average elevation of the Chotanagpur plateau is 700 m. The Chotanagpur plateau consists of a series of plateaus occurring at different heights called patlands. Here the Chotanagpur plateau reaches its highest elevations of around 1100 m. From the Patlands in the middle-west, the height of the Chotanagpur Plateau descends in all directions. River Damodar drains centrally across the Chotanagpur plateau. To the north of Damodar river, the Chotanagpur plateau is made up of the Hazaribagh Plateau with an average elevation of 600 m. South of river Damodar lies the Ranchi plateau. The western parts of the Ranchi Plateau typically have the Pats. The Chotanagpur plateau is India's richest mineralised region and accounts for 40% of the metallic mineral deposits of India. The Chotanagpur Plateau includes the drainage of North Koel, South Koel, Damodar and Suvarnarekha rivers. It is over the Chotanagpur plateau that the Bay of Bengal and the Arabian Sea branches of the southwest monsoon converge.

The Deccan Plateau : This is the largest plateau of India and the largest physiographic unit of peninsular India. It is a triangular plateau bounded by the Satpura and Vindhyan ranges in the northwest, the Mahadev and Maikala hills in the north, the W. Ghats in the west and the Eastern Ghats in the east. The average elevation of the Deccan plateau is 600 m but in the south it is 1000 mts. The Deccan plateau is made up of volcanic rocks called basalts which have given birth to the black regur soils. The plateau is made up of horizontal layers of solidified lava flows. The solidified lava flows give to the Deccan plateau the Trap Structure i.e., a surface made up of a series of steps. Balaghat plateau within the Deccan plateau makes up Balaghat Ranges. The Ajanta range within the Deccan Plateau lies south of river Tapti. The W. Ghats of the north i.e., the Sahyadris, constitute the western edge of the Deccan plateau. Telangana Plateau is the extension of Deccan Plateau into A.P. while Mysore Plateau is an extension of the Deccan Plateau in Karnataka.

The Deccan plateau includes :

a) **Maharashtra plateau** : This includes the Ajanta ranges to the south of river Tapti.

b) **Khandesh** : This includes the valleys of Tapti and its tributary Purna. Khandesh is a narrow region bounded by the Satpura hills in the north and the Ajanta hills in the south. The region includes the Tapti rift valley.

The Karnataka Plateau : This is also called the Mysore Plateau. It has an average elevation of between 600-900 m and its northern portions include parts of the Deccan plateau. It is made up of the very old Dharwar igneous and metamorphic rocks. The northern part of the Karnataka plateau is called Malnad. The Malnad is a

hilly forested region. The most prominent ranges of Malnad are the Bababudan hills in Chickmagalur district. The southern part of the Karnataka plateau is called Maidan. This is a rolling plain of low height.

The Telangana Plateau : This makes up the northern and western parts of A.P. It is made up of very old Dharwar rocks. It is a low lying surface often described as a peneplain. The average elevation is between 500-600 m. The Godavari, the Krishna and the Pennar drain the Telangana plateau.

The Chattisgarh Plateau: It is actually a low lying rolling plain in the middle of plateaus and hills of Peninsular India. It is a saucer like basin in the upper Mahanadi region. It is between Maikala hills and Orissa hills. Its average elevation is between 330-250 m. The region includes the upper course of Mahanadi and the tributary of Godavari, Wainganga. * Much of the plateau is made of the plane of river Mahanadi and its tributaries. When high land are completely eroded by river and convert into the lying surface.

The Meghalaya or the Shillong Plateau : This is considered to be part of peninsular India. It is separated from the Peninsular plateau by the Rajmahal - Garo Gap. The Shillong plateau is made up of igneous and metamorphic rocks of Dharwar age. Garo, Khasi and Jaintia hills are highland portions of the Meghalaya plateau. The Garo hills (900 m) are the water- divide between rivers Surma and Brahmaputra and continue into Sylhet in Bangladesh. The Khasi and Jaintia hills have an average height of 1500 m. The Shillong Plateau descends into the Surma Valley of Assam and to its north lie the Mikir hills.

Kathiawar : This is part of the Deccan Plateau and has a series of volcanic hills like Gir, Junagarh and Pavagarh hills. The Kathiawar peninsula is bounded in the east by the Little Rann and

in the northeast by the Nal Sarovar Lake. In the centre of Kathiawar region occur the Mandav hills with Mt. Girnar. The Gir ranges lie in the southern part of Kathiawar.

The Western Ghats : These are also called the Sahyadris in the northeastern part. They extend between 21° N to 11° N. They rise to 1000 m from the Arabian Sea coast. The Sahyadris (i.e., W. Ghats north of Coorg) are the edges of the Deccan Plateau. Kathiawar Peninsula is the western outlier of the W. Ghats and is made up of schists and gneisses. The Sahyadris are between 21° N to 16° N i.e., between river Tapti to North Goa. Their average height is 1200 m. They form excellent scarps along the coast particularly north of Karnataka. * Mahabaleshwar Plateau (1438 m, the birthplace of Krishna) is the highest plateau of the Sahyadris. Between Goa and the Tapi valley, the Sahyadris have an average elevation of 1200 m. The prominent peaks here are Salher, Kalsubai, Mahabaleshwar and Harishchandragarh Peak. The Bhorghat Pass (Bombay - Pune link) and the Thalghat Pass (the Bombay - Nasik link) are prominent passes across the Sahyadris in the north.

The Middle Sahyadris lie between 16° N to Nilgiris i.e., they include the Western Ghats between Goa and Nilgiris. * Here the W. Ghats are not plateau edges of the Deccan plateau. The middle Sahyadris are of an average height of 1200 m. The middle Sahyadris are made up of Dharwar igneous and metamorphic rocks. The prominent peaks are Vavul Mala, Kudremukh, and Pushpagiri. The Nilgiris join the Sahyadris near Gudalur. The Nilgiris mark the junction between the Western Ghats and the E. Ghats. Doddabeta (2637 m, at whose foothill lies the hill station, Ooty) is the tallest peak of the Nilgiris. Jog or Gersoppa Falls (250 m) is developed by Shravati in W. Ghats.

The southern Western Ghats are separated from the main Sahyadris by the Palghat Pass which separates the Nilgiris from the Anamalai hills. The Palghat Pass is divide between northern western ghats and southern western ghats. The Anamalai hills fan out from the Anaimudi peak (2695 m, the tallest peak in south India). The Anamalai hills have an average elevation of 2000 m- 1800 m. The Palani hills (average elevation is 1200 m- 900 m) are an offshoot of the Anamalai hills. The Kodaikanal resort is located in the Palani hills. The Cardomom hills lie south of the Shencottah Pass (which separates the Anamalai hills from the Cardomom hills). The Cardomom hills divide the Malabar coast from the Tamil Nadu coast.

The Eastern Ghats : These are a chain of discontinuous hills stretching between Mahanadi in Orissa to river Vaigai in Tamil Nadu. [★] Eastern Ghats are made up of old Archean rocks of the Peninsula and also rocks of the Cuddapah System. The total run of the Eastern Ghats is about 800 km. The Ghats are 200 kms wide in Orissa and narrow down to 100 km southwards.

Between Krishna and Pennar, the E. Ghats are made up of the Nallamala, Palkonda and Velikonda hills. The Eastern Ghats take the form of true mountains between Godavari and Mahanadi. The Garjhat hills are the northeastern hills of Orissa and are part of the E. Ghats. The E. Ghats of Andhra Pradesh are called the Nallamalai hills (average height is 850 m- 650 m). The southern part of Nallamalai hills are called the Palkonda ranges. The E.Ghats of Tamil Nadu are the Javadi, Shevaroy and the Palani hills. The E. Ghats join the Western Ghats in Nilgiris via the Palani hills.

Gondwana Troughs : These are the rift valleys within which Damodar, Mahanandi and Godavari flow. The rift valleys formed in the Paleozoic era and contain thick deposits of coal of the Gondwana formations.

Narmada and Tapti Troughs : These are rift valleys within which Narmada and Tapti flow west. The Satpura uplands lie between the Narmada and Tapti troughs.



ISLANDS OF THE INDIAN UNION

The Union of India has 247 islands of which 204 lie in the Bay of Bengal (the "Andaman and Nicobar Group) and 43 islands lie in the Arabian sea (Lakshadweep Group) as well as between India and Sri Lanka in the Palk Strait.

Andaman and Nicobar Group: These lie between $6^{\circ}39' N$ and $13^{\circ}34' N$. The northernmost island of the Andaman and Nicobar group occurs about 901 kms from the mainland while the southernmost tip lies about 146.5 kms from Sumatra. The Andamans are made up of North, Middle and South Andaman and are separated from the Nicobar group by the Ten Degree Channel (which is about 121 km wide). *Saddle Peak* (738 m) in N. Andaman and *Mt. Thulier* (642 m) in Great Nicobar are prominent peaks. The *Duncan Passage* occurs between South Andaman and Little Andaman. The Nicobar Group has about 19 major islands, the largest being Great Nicobar. *Barren islands* and *Narcondom islands* in the Andaman Group constitute active and sleeping volcanoes. About 86% of the Andaman and Nicobar Group is covered by dense tropical evergreen and mangrove forests.

The Lakshadweep Group : All islands of the Arabian sea are coral islands. The Lakshadweep occupy an area of 32 sq kms and lie between $8^{\circ}N-11^{\circ}N$. The Minicoy island, the largest of the Lakshadweep Group (4.5 sq km), lies south of the Eight Degree Channel.

North

Pamban Island: This is situated between India and Sri Lanka and is a rocky island and represents the extension of peninsular landmass in the Ramnad district of Tamil Nadu.



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LANDFORMS : THE INDO-GANGETIC PLAINS

aggrade : Built to a level by
depositing sediments

Introduction: The Great Plains, covering an area of about 7.5 lakh sq. ms are aggradational plains. The Great plains stretch in an east-west direction for 24,000 kms from the arid plains of Rajasthan in the west to the Ganga delta in the east. They extend between Himalayas in the north to the peninsular plateau in the south. These plains are drained by Beas and Sutlej (of the Indus system) in the west, Ganga and its tributaries in the east and Brahmaputra in the farther east. The average depth of the Great Plains is 1300 - 1400 metres with maximum depth between Delhi and Rajmahal hills. The plains have an average elevation of 150 m ranging from almost nothing in the Bengal delta to nearly 300 m in the foothills. The plains display a gentle slope towards the east in Rajasthan while the Ganga plains slope towards the south. The Delhi ridge, which is a subdued expression of Aravallis, divides the Great Plains into Western Plains and Eastern Plains. The Western Plains are made up of Thar desert, Malwa Plains (M.P.) and Punjab - Haryana Plains. The Eastern Plains are made up of the Ganga and Brahmaputra plains.

- A) **Punjab - Haryana Plains:** These extend 640 kms in a NE-SW direction and 300 kms in an East-West direction. The Aravalli range (upto Delhi) forms the eastern boundary. The plains merge with the plains of Rajasthan in the South and Plains of Indus in the West (in Pakistan). The height of the plains varies from 300 m in the north to 200 m in the South. For most part, there are no perennial rivers. The Ravi, Beas Sutlej and the Yamuna are the only perennial rivers. Though Ghaggar is perennial in its upper course, it becomes dry after flowing for a short distance from the hills. The soils are of an alluvial character. The upper Bari doab, the Bist doab and the Malwa plains are relatively higher upland plains. The **Bets** are the Khadar Plains in Punjab, the **Dhaya** are gullied bluffs which flank the Khadar Plains, **Chos** are narrow streams with large number of gullies, especially in Hoshiarpur district of Punjab.

Be located at the
sides of something

A higher
steep Bank
on one side

*inland drainage
These rivers do not reach up to a sea
playas & playas etc in C)
a desert*

B) **The Rajasthan Plains:** The Rajasthan plains include the Marusthali and the adjoining Bagar (steppe land) to the west of Aravalli. The Rajasthan Plains account for **one-third of the Great Plains**, with elevation ranging from 300 m in the northeastern part to 150 m in the south. The region receives less than 50 cms of rainfall, mostly from the monsoons. Except the southeastern portion, the rest of the Rajasthan plain is an area of inland drainage with a series of salt lakes - Sambhar, Dagana, Didwana, Kuchaman, Pachpadra etc. The biggest is Sambhar which covers an area of 300 sq m during the rainy season. The shifting sand dunes are called Dhrian while the playa lakes are called Ranns. The most important river flowing in the region is Luni, which rises in the Aravallis and flows southwest. It reaches the Rann of Kutch only during the rainy season. The Rajasthan plains are only partly aggradational. They are believed to have resulted due to uplift of shelf sands due to regression of sea followed by long spells of dry and wet conditions.

Ganga Plains : The Ganga plains of UP, Bihar and W.Bengal occupy an area of 3.57 lakh sq kms. The plains drain towards southeast into Bay of Bengal. The Ganga plains can be divided into the upper Ganga Plains, Middle Ganga Plains and Lower Ganga Plains:

gentle slope leading from the base of a mountain to a region of flat land

a) **Upper Ganga Plains :** These lie between Yamuna and Allahabad (east). The average depth is 1300 - 1400 m which decreases gradually towards the south. Along the northern margins of the plains lie two narrow bands making up the Terai-Bhabbar Sub-montane belt. The bhabbar is a piedmont plain composed of unsorted debris from the Himalayas. The surface streams disappear in this zone of boulders / sands to reappear later. Immediately below the Bhabar is a 15 - 30 km wide low lying Terai region which makes up the swampy foot hills. The terai is characterised by finer sediments, natural forest cover, high water-table resulting in swamps and marshes.

The 3 micro physiographic regions making up the upper Ganga Plains are a) The Bhabar - Terai Sub-montane

belt b) The Ganga-Ghaghara doab c) The Ganga-Yamuna doab. East of the Ganga-Yamuna doab lie the low lying *Rohilkhand plains* which merge into the Avadh plains farther east. The Yamuna, Ramganga and the Ghaghara are the major rivers draining the upper Ganga Plains. From the south, the Chambal is the most important river draining the region. Bangar is the older, upland alluvium occupying the zones above general flood limits. Khadar is the younger, lowland alluvium which is renewed annually in the floodplains.

- b) **Middle Ganga Plains:** These make up eastern U.P. (Avadh Plains) and Bihar. The long line of marshes along the northern Bihar plains are called Caurs.

Lower Ganga Plains: The plains are the Bengal plains. The Bengal plains are mostly made up of the Ganga delta, including the Sunderbans delta. The Bengal plains forms the Ganga-Brahmaputra doab in the north and a piedmont plain between Hooghly and Chotanagpur plateau in the south.

- D) **The Brahmaputra Plains:** The Brahmaputra plains extend between Sadia and Dhubri in Assam for a length of 640 kms and an average width of 100 kms. The Brahmaputra or the Assam plains are made up alluvial terraces of the Brahmaputra and its tributaries (Sesiri, Luhit and Dibang). The plains slope to the east and south and have many paired terraces and different levels of floodplains (due to frequent flooding of the Brahmaputra).

Paired
Terraces

LANDFORMS - LAKES OF INDIA

The lakes of India can be put under different categories based on the geographical setting and nature. The chief categories are :

- A) **Tectonic Lakes:** These are formed due to differential earth movements (like faulting, folding, subsidence etc). The old pleistocene lakes of Kashmir and Kumaon Himalaya belong to this type.
- B) **Volcanic Lakes:** These are developed within volcanic craters. The *Lonar Lake* in Buldana district of Maharashtra is an example.
- C) **Solution Lakes:** These are formed due to the subsidence of surface rocks due to solution of soluble rocks below the surface. Some of the Lakes in Kumaon belong to this type.
- D) **Glacial Lakes:** These are formed due to glacial erosion or when glacial moraine forms barriers across glacio-fluvial streams. The tarn lakes on the northeastern slopes of Pir Panjal ranges belong to the *former type* while those of Kumaon belong to the latter type. Some of the *margs* of Kashmir are moraine bound basins.
- E) **Alluvial Lakes:** These are formed by uneven deposition of sediments in deltas and are called *Jhils*. Some alluvial lakes are Ox-bow lakes which are found in great abundance in the Ganga plains of eastern UP and Bihar.

- F) **Aeolian Lakes:** These are temporary lakes in blowouts in deserts i.e., playas. Western Rajasthan has many of these type.
- G) **Rock Fall Lakes:** These are produced by landslides or landslips which obstruct stream courses. The Gohna Lake of Garhwal formed due to a landslide across Ganga.
- H) **Lagoons:** These form due to deposition of sand bars along the coast. The Chilka lake of Orissa, the Pulic平 lake (due to Sriharikota island as a sand bar) and the Kayals of the Kerala coast are examples.

Lakes of Kumaon: Nainital district in Uttaranchal abounds in lakes which include Nainital, Bhimtal, Naukuchiatal, Khurpatal, Sattal, Punatal, Malwatal etc.

Lakes of Kashmir: The glacial lakes of Kashmir are Dal, Wular, Anantnag, Sheshnag, Verinag, Gandharvabal, Nagin and Manasbal.

Lakes of Rajasthan: Several salt water lakes occur in the Thar, the biggest being Sambhar. The others are Didwana, Lunkaransar, Falodi, Kachhor, Rivasa etc. The freshwater lakes of Rajasthan are Udaisagar, Fatehsagar, Pichhola, Jai Samand, Rajasamand and others.

Lakes of South India: Ashatmudi and Vembanad (Kerala), Pulic平 and Kolleru (A.P.), Chilka (Orissa) and Lonar (in Maharashtra) are the most prominent.

DRAINAGE OF INDIA

Classification of River Systems : The river systems of India are classified into the following based on hydrological characteristics.

1. **Himalayan Rivers :** These are perennial and snow-fed. These belong to the Indus, Ganga and Brahmaputra systems. The Himalayan river systems encompass a drainage area of one million sq kms and cover a region with good ground water potential.
2. **Peninsular Rivers :** These are seasonal and get their water from rainfall. These include the Deccan rivers and the Coastal rivers.

Classification by size :

1. **Major Drainage Basins :** These are river basins having a drainage area of 20,000 sq kms or more. Indian territory is basically made up of large sized basins.
2. **Medium Drainage Basins :** These are river basins having a catchment area of 2000 - 20,000 sq kms.
3. **Minor Drainage Basins :** These are river basins with a catchment area of less than 2000 sq kms.

Contrast between Himalayan and Peninsular Rivers :

HIMALAYAN RIVERS	PENINSULAR RIVERS
1. These are snow-fed or glacier fed.	1. These are rainfed.
2. These originate at great elevations	2. Originate at much lower altitudes
3. The volume of waters discharged is less in winter i.e. the lean period is in winter	3. The discharges are very low in the non-rainy months but heavy during the south-west monsoon period.

4. Are uncertain and unpredictable in their behaviour.	4. Are more predictable in their behaviour.
5. Show meandering courses at places.	5. Are devoid of meanders
6. The Himalayan rivers are youthful and descend down steep slopes.	6. Peninsular rivers are quite old and rain an old and a senile topography.
7. These develop their courses freely in the Great plains and have a general dendritic pattern. These also show characteristics of antecedent rainage and these are instances of river capture in the basins of Kosi, Gandak and Ghaghara.	7. These follow major structural lines like joints and faults in the old crystalline rocks of the Peninsula and hence show evidences of superposed drainage and river capture due to the differences in rock formations.
8. The Himalayan rivers are best suited for irrigation because they are perennial and also because canals can be easily dug in the alluvial plains they drain.	8. These rivers are better placed for hydel power development because they drain a hilly terrain and fall from steep scarps at many places, especially in the W. Ghats.

Contrast between West flowing and East flowing rivers :

WEST FLOWING RIVERS	EAST FLOWING RIVERS
1. These are short and flow swiftly.	1. These are long and drain slowly.
2. These flow in narrow valleys and extend their courses headwards.	2. These flow through broad valleys with gentle slopes.
3. River-courses have not yet been graded to their base level.	3. River courses are graded almost upto their sources.
4. These descend the steep slopes of W.Ghats through waterfalls and rapids.	4. These descend over relatively gentler slopes / scarps.

5. These usually flow between two mountain ranges and hence their catchments are more elongated and narrow.	5. These have wide and fan shaped courses.
6. These do not build deltas due to their great velocity and fast flow.	6. All these typically build large deltas.

1. **Indus**: Arises near Mansarovar lake, flows between Ladakh and Zaskar ranges and encircles Leh. It is joined by Zaskar near Leh. It is joined by Shyok close to Skardu. It has cut a gorge at Bunji, north of Nanga Parbat. Its mountain tributaries are Gilgit, Gortang, Dras, Shigar and Hunza. It flows through the Potwar plateau of Pakistan and crosses the Salt Range. Near Mithankot, it receives the waters of its five eastern tributaries - i.e., the Panchnad. Out of its total length of 2880 km, only 709 km is in India.
2. **Jhelum**: It arises near Verinaag at the foothills of Pir Panjal ranges in southeastern Kashmir valley. It bends sharply at Muzzafarabad beyond which it is joined by the Kishanganga. Its main tributaries are Lidar and Sind. It forms the India-Pakistan boundary for 170 kms and emerges in Potwar Plateau near Mirpur. It enters the plains in Pakistan near Jhelum city. Its total length is 724 kms. The third longest tributary of Indus, it joins Chenab.
3. **Chenab**: It arises near Bara- Lacha la pass in Kulu hills of Himachal in Lahul-Spiti region. It enters Jammu and Kashmir as Chenab. It has cut a gorge at Kishtawar. It emerges in the plains at Akhnoor (in J&K). It is the largest tributary of Indus. Its total length is 1180 km. It is the river of Chamba valley of H.P. It has cut a gorge close to Kishtawar. Chenab joins Sutlej after receiving waters of Ravi and Jhelum.

4. **Ravi** : It arises in the Kulu hills of H.P. close to Rohtang Pass. It drains between Pir Panjal and Dhauladhar ranges. It has cut a gorge across Dhauladhar ranges. It enters Pakistan below Amritsar and joins Chenab close to Rangpur. It is the second longest tributary of Indus.
5. **Beas** : The shortest tributary of Indus. It is also born in the Kulu hills of H.P., close to the Rohtang Pass. It has cut a gorge across Dhauladhar ranges. It joins Sutlej in Harike. Its total length is 460 km.
6. **Sutlej** : It is born close to Mansarovar lake near Darma pass in Tibet. It has cut a large canyon in Nari Khorsan province of Tibet which is 900 m deep. River Spiti joins Sutlej near Shipki pass. It has cut another gorge in Naina Devi in India where the Bhakra dam has been constructed. It enters the plains in Roopnagar, Punjab. It forms the boundary between India-Pakistan between Ferozpur and Fazilka. It joins Indus near Mithankot. Its total length is 1450 km of which 1050 km is in India.

Brahmaputra System : Arises in the Chemayungdung Glacier in Kailas range. Its total length is 2900 km. It is known as Tsangpo in Tibet and Yarlung Zangbo Jiangin in Chinese. It swings north close to Namcha Barwa (7756 m) and swings south into India through the Dihang or the Siang Gorge. It enters the plains of Assam near Sadiya where it is called Siang and Dihang. The Dibang from the north and Lohit from the south join it near Sadiya. It flows till Dhubri for 720 kms as Brahmaputra. In Assam plains, the tributaries joining it from the north (i.e., the right bank tributaries) are Subansiri, Kameng, North Dhansiri, Teesta and Manas. The tributaries which join it from the south (the left bank tributaries) are Dibru, Buri Dihing, South Dhansiri and Kalang. It is called Jamuna till it joins Ganga at Goalunda.

Ganga System : The Ganga basin covers 26.3% of India's geographic area. The basin covers ten states. Uttaranchal and U.P. account for 34.2% of basin area followed by M.P. and Chhattisgarh, Bihar and Jharkhand, Rajasthan, Himachal and Delhi.

- A) Ganga** : Originates as Bhagirathi in Gangotri glacier in Uttar Kashi district of Uttarakhand. Bhagirathi meets Alakananda at Devaprayag. Ganga enters plains near Haridwar. From its source to its mouth along Hooghly, Ganga is 2525 kms.
- B) Yamuna** : It originates in Yamunotri glacier on the Bandarpunch Peak in Garhwal. It cuts across the Nag Tibba and Mussoorie ranges. It enters plains near Tajewara. Tons is its main tributary which also arises from the Bandarpunch Peak. Between Agra and Allahabad, Yamuna is joined by Chambal, Sind, Betwa and Ken. The total length of Yamuna is 1370 km. It is the longest and largest tributary of Ganga. The important tributaries of Yamuna are :
- 1) Chambal** : It arises southwest of Mhow in Janapao hills of Vindhyan ranges. It drains the Malwa plateau. Chambal joins Yamuna in Etawah district of U.P. The total length of Chambal is 1050 km. Banas is an important tributary of Chambal. It originates in the Aravalli ranges and joins Chambal near Sawai Madhopur, Rajasthan.
 - 2) Sind** : It originates in the Vidisha plateau of M.P. It flows for 415 km before joining Yamuna.
 - 3) Betwa** : Arises in Vindhyan ranges of Bhopal and joins Yamuna near Hamirpur after flowing for 590 km.
 - 4) Ken** : Arises in Barner Ranges of M.P. and joins Yamuna near Chila.
- C) Ghaghara** : It is the second longest tributary of Ganga. It arises in the Gurla Mandhata peak of Ladakh ranges, south of Mansarovar. It joins Ganga near Chapra, Bihar, after flowing for 1080 km. Sarda, Sarju and Rapti are its important tributaries. About 45 % of the catchment of Ghaghara is in India.
- D) Gomati** : It is the third longest tributary of Ganga.
- E) Gandak** : It originates along Nepal-Tibet border. It enters the plains near Tribeni. It joins Ganga near Hajipur and flows for 425 km in India.

- F) **Burhi Gandak** : It arises in Sumesar hills along India-Nepal border. It joins Ganga apposite Monghyr. It flows for 610 kms.
- G) **Kosi** : It is due to seven headstreams and hence called Saptkosi. The most important tributaries are Tumar Arun and Sun Kosi. The headstreams unite in Triveni in the Mahabharat Ranges of Nepal. Kosi flows for 730 km in India and joins Ganga near Kursela, Bhagalpur.
- H) **Ramganga** : It is born in the Nainital hills of Garhwal. It flows for 596 kms and joins Ganga at Kannauj, Farukkabad, U.P.
- I) **Kali** : It arises in the Trans-Himalayas of Nepal-Kumaon boundary. It is called Sarda after it enters the plains near Tanakpur.
- J) **Son** : It is born in the Amarkantak Plateau. It flows parallel to the Kaimur range and joins Ganga at Danapur in Patna district. It flows for 784 km.
- K) **Damodar** : It is born in Chotanagpur hills close to Palamu. It flows for 541 kms before it joins Ganga (Hooghly), south of Kolkata.

Peninsular Rivers :

- A. **Godavari** Flows for 1465 kms. It is born in the Trimbak Plateau of Sahyadris in Nasik, 80 kms from the Arabian sea. Manjira, 724 km long, is the only important right bank tributary. It joins Godavari near Kondalwadu after passing through Nizamsagar. Penganga (676 km) arises in Buldana range and joins Wardha near Ghughus. Wardha (483 km) joins Wainganga. The united river of Wardha and

Wainganga is called Pranahita which joins Godavari. Downstream of Sironcha, Indravati joins Godavari.

B. **Krishna** : It arises in Mahabaleshwar Plateau, 64 kms from the Arabian Sea. It flows for 1400 kms. The longest tributary is Bhima which arises in Matheron hills. Bhima joins Krishna near Raichur after flowing for 861 kms. Bhima is a left bank tributary. Tungabhadra, a confluence of Tunga and Bhadra, arises from Gangamula hills of Sahyadris. It is a right bank tributary and flows for 531 kms. the other tributaries are Musi, Malprabha, Ghataprabha, and Koyna.

C. **Cauvery** : It arises as Talakaveri in Brahmagiri hills in Coorg district. Its flows for 800 kms. It descends from Karnataka plateau into Tamil Nadu plains as Sivasamudram falls (101 m). It starts forming a delta near Tiruchirapalli. It's northern tributaries are Arkavati, Srimsha, Himavati, Lokpavani and Herangi. The southern tributaries are Lakhshmanatirtha, Kabani, Bhavani and Amaravati. The longest tributary is Bhavani.

D. **Mahanadi**: It is born in the foothills of Dandakaranya near Sihawa in Raipur. The main tributaries in its upper course are Ib, Mand, Hasdeo, Sheonath on the left bank and Ong, Jonk and Tel on the right bank. The total length of Mahanadi is 857 km.

E. Brahmani: Flows for 800 kms after its birth near Rourkela. Its headstreams are Koel and Sankh.

F. Suvarnarekha: It is born in the Ranchi Plateau and forms part boundary of Bengal and Orisha in its lower course. It joins Bay after flowing for 395 km. Its basin states are Jharkhand (71%), Orissa (16%) and W.Bengal (18%).

G. Pennēru: It is born in the Nandi Durg hills of Karnataka. It enters A.P. and then flows into Bay after flowing for a total distance of 597 km.

H. Narmada: It is born in Shahdol district of M.P. in the Amarkantak plateau. It flows via the rift between Vindhya and Satpuras. Its total length is 1310 km of which 1078 km lies in M.P. In Jabalpur, it forms the Dhuandhar falls (15 m). Its tributaries are Hiran which is a right bank tributary and joins Narmada close to Chhindwara. The other right bank tributaries are Barna, Kolar, and Orsang. The left bank tributaries are Burnher, Banjar, Shakkar, Tawa, Kundi and Shar.

I. Tapti: It arises in Betul plateau in a tank in Multai in Satpura hills. Its main tributary is Purna which joins Tapti in Khandesh (between Satpura and Ajanta Ranges). It flows for 730 kms and its lower 48 km is in a tidal stretch. The other tributaries are Arunavati, Gomai and Ganjar.

J. **Sabarmati**: It is born due to confluence of Hathmati and Sabar. It arises in Mewar hills and flows for 320 kms. The tributaries are Wakul, Vatrak and Hathmati.

K. **Mahi** : It is born in the Vindhyan ranges. It flows for 533 kms. The basin states are Rajasthan, M.P. and Gujarat.

L. **Lune** : Also called as Salt river. It is born in the Aravallis of Ajmer. It flows for 482 kms.



LANDFORMS - COASTAL PLAINS OF INDIA

West Costal Plains : The west coast is about 1400 kms long, and 10-80 kms broad. The Konkan coast (about 500 kms long), stretches between Daman and Goa. The Konkan coast is a **submerged coast** and is a faulted coast. Rocky hills of the Sahyadris reach the sea in and around Goa. The Kanara coast occurs off Karnataka and is a submerged coast. It is very narrow and confined to stream courses. The maximum width of the Kanara coast occurs in the valley of **Netravati** in Mangalore. From Cannanore to Kanya Kumari, the west coast is called Malabar coast. It runs for a length of 550 kms and is anywhere between 20-100 km wide. It is an emerged coast and falls in the category of a belted coast. Periyar is the longest river along the Malabar coast.

East Coastal Plains: These lie between 8°-2°N and are broader than the west coastal plains with well developed deltas of major rivers. The general name of east coastal plains is Coromandel coast. The east coast is an *emerged coast* and is characterised by a straight shore line. The coast off Tamil Nadu is the Tamil Nadu plains which stretch for about 675 kms. The middle

stretch is called the Andhra Plain where the *east coast becomes the broadest*. The coast off Orissa constitutes the Utkal plains with many beach ridges. Lake Chilka is the largest saline lake of Asia lying within the Utkal coast.

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SOILS OF INDIA

1. **Black Soils**: Derived from the basalts (the volcanic rocks) of the Deccan plateau. The black colour is due to the presence of titanium bearing iron and to a certain extent humus. Also called Regur soils, Black Cotton soils or Tropical Chernozem soils. The soils are poor in nitrogen, phosphorous but rich in humus, potassium, calcium, magnesium and lime. The soils are fertile because they contain water soluble salts and because they retain moisture. The largest occurrence of Black soils is in Maharashtra. They also occur in Malwa and Kathiawar.
2. **Alluvial Soils**: The most dominant soils by volume. In the northern plains they show belts in the form of Bhabhar, Terai, Bangar and Khadar. They do not show any horizons and have a loamy texture. Poor in humus, nitrogen and phosphorous but rich in Potassium. Their fertility is due to diversity of mineral species within them and due to the rich subsurface water resources. Usar soils are alluvial soils of Punjab with high concentration of sodium salts.
3. **Red Soils** : These are made up of Red and Yellow soils. They have been developed from the very old granitic rocks of Peninsular India. Their red colour is due to iron oxides. The yellow soils have a coating of hydrated oxide of iron which is yellow in colour. The Red soils are poor in nitrogen, phosphorous, humus and lime (calcium oxide) but are rich in iron and potassium. They red soils are the most widespread in Tamil Nadu and occur throughout peninsular India wherever the granitic rocks occur. The red soils are the most widely distributed soils of India.
4. **The Lateritic Soils** : These occur as cappings on hill tops/ plateau tops. They have developed due to intense chemical weathering of rocks (i.e., intense leaching) and hence have only iron and aluminium oxides (because every other element has been leached away). They are very infertile. They are clayey and show a lumpy appearance. These soils are residual.

5. **The Desert Soils** : The desert soils of Rajasthan represent the sands of the continental shelf of the Arabian sea. They are light coloured and have a high percentage of water soluble salts. They are poor in nitrogen, humus and clay. They are rich in phosphorous, potassium, calcium and sodium. The desert soils of Thar are very rich in phosphates.
6. **Forest Soils** : These are rich in humus. In higher mountainous regions the forest soils are called Podsols which are acidic. In higher elevations, the forest soils are called mountain meadow soils.
7. **Saline and Alkaline Soils**: These soils contain high concentrations of sodium, magnesium, and calcium. The alkaline soils are deficient in nitrogen but rich in calcium and magnesium. The saline and alkaline soils are called by different names like Reh, Kallar, Usar, Chopan and Tur.



VEGETATION AND FORESTS OF INDIA

Types of Forests :

A) **Tropical wet forests.** These are made up of Tropical Evergreen, Tropical semi-evergreen Tropical Dry Evergreen and Tropical Moist Deciduous forests.

1. **Tropical Evergreen Forests** : These develop in regions with rainfall more than 250-300 cms a year. They cover 49% of total forest area. They are found in areas below a height of 900 metres in W. Ghats, Northeast, Andaman and Nicobar and West Coastal Plains. The species are broadleafed evergreens. The species are Rosewood, Ebony, Mahogany, Rubber, Ironwood, Gurjan and Sissoo.
2. **Tropical Semi-evergreen Forests** : They occur in regions receiving between 250-200 cms of rainfall. They are made up of evergreen and deciduous species. They occur in northern parts of W. Bengal, Orissa hills and Coast, and parts of Andaman and Nicobar. The species are Champa, Rosewood, Laurel and Aini.
3. **Tropical Dry Evergreen Forest** : These occur along Tamil Nadu coast and have developed under northeast monsoon rainfall. The average annual rainfall is above 100 cms. The species are evergreen and include Palms, Casuarina, Khirni, Jamun and Neem.
4. **Tropical Moist Deciduous Forests** : These have developed in regions with 100-150 cms of rainfall. Sal is more widespread than Teak because Sal grows in

more humid conditions. The other species besides Sal and Teak are Sandalwood, Kusum, Ebony, Khair and Shisham. They are distributed in northeast, eastern slopes of Himalayas and Central Plateaus.

B) **Tropical Dry Forests** : These are made up of :

1. **Tropical Dry Deciduous Forests** : They develop in regions with rainfall between 75-100 cms. They occur on the low hills of A.P., T. Nadu, Karnataka, Maharashtra and M.P.. The species are teak, (which dominates in western and central India) Sal (which dominates in east, northeast and north India), Khair, Tamarind and others.
2. **Tropical Thorn Forests** : These have developed in regions with rainfall between 60-100 cms. The vegetation is deciduous, of low density and made up of low trees which are thorny. These forests are distributed in Rajasthan, northern Gujarat, the drier parts of Deccan etc. The species are Tamarind, Babul, Kikar, Date Palm Euphorbia and Cacti.

Temperate Forests : These include temperate evergreen forests, and coniferous forests.

1. **Temperate Broadleaf Hill Forest** : These occur in altitudes between 900-1800 metres where the annual rainfall is 75-125 cms. The forests are a mixture of tropical and temperate evergreen forests. These are found in highlands of

Chattisgarh, Nilgiri and Palni Hills and lower slopes of Eastern Himalayas. The species are Magnolia, Deodhar and Hemlock. Evergreen Oak and Chestnut are the temperate hardwood species.

Shola Forest is a special type of temperate broad leaf hill forest. It a type of rainforest which originated millions of years ago and is found in Nilgiris (especially in Silent Valley region of Kerala). The trees are short with leathery leaves and the forests are dense.

2. **Sub-Tropical Dry Evergreen Forest** : This occurs in a restricted area in the Bhabar, the Siwaliks and the Western Himalayas upto 1000 m. The rainfall is between 100 cm - 50 cm. This is a shrub forest of evergreen trees and grasses. Olive and Acacia are the important species.
3. **Montane Wet Temperate Forests** : These occur in altitudes between 1800 m - 3000 m where rainfall is 150-300 cms. They occur in the higher hills of Tamil Nadu, Kerala, Eastern Himalayas of Assam and W. Bengal. The important species are Oak, Deodhar (a conifer), Pine and Magnolia.
4. **Montane Moist Temperate Forests** : These occur in the temperate region of eastern and western Himalayas between heights of 1600 m to 3500 m. The rainfall is between 250-150 cms. The dominant species are the conifers though some temperate broadleaf evergreen species like the Oak occur. The conifers are Spruce, Deodhar, Pine and Birch.
5. **Alpine Forests** : These occur at elevations between 2900-3500 meters. They are a mixed forest of low height (i.e., shrub) temperate deciduous and temperate evergreen

species. They are made up of Fir, Spruce, Birch, Juniper and Rhododendron. At elevations higher than 3500 m (and upto 4500 m) the vegetation is made up of Alpine Grass.

Tidal / Littoral / Swamp Forests : These are tropical forests which grow in inter-tidal zones of the littoral areas where rainfall is between 40 cms to 200 cms. They are made up of the salt tolerant species which grow in brackish water conditions. They include the mangrove forests. They are evergreen. The typical species are Sundari, Pine, Coconut, Agar etc.



CLIMATE OF INDIA

The India Meteorological Department (IMD) has divided India's climate into the following :

- A) **Cold Dry Season** : This lasts between November to March. The northern two-thirds of India has mean temperatures below 21 degrees centigrade. The southern one-third is relatively warmer and does not have a distinct winter. The 20 degrees centigrade. isotherm follows the Tropic of Cancer. South of the Tropic of Cancer, temperatures are above 20 degrees centigrade. For e.g., January temperatures over Thiruvananthapuram is 31 degrees centigrade. January in this season is the coldest month and Dras and Kargil record lowest temperatures. India is affected by Western Disturbances - the temperate cyclones born over the Mediterranean and Red Sea. These occlusions bring snowfall to Western Himalayas and rainfall to north India. J & K, Delhi, Punjab, Chandigarh, Haryana and Rajasthan get some rainfall in January and February. NE India also gets rainfall in this season due to Northeast Monsoons. The isotherm of 18 degrees centigrade. is representative of India in this season. The northern state are frequently affected by cold waves in this season.
- B) **Hot Dry season** : This lasts between March to beginning of June . The season has no prevailing winds. The highest air temperatures of 48 degrees centigrade. are recorded at Barmer, Rajasthan in May and the highest temperature in Punjab and Haryana are recorded in June in Rajasthan and adjoining M.P. N. India is affected by heat waves and also dust storms. Towards the end of May, thunderstorm related rainfall occurs. These are the pre-monsoon showers called Mango showers in Kerala, Bordoichilla in w. Bengal and Assam, and Kalbaisakhi in W. Bengal. The 30 degrees centigrade. isotherm encloses most of India.

Malabar may receive between 25-15 cm of rain in this season and Assam may get 50 cms of rain. Maximum May temperature of select stations are : Sri Ganganagar – 54 degrees centigrade. 2. Jodhpur – 41 degrees centigrade.

- C) **Hot Wet Season** : This is between June and September and is the season of Southwest monsoons. It is the season of maximum rainfall. The landmass of India gets 78.7% of the rain in this season. Monsoon depressions i.e., low pressure systems are born in the monsoon trough covering the head of the Bay of Bengal. These bring rainfall to east India. The southwest monsoon is in the form of two branches – the Arabian Sea branch and the Bay of Bengal branch. Both these branches eventually merge over the Chotanagpur Plateau. The stream of Arabian Sea branch are: first stream reaches Western Ghats between 10° - 20° north. Bombay gets 190 cms of rain, Khandala (50 km east) gets 460 cms of rain and Pune (160 kms away from Bombay) gets 50 cms of rain. The second stream blows through Narmada – Tapti trough giving rainfall to Khandesh and Nagpur. The third stream is parallel to the Aravallis except southeastern Aravallis where Mt. Abu gets 170 cms of rain. The streams of the Bay of Bengal branch - The first stream crosses the Ganga delta and reaches Meghalaya. Cherrapunji (25° north) gets 1102 cms of rain, Mawsynram (16 kms from Cherrapunji but on the same latitude) gets 1221 cms of rain. Guwahati (90 kms from Cherrapunji) gets 161 cms of rain. The second stream reaches the Himalayan foothills and brings the rain to the plains. Kolkata gets 119 cms, Patna – 105 cms, Allahabad – 91 cms, Delhi – 51 cms and Bikaner – 24 cms. The Tamil Nadu coast is the rainshadow region of Arabian Sea branch and is parallel to the Bay of Bengal branch. The southwest monsoon establishes itself by 1st June over the Malabar Coast, by 10th June over Bombay, by 15th June over the Ganga plains and by 1st July over the Punjab-Haryana plains. On 60% of the occasions the onset

is between 29th May to 7th June. The 7th June isoline is on Kolkata.

The rainfall in July of select stations is: 1. Cherrapunji – 2446 mm 2. Jaisalmer–90 mm

Origin of the Monsoon :

A) Classical Theories :

1. **Halley's Thermal concept** : Indian monsoon is because of thermal contrast between Indian Subcontinent and adjoining Indian Ocean. Halley's theory, suggested in 1686, considers the summer monsoon to be a regional phenomenon.
2. **Aerological concept** : This was suggested by R. Scherhag in 1948. According to this theory, monsoonal circulation develops due to changes in air temperature at all levels over the Indian Subcontinent and adjoining Indian Ocean.

B) Modern Theories :

1. **Dynamic Theory** : Flohn (1951). According to Flohn, the monsoon is a global phenomenon due to global shift in pressure belts. The shift in pressure belts bring the ITC much more into the northern hemisphere and its northern margin is around 30 degrees north over the Indian Subcontinent. This brings the SE trades over the Indian subcontinent as south westerly monsoons. Similarly, the shift in pressure belts globally when it is winter for the N. Hemisphere pushes the ITC to a little more south of the equator. This brings the sub-tropical high on to the southern slopes of Himalayas and hence the NE

trades blow from northeast to southwest as northeast monsoons.

2. **Tibet and Easterly Jet** : Dr. P. Koteswaram and Flohn concluded that heating of Tibet in summer strengthens the monsoonal circulation. With an average height of 4 kms above the MSL, Tibetan surface is warmed in summer and generates ascending warm air. The air turns to its right and sinks over the Arabian sea and joins the southwesterly winds thereby strengthening the monsoon. This circulation is part of the tropical easterly jet stream.
3. **Role of Sub-Tropical westerly Jet** : The Sub-tropical Westerly Jet normally located on the south slopes of Himalayas and the northeast plains disintegrates in summer due to intense heating of the northern plains and the global shift in pressure belts to the north in summer of the northern hemisphere. This facilitates the onset of the monsoon over India by facilitating the development of the monsoon trough.
4. **The Somali Jet** : The offshore areas of Somalia develop cold waters due to upwelling giving birth to the Somali Current. The cold waters lead to low temperature along Somali Coast (15 degrees centigrade) whereas along Mumbai, the temperature is 30 degrees centigrade. This thermal gradient leads to development of the Somali Jet stream blowing from Western Arabian sea to the eastern Arabian sea. This adds moisture bearing winds to the southwest monsoon.

AGRICULTURE

Basic Facts: The largest area under foodgrain and the largest producer of foodgrain is U.P. The largest area under non-foodgrain crop and the largest producer is Maharashtra. The largest producer of kharif foodgrain and rabi foodgrain is U.P. The largest average size of land holdings 1. Rajasthan 2. Punjab 3. Gujarat 4. MP (smallest is in Kerala).

Facts about crops :

Rice: Most of the rice crop is raised in regions with an average monthly temperature of 24°C and average annual rainfall of 150 cms. Deep fertile clayey soils or loamy soils are best. In east coast plains, Bengal plains and Konkan plains, rice is raised throughout the year and hence these regions are rice monoculture zones. The largest area under rice and the largest producer is West Bengal. The second and third largest producers are Punjab and U.P.

Wheat: This is the most important rabi cereal crop. In India wheat is grown in regions with not more than 75 cms of yearly rainfall. It requires 200 frost free days. The largest area under wheat and the largest producer is U.P. The second and third largest producers are Punjab and Haryana

Coarse cereals :

- A) **Jowar (Sorghum or Great Millet):** It is both a rabi and a kharif crop. It is grown in regions with moderate rainfall and in India it is grown in regions with less than 45 cms of rainfall per year. It requires high temperatures between $27^{\circ}\text{C}-32^{\circ}\text{C}$. The temperature should not drop below 16°C as jowar cannot withstand frost. The largest area under Jowar and the largest producer is Maharashtra.
- B) **Bajra (Rush Millet):** It is a typical short season kharif crop. It grows in regions with 40-50 cms of rain per year and temperatures between $25^{\circ}\text{-}30^{\circ}\text{C}$. It cannot withstand heavy rains and grows in more inferior soils and more dries

conditions than jowar. The largest area under Bajra is in Rajasthan and the largest producer of Bajra is Maharashtra.

- C) **Ragi** : It is mainly a kharif crop. It grows in regions with an annual average rainfall of 50-100 cms and where temperatures are between 20-30°C. The largest area under Ragi and the largest producer is Karnataka.
- D) **Barley** : It is a rabi crop in the northern plains. It requires less rainfall than wheat and can withstand more cool conditions than wheat. It grows in regions with 100-75 cms of rainfall and where temperatures are : 10-15°C. The largest area under Barley. and the largest producer is UP
- E) **Maize** : It is mostly a kharif crop. It requires high temperatures of around 35°C and where annual rainfall averages around 75 cm. It grows best in fertile alluvial soils. The largest producers are Karnataka, A.P. and Maharashtra.

Oilseeds: India cultivates 9 major oilseeds. India has the largest area under oilseeds. Oilseeds are raised throughout India under varied climatic and soils conditions. They are raised both as kharif and rabi crops. India is the largest producer of oilseeds. The major oilseeds that account for bulk of oilseed output are :

Groundnut: India is the world's largest producer. The largest area and the largest producer is Gujarat followed by A.P., Tamil Nadu

Rapeseed -Mustard : The largest area and the largest producer is Rajasthan followed by Haryana and M.P. **Sunflower** : The largest area is in Karnataka and the largest producer is also Karnataka followed by A.P. Maharashtra. **Soyabean**: The largest producer is M.P. In total oilseeds production the leading states are M.P., Rajasthan and Gujarat.

Pulses : India has the largest area under pulses and is the largest producer. Chickpea (gram) and pigeon pea (tur or arhar or red gram) account for half of India's pulses output. The largest producer of gram is M.P. The largest producer of tur is U.P. In general, the largest producers of pulses are M.P., Maharashtra and U.P.

Cotton : It is a kharif crop. India has the largest area under cotton and is the 2nd largest producer after China. Cotton requires temperatures between 21°C to 45°C. It cannot withstand temperatures below 20°C and requires 200 frost free days. The largest producers are Gujarat, Maharashtra and A.P.

Sugarcane : It is a kharif crop. India has the second largest area under cane and is the second largest producer of cane after Brazil. Sugarcane is a typical summer crop as it requires temperatures of 21-27°C throughout the year. It grows best in regions with 150-100 cms of rainfall distributed throughout the year. Sugarcane requires water-retentive soils like clayey soils. The largest producers are U.P., Maharashtra and Karnataka.

Tea : India has the world's largest area and is the second largest producer of tea after China. Tea requires 21° C during its 8-month growing season. It is grown in regions with 200-150 cms of rainfall per year which is distributed throughout the year. It requires well drained humus rich soils which are acidic. The largest area under tea and the largest producer is Assam. India is the fourth biggest exporter of tea in the world.

Coffee : It is a biennial crop. It requires a mean monthly temperature of 24-26°C. It grows best in well drained soils which are slightly alkaline and also potash rich. The coffee tree requires 200-150 cms of yearly rainfall. The largest area under coffee is in Karnataka and the largest producer is also Karnataka. India is the 6th largest producer in the world. 52% of Indian coffee is Robusta and rest is Arabica.

Natural Rubber : It is an equatorial tree. It is the fourth largest producer of rubber in the world. Rubber trees require around 300 cms of rainfall per year which is distributed throughout the year. It requires temperatures between 35°C-25°C and temperature should not drop below 21°C. It grows in well drained soils. The largest area under rubber and the largest producer is Kerala.

Jute : India has the largest area under jute and is the largest producer of jute. Jute requires a hot-humid climate with temperatures between 35°C-25°C and yearly average rainfall of 150 cms. It requires a high relative humidity of 90%. It requires

flooded swampy soils. The largest area under jute and the largest producer is W. Bengal.

Tobacco : India is the third largest producer of tobacco after China and USA. It is grown best in regions with moderate rainfall and moderate temperatures. It requires 180-120 frost free days. The largest area and the largest producer is A.P.

Other Crops : 1. **Cashewnut**: India has the largest area and is the largest producer and exporter of cashew in the world. The largest producer is Maharashtra 2. **Coconut** : India is the 3rd largest producer of coconuts after Indonesia and the Phillipines. The largest producer of coconut in India is Kerala.

Spices Crops : AP has the largest area under turmeric and is the largest producer. Kerala has the largest area under cardomom, ginger and pepper and is also the largest producer of these crops. Karnataka has the largest area and is the largest producer of arecanut.

Fruits: Largest producer of citrus fruits - Maharashtra. Largest producer of grape - Maharashtra. Largest producer of onion - Maharashtra. Largest producer of banana - T.Nadu. Largest producer of apples - J&K. Largest producer of mango - A.P. Largest producer of lemon - A.P. Largest producer of grape-fruits -A.P.

India is the world's largest producer of pulses, mango, banana, oilseeds and the second largest producer of rice and wheat in the world.

Plantation Agriculture: This occupies 1% of total cultivated area and accounts for 6.5% of agro and allied product exports

Fruits : The largest fruits by area are mango, citrus fruits, papaya and guava. The largest producers of fruits are Tamil Nadu, Maharashtra, A.P. and Gujarat.

Vegetables : The largest area under vegetables is tomato followed by onion, brinjal, tapioca and cabbage.

Spices Crops : The largest crops in spices by output are chilly, garlic, turmeric, ginger and coriander.

ALLIED SECTORS OF AGRICULTURE.

DAIRY

Dairy in India : In terms of total production of milk, India ranks first in the world followed by U.S.A. Traditionally, India was perennially short of milk supply and the meagre amount of milk produced was disposed of in the most haphazard manner, affecting both the consumers and the producers adversely.

Operation Flood-I : It was the Anand pattern which inspired launching of Operation Flood-I. The Anand pattern provides for conversion of surplus milk in the flush season into milk powder which could be blended with liquid milk during the lean season. This ensures uniform prices for milk producers throughout the year. The Anand model had the basic features of the first integrated effort for dairy development with the organisation of milk producers into co-operatives eliminating middlemen, collection of milk from the villages, fair and prompt payment to milk producers and an efficient system of transport and milk supply to urban consumers. The three basic features of the Anand model are : village level dairy co-operatives which collect milk, a milk union formed by a number of dairy co-operatives which is responsible for procurement / processing and marketing milk and, a state federation which provides technical, financial support and support for marketing milk.

Operation Flood-I (OF-I) was launched in 1970-71 with an aid from the World Food Programme in terms of skimmed milk powder and butter oil. The immediate objective was to secure a commanding share of the liquid milk market in Bombay, Calcutta, Delhi and Madras and to stabilise the consumption of milk in these cities.

The ultimate aim of OF-I was to link 18 milksheds in 11 states, to 4 metros.

Operation Flood-II: This was launched in 1979 and ran till 1985. This sought to cover one crore rural milk producer families. It aimed at milk marketing in 144 cities other than the 4 metros and included other features such as improvement of breeds, improving fodder supply to milch cattle, promote animal health care and so on.

Operation flood-III : This was launched in 1987 and was completed in 1996. Its immediate aim was to set up 170 milk centres to benefit 250 districts in 22 states.

As a result of these steps, milk production in India went up from 21 m.t. before operation flood to 127 m.t. in 2010-2011. The per capita availability went up from 124 gms / day in 1950-51 to 281 gms in 2010-11. Around 30% of India's milk is produced by the cooperatives.

Infrastructure for Dairy Sector: The Indian Dairy Corporation was set up in 1970 to administer Operation Flood. Earlier, in 1965, the National Dairy Development Board was constituted to assist the development of the dairy sector. The National Dairy Research Institute, Bangalore has its branches in Karnal (Haryana) which offer graduate and post-graduate programmes in dairy science. In addition, a Central Frozen Semen Production and Training Institute has been set up at Bangalore.

The National Dairy Plan was launched in 2011 with an outlay of 17,300 crore. The aim is to increase milk production by cooperatives from 30% to 65% in the next 15 years. Phase - I of the plan will cover 14 major milk producing states.

The top producers of milk in India are U.P., Rajasthan, A.P. and Gujarat.

FISHERIES

Importance: Though fishery sector contributes less than 1% of Indian GDP, it provides sustenance to 14 million people and is a major forex earner.

Potential: Indian marine fishery has 8,118 km coastline, 2.02 million sq. km of EEZ which includes 0.5 million sq km of continental shelf. Freshwater fishery potential is in 195,210 km of rivers and canals, 2.9 million hectares of minor and major reservoirs and 2.4 million hectares of ponds/lakes and 0.8 million hectares of other water bodies. The EEZ alone has a potential of 3.9 m.t. of which around 60% is exploited presently. The Bay of Bengal has rich potential in crustaceans in deep sea fishery. In the Bay of Bengal, pelagic species like mackerel and tuna are abundant. Arabian Sea is rich in tuna. About 75% of marine fish is caught off the west coast.

Infrastructure: In the 5th and 6th 5- year plans, programmes for development of inland fisheries have been started. These are Fish Farmer Development Agencies (FFDA) and National Programme for Fish Seed Development (NPFSD). Under NPFSD many fish hatcheries have been set up. The Central Institute of Freshwater Aquaculture (Kaushalyanganga, Bhubaneshwar) and Central Inland Capture Fisheries Research Institute provide technology support. The Central Institute of Coastal Engineering for Fishery, Bangalore has been upgraded into a centre for Aquaculture Engineering to increase yield of low yield fish. Deep sea fishing stations have been set up at Mumbai (Sassoon Dock), Kolkata, Kochi, Tuticorin and Vishakhapatnam. The Marine Production Export Development Authority (MPEDA) provides support for upgradation of vessels.

The National Fisheries Development Board was set up in July 2006. Parliament passed Coastal Aquaculture Act in 2005.

Production: Fish output has increased more than 10 fold since 1947. According to FAO, India's fish output doubled between 1990-2010. Inland fishery output of India has been more than marine fishery output since 2000-2001. India ranks second in culture fishery output (aquaculture output) after China in the world. India produced 8.5 m.t., of fish in 2011-12. A.P. is India's biggest producer of fish. Other important fish producing states are West Bengal, Tamil Nadu, Gujarat, Odisha, Kerala and Maharashtra. India ranks 10th in the world fishery output (the top four are China, Peru, Chile and Japan).

Poultry : It is a 55,000 crore industry in India (as on March 31, 2012) It employs 6 million people directly/indirectly. India ranks fourth in world egg production and 5th in broiler meat production. 70% of India's poultry industry is in A.P. and Tamil Nadu. A.P. accounts for 1/3rd of India's poultry industry which is mostly concentrated in Telangana region. In Tamil Nadu, much of the industry is in Chennai and Coimbatore. The other important poultry states are Karnataka, Maharashtra, Punjab and West Bengal.

OTHER LIVESTOCK

Sheep : India with 4% of world sheep population ranks 6th in the world. Rajasthan, Karnataka, A.P., Tamil Nadu and Maharashtra account for around 71% of sheep population.

Rajasthan: It has one fourth of total sheep population and is first in wool productions Lohi and Marwari breeds are popular for blanket wool, Bikaneri for carpet wool and Kutchi for meat

and wool. The other breeds are Jaisalmeri, Kathiawari; Pugal, Sonadi and Maipuri.

A.P. : This is second in sheep population and 4th in wool output. The Nellori breed is popular for wool.

Karnataka : It is third in sheep population and also in wool output.

Jammu and Kashmir : In Kishmir, Gurej, Karna, Gaddi, Rampur-Bushair breeds are reared by Gaddis and Gujjars. J & K is the second largest producer of wool.

T. Nadu : Ranks third in sheep population.

GOAT: India has one-sixth of world goat population. About 90% of goats are desi or non-descript with a maximum concentration in Deccan. Angora goat known as Chamba and Gaddi is reared in Himachal, J & K and Haryana. It yields soft Pashmina wool. The Yamuna-Chambal doab has Jamunapuri and provides meat, and milk. The Barabari breed is popular in Western U.P. In Rajasthan, Gujarat and M.P. the Mehsana, Marwari and Zalwadi are cross bred from Jamunapuri. In Deccan, the Barari and Surti are popular.

BUFFALOES: India has 50% of world buffaloes. Buffaloes account for 55% of milk production in India. Murrah is an indigenous breed of Rohtak, Hissar and Gurgaon in Haryana. The Nagpuri belongs to Vidharba of Maharashtra. Nili-Ravi is indigenous to Ferozepur of Punjab. The light coloured Bhadawari is native to Etawah and Agra in U.P. and adjoining parts of M.P. and Rajasthan. The Jaffarabadi with its huge size and large milk yield is native to Gir region of Gujarat. The

largest buffalo population is in U.P. followed by Rajasthan A.P. and M.P.

CATTLE: India has around 20% of world cattle. The best milk breeds of cattle are Gir (Gujarat and Rajasthan), Sindhi (Gujarat, Rajasthan and Maharashtra), Sahiwal (Punjab, Haryana, U.P., and Rajasthan) and Deoni (A.P.). Some drought breeds are Nagori (U.P., M.P., Rajasthan and Haryana) Bauchaur (Bihar), Kenkatha or Kenwariya (U.P., M.P.,), Halikar (Karnataka) and Bargur (Tamil Nadu). Some important dual purpose breeds are. Tharparkar (Gujarat and Rajasthan), Nimari (M.P.), Krishna Valley (Maharashtra), Ongole (A.P.) and Kankrej (Gujarat). The largest cattle population is in Bihar followed by U.P., M.P. and Maharashtra. The density of cattle i.e., cattle per 100 hectares of total cropped area is highest in J&K followed by Tripura, Meghalaya and Manipur.

According to 2007 livestock census India has 648.88 million heads of livestock, the highest in the world. India has 304.42 million cattle and buffaloes. The livestock sector contributes 31.6% of agro GDP and 5.26% of total GDP.

IRRIGATION IN INDIA

Need for Irrigation in India:

1. 70% of the arable land is dependent on the monsoon rains i.e. rainfed. Even during a normal monsoon, the rainfall is adequate for only one-third of the area of the country.
2. Vagaries of the monsoon (like early withdrawal or late onset or a weak monsoon) in even areas of good rainfall makes assured supply of water via irrigation very important.
3. Irrigation is essential to cultivate wet crops (like rice and sugarcane) even in moderate rainfall regions.
4. Irrigation in drought prone areas of India assumes importance because about one-third of the country is drought-prone.

Potential of Irrigation according to the Irrigation Commission (1969 - 1972) :

1. Ganga carries 400 Million Acre Feet (MAF) of water. It is possible to utilise 150 MAF for irrigation purposes.
2. Nearly 300 MAF of the Brahmaputra waters continue to flow annually into the Bay of Bengal. Because of rugged / hilly topography, it is not possible to utilise these waters except through a few medium and lift irrigation schemes in Assam.
3. The entire waters of Godavari, Krishna, Narmada and Tapi can be utilised for irrigation.
4. The west flowing rivers of India (except Tapi and Narmada) carry 200 MAF of water of which 40 MAF can be utilised if they are diverted eastward, and the balance of 160 MAF will continue to flow into the Arabian Sea.
5. The Mahanadi system carries 100 MAF of which 40 MAF flows into the Arabian Sea.
6. Cauvery waters have been fully utilised.

Types of Irrigation in India:

1. **Well Irrigation** : Most widely distributed source of irrigation in India and accounts for largest area of the net irrigated area of the country. Well irrigation is popular in Deccan, Gujarat, Maharashtra, Rajasthan and U.P. and to a small extent, in Punjab and Haryana.
2. **Canal Irrigation** : It is the principal source of irrigation in the plains and accounts for the second largest area of the net irrigated area of India. It is most intensely distributed in the Northern Plains of India due to factors such as : perennial nature of Himalayan rivers; gradual and gentle slopes of these plains which make possible canal irrigation in the lower valleys; absence of rocky ground in these plains; definite volumes of water discharged by the Himalayan rivers and finally the fertile soils of these plains which make possible reaping greater yields with irrigation.
3. **Tank Irrigation** : This accounts for the third largest area of the net irrigated area of the country and is well developed in Tamil Nadu, A.P. and Karnataka. W. Bengal, Orissa and Kerala also have considerable acreage under tank irrigation.

Major Irrigation Projects of India:

Important Irrigation Projects :

1. **Bakra and Nangal** : Across Sutlej. Bhakra is one of the highest gravity dams in the world. It is a joint venture of Punjab, Rajasthan and Haryana. The Govind Sagar lake is the reservoir of Bhakra.
2. **Thein Dam** : It is across Ravi in Punjab.
3. **Dulhasti Project** : It is across Chenab in Jammu and Kashmir.

4. **Salal Project** : It is across Chenab in Jammu and Kashmir.
5. **Beas Project** : Across Beas in Punjab. It is a joint venture of Punjab, Haryana and Rajasthan.
6. **Sharda Sahayak Project** : It is across Ghaghara in U.P.
7. **Rihand Project** : It is across Rihand in U.P.
8. **Mayukrakshi Project** : It is across Mayurakshi in W. Bengal.
9. **Damodar Valley Project** : It is a multipurpose project across Damodar and is shared by Jharkhand and W. Bengal. It includes 4 dams - Maithon and Tilaiya (on Barakar river), Konar (on Konar River) and Panchet (on Damodar river).
10. **Hirakud Project** : It has the world's longest mainstream dam. It is across Mahanadi in Orissa.
11. **Nagarjunasagar Project** : The Nagarjunasagar dam is the world's tallest masonry dam, across Krishna in A.P.
12. **Pochampad Project** : It is across Godavari in A.P.
13. **Jayakawadi Project** : It is across Godavari in Maharashtra.
14. **Upper Krishna Project** : It is across Krishna in Karnataka.
15. **Tungabhadra Project** : It is across Tungabhadra in Karnataka and is a joint venture between A.P. and Karnataka.
16. **Gandak Project** : It is an international project between India and Nepal across Gandak. It is in U.P.
17. **Kosi Project** : It is another international project between India and Nepal across Kosi in Bihar.

18. **Chambal Project** : It is a multipurpose project between Rajasthan and M.P. It includes the Gandhi Sagar Dam (M.P.), Rana Pratap Sagar Dam (in Rajasthan) and the Kota Dam or the Jawahar Sagar Dam (in Rajasthan).
 19. **Tawa Project** : It is across Tawa, a tributary of Narmada in M.P.
 20. **Mahi Project** also called Jamnalal Bajaj Sagar Project. It is across Mahi in Gujarat.
 21. **Matatila Project** : It is across Betwa. It is a joint venture between U.P. and M.P.
 22. **Ukai Project** : This is across Tapi and is in Gujarat.
 23. **Kakrapara Project** : This is across Tapi in Gujarat.
 24. **Sharavati Project** : It is near Jog Falls across Sharavathi in Karnataka.
 25. **Malprabha Project** : It is across Malprabha, a tributary of Krishna in Karnataka.
 26. **Bhima Project** : It is across Bhima in Maharashtra.
 27. **Mettur Project** : It is across Cauvery in Tamil Nadu.
 28. **Shivasamudram Project** : It is across Sivasamudram Falls created by Cauvery in Karnataka.
 29. **Ghatprabha Project** : It is across Ghatprabha, a tributary of Krishna in Karnataka. It is a joint venture between A.P. and Karnataka.
 30. **Chukka Project** : An international project between India and Bhutan across Teesta.
- U.P.** has the largest area under well irrigation followed by Rajasthan, M.P. and Gujarat.
- U.P.** has the largest area under canal irrigation followed by M.P., A.P., and Rajasthan.
- A.P.** has the largest area under tank irrigation followed by Tamil Nadu, Maharashtra and Orissa.
- U.P.** has the largest area under irrigation.

Miscellany:

1. **Major Irrigation Scheme** : These have a culturable command area of more than 10,000 hectares.
2. **Medium Irrigation Schemes** : These have a culturable command area between 10,000 to 2,000 hectares.
3. **Minor Irrigation Schemes** : These have a culturable command area of less than or upto 2,000 hectares.

ENERGY RESOURCES OF INDIA

Introduction: Energy resources of India can be divided into commercial and non-commercial. The non-commercial energy resources are traditional and include fuelwood, charcoal, cowdung; agricultural / animal waste and animals on farms. Non-commercial energy sources meet around 40% of India's energy requirement, especially in the rural and the domestic sectors. Among the non-commercial energy sources, fuelwood alone accounts for 65% of the source. The commercial energy sources are coal, oil and gas and electric power. Coal meets 55% of India's commercial energy requirement. Thousands of medium and small scale industries depend on coal for their process and energy requirements. Oil and gas account for around 43% of India's commercial energy sources. In general, the share of non-commercial fuels in the total energy consumption has come down from 74% in 1950-51 to around 35% today. Relatively, the share of commercial energy has gone up in the same period.

Electric Power : This is a major source of commercial energy in India produced from of water, coal, oil and natural gas, uranium and others. The major sources of electric power are however water, coal, followed by radioactive nuclear minerals and oil and natural

gas. Of the total installed capacity to generate electric power, the installed capacity in thermal power is around 65.16%, the installed capacity in hydro power is around 21.8%, while it is 2.7% for nuclear power, and renewable energy accounts for 11% of installed capacity. In general, of the total capacity, the central sector accounts for 32% of installed capacity, the states sector accounts for 41% and the Private sector accounts for 27%.

Per capita consumption of electric power : The per capita power consumption in India was 778 KWh in 2010 while the world average was 2782 KWh. Western India has the highest per capita power consumption followed by South India, North India, East India and the Northeast. Delhi has the highest per capita consumption of power followed by Punjab.

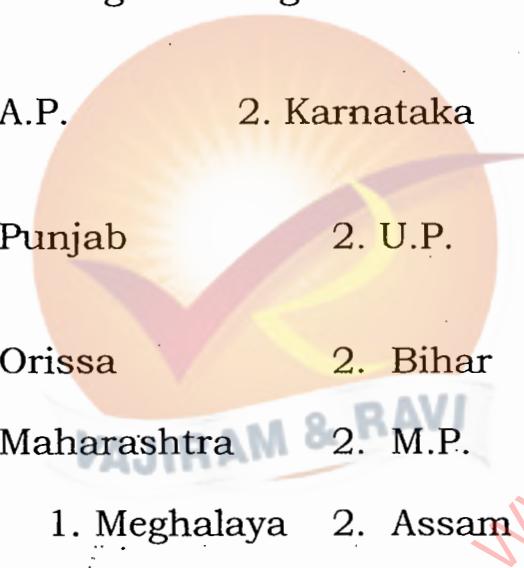
Hydel Power : The hydel power potential of India is placed around 84,000 MW at 60% PLF. Arunachal Pradesh has the largest hydel power potential of 26,756 MW, followed by Himachal Pradesh (11,647 MW), Uttar Pradesh (9,744 MW) and Jammu and Kashmir (7,487 MW) in that order. The oldest hydro power plant is the Darjeeling power plant set up in 1897. The following table shows the potential of hydel power and its development in different regions of India.

REGION	POTENTIAL (IN MW)
1. Northeastern	31,857
2. Northern	30,155
3. Southern	10,763
4. Western	5,680
5. Eastern	5,590

Thus, the largest hydel power potential of India is in the Northeast but has been least exploited. Most hydel power development has occurred in the northern region in terms of absolute power generated. But in terms of potential present and developed potential, the southern region leads in India.

Thermal Power : Coal based power plants, atomic power plants and oil/gas based power plants come under this category. It has already been mentioned that thermal electric power is the major source of electric power in terms of installed capacity and output. Coal based thermal power plants account for 56% of installed capacity and 70% of electric power produced. Natural gas based power plants account for around 9.3% of installed capacity in electric power.

The leaders in installed capacity for power generation (from all sources) in respective regions are given below :

- 
- A. South : 1. A.P. 2. Karnataka 3. Tamil Nadu 4. Kerala
 - B. North : 1. Punjab 2. U.P. 3. Rajasthan
 - C. East : 1. Orissa 2. Bihar 3. W. Bengal
 - D. West : 1. Maharashtra 2. M.P. 3. Gujarat
 - E. Northeast : 1. Meghalaya 2. Assam

Installed capacity in states in Thermal power:

- 1. Maharashtra 2. Gujarat 3. West Bengal 4. U.P.

Installed capacity in Hydro Power in States:

- 1. A.P. 2. Karnataka 3. Maharashtra 4. Punjab

Total Installed Capacity : 1. Maharashtra 2. A.P. 3. Gujarat 4. Tamil Nadu

Some Important Power Projects:

1. **Lower Sileru Hydel Power Project :** An important power project in A.P. It is a hydel power project across the sileru, a tributary of the Godavari and the total Potential planned is 600 MW.
2. **Kothagudem Thermal Power Project :** Situated in the Singareni coalfield of A.P. The total installed capacity is 240 MW (completed), and 110 MW (to be completed).
3. **Dhuvaran Thermal Power Satation :** This is located in Dhuvaran, close to Cambay in Kheda district of Gujarat. The total installed capacity is 534 MW. This is based on natural gas.
4. **Sabaragiri (Pamba - Kakki) Hydel Power Project :** An important power project of Kerala, located southeast of Kottayam. It has 3 storage dams, the Pamba dam, the Kakki dam and another flanking dam. The total power potential is 300 MW.
5. **The Idduki Hydel Power Project :** This is the most important power project of Kerala and has three storage dams across Iddiki, Periyar and the Cherutheni rivers, all in Iddiki district of Kerala. The total installed capacity is 390 MW.
6. **Korba Thermal Power Station :** This is located near the Korba coalfield in Bilaspur district of M.P. and has a total installed capacity of 300 MW.
7. **Satpura Thermal Power Station :** This is in Betul district of M.P. with a total installed capacity of 342 MW. The power is shared between Rajasthan and M.P.
8. **Koyna Hydel Power Project :** This is across the Koyna in Satara district of Maharashtra and has an underground power house at Pophali below the W. Ghats. The total capacity is 860 MW.
9. **Nagpur Thermal Power Station :** This is located north of Nagpur in Maharashtra and has an installed capacity of 480

MW. This serves the Vidharbha and Marathwada regions and is based on coal locally available at Nagpur.

10. **Kalinadi Hydel Power Plant** : Across Kalinadi, a west flowing river of the W.Ghats and is in N. Kanara district of Karnataka. The power potential to be eventually created is close to 1300 MW.
11. **Sharavati Hydel Power Project** : It is one of the largest hydel power projects in India and is in Shimoga district of Karnataka. The total installed capacity is 891 MW.
12. **Talcher Thermal Power Station** : Located in Talcher in Orissa, it has an installed capacity of 250 MW.
13. **Kundah Hydel Power Project** : It is across the Kundah and its tributaries in the Nilgiri Hills in Tamil Nadu. The ultimate potential will be around 530 MW.
14. **Neyveli Thermal Power Project** : The project is based on the local availability of lignite in Neyveli and has a total installed capacity of 600 MW.
15. **Obra Thermal Power Plant** : This is in Mirzapur district of U.P. and is based on coal supplies from M.P. The total installed capacity is 250 MW and around 900 MW more is planned to be added. The coal is supplied by Singrauli coal field in M.P.

The other power projects in various states are :

1. **National Capital Territory Region of Delhi**
 - a. Badarpur Thermal Power Plant
 - b. Indraprashtha Thermal Power Plant
2. **Haryana**
 - a. Faridabad Thermal Power Plant
 - b. Panipat Thermal Power Plant
 - c. Surajpur Thermal Power Plant
3. **Jammu and Kashmir**
 - a. Kalakote Thermal Power Plant

4. Punjab

- a. Bhatinda Thermal Power Plant

5. U.P.

- a. Harduaganj Thermal Power Plant
b. Rensugar Thermal Power Plant
c. Panki Power Plant
d. Upper Ganga Hydel Power Project
e. Sarda Hydel Power Project (across Sarda in Nainital)

6. Gujarat

- a. Ukai Thermal Power Plant
b. Gandhinagar Thermal Power Plant
c. Uttran Thermal Power Plant
d. Sabarmati Thermal Power Plant

7. Madhya Pradesh

- a. Satpura Thermal Power Project
b. Amarkantak Thermal Power Plant

8. Maharashtra

- a. Nasik Thermal Power Plant
b. Khaperkheda Thermal Power Plant
c. Paras Thermal Power Plant
d. Bhusawal Thermal Power Plant
e. Parlia Thermal Power Plant
f. Ballarshah Thermal Power Plant
g. Tata Hydel Power Project

9. A.P.

- a. Vijayawada Thermal Power Plant
b. Ramagundem Thermal Power Project
c. Nellore Thermal Power Plant
d. Machkund Hydel Power Project (between Orissa and A.P. across Machkund in Orissa).

10. Tamil Nadu

- a. Ennore Thermal Power Plant
b. Tuticorin Thermal Power Plant
c. Pykara Hydel Power Project (across Pykara river in Nilgiris).
d. Mettur Project (across Cauvery).

11. Bihar

- a. Patratu Thermal Power Plant
- b. Barauni Thermal Power Plant.

12. West Bengal

- a. Calcutta Electric Supply Corporation
- b. Bandel Thermal Power Plant
- c. Durgapur Thermal Power Plant
- d. Satnaih Thermal Power Plant

13. Assam

- a. Kamrup Thermal Power Plant
- b. Chandrapur Thermal Power Plant
- c. Namrup Thermal Power Plant (based on natural gas)

14. Karnataka

- a. Sivasamudram Hydel Power Project (makes use of Sivasamudram Falls developed by Cauvery).

Non - Conventional Energy Sources

1. **Solar Energy** : The potential of solar energy is 35 times more than the total installed capacity of India. The Ministry of Non-conventional Energy sources has declared the Jodhpur - Jaisalmer stretch of the Thar desert as a Solar Energy Enterprise Zone. The largest installed capacity in Solar Power is in Tamil Nadu.
2. **Tidal Power** : Tidal Power along the Indian coast has a potential of 8000 MW. The Gulf of Cambay and the Gulf of Kutch have a high range of tides and have a potential of over 1000 MW each. Pilot plants to produce tidal power are at Vizhingam (Kerala), Thangaserry (Kerala) and Car Nicobar.
3. **Wave Energy** : The coastline of India has a potential of 40,000 MW of wave energy. A pilot plant to produce wave energy is being set up at Kovalam, Kerala.
4. **OTEC Power** : Ocean Thermal Energy Conversion (OTEC) potential of Indian Coasts is around 50,000 MW. A pilot plant to produce power from OTEC is being set up at Kulashkarapatanam, Tamil Nadu.

5. **Geothermal Energy** : This depends on thermal gradients in the earth's interior in the vicinity of fractures and faults. A pilot plant is coming up at Parbati valley, Himachal Pradesh
7. **Wind Power** : The Wind Power Potential of India is 20,000 MW. India has already created an installed capacity of 17,000 MW. Tamil Nadu has the largest installed capacity



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TRANSPORT GEOGRAPHY OF INDIA

Roadways : The road route length of India is 33,16,452 kms and is the second largest network in the world after USA. In terms of percent of villages connected by all-weather roads, Kerala leads followed by Haryana, Punjab and Gujarat. a) Route length of national highways is highest in M.P. b) Route length of state highways is highest in Maharashtra c) Road density is highest in Kerala. d) Total road route length is longest in Maharashtra.

National Highway Development Programme includes Golden Quadrilateral (Phase-I), North-South Corridor (Phase-II) and East-West Corridor (Phase-II). North-South Corridor will be 4000 kms long between Srinagar and Kanyakumari. East-West corridor will be 3300 kms long between Silchar and Porbander. The Golden Quadrilateral includes : Delhi - Kolkata corridor will have route length of 1453 km. Mumbai - Chennai corridor will have a route length of 1290 km. Kolkata -Chennai corridor will be 1684 km long. Delhi - Mumbai corridor will be 1419 km long.

Asian Highway – I : This touches Dawki (in Meghalaya along India – Bangladesh border) and Moreh (In Manipur along India – Burma border)

Dedicated Freight Corridors: These are part of the Delhi – Mumbai Industrial Corridor Project. The two corridors are : Eastern DFC – This will be between Dankuni (near Kolkata) to Ludhiana with a length of 1804 kms and will pass through U.P., West Bengal, Jharkhand, Bihar, Punjab and Haryana. Western DFC – This will be between Dadri in U.P. to Jawaharlal Nehru Port with a length of 1483 kms and will pass through Rajasthan, Gujarat, Maharashtra and Haryana. Four more freight corridors will be set up separately which will be Kolkata – Mumbai, Kharagpur – Vijayawada, Chennai-Goa and Delhi – Chennai.

Trans Asia Rail : This will be developed by 28 nations. The southern corridor will be between Kunming in China and Bangkok in Thailand till Kapikule in Bulgaria. The Southern corridor will

connect China, Thailand, Myanmar, Bangladesh, Pakistan, India, Iran and Turkey. It will enter India in Manipur and go into Bangladesh and again enter India at Gede along India – Bangladesh border and will go to Pakistan via Attari. It is a project of ECOSOC for Asia – Pacific.

Major Ports :

- 1) Mumbai Port : Biggest port, natural harbour handles dry cargo.
 - 2) Nhava Sheva Port (Jawaharlal Nehru Port) - To ease congestion of Bombay Port. Natural harbour.
 - 3) Haldia – Estuarine port on Hooghly, auxillary port to ease congestion of Calcutta port.
 - 4) Chennai port : Artificial harbour, mainly handles crude oil and iron ore.
 - 5) Vishakapatnam port : Deepest landlocked port, handles iron ore, crude oil and petroleum products.
 - 6) Kolkata Port : Tidal port, a riverine port with 2 docks.
 - 7) Paradweep port : Joined to national highway -5, mainly handles iron ore, coal and dry cargo. Natural harbour.
 - 8) New Tuticorin port : Artificial harbour, mainly handles coal.
 - 9) New Mangalore Port : Has special facilities to export kudremukh iron ore. Natural harbour.
 - 10) Kandla Port : Set up as an import port to import crude and petroleum products. Located on the mouth of Kandla creek.
 - 11) Marmugoa Port : Set up as an export port. Located on mouth of Zuari creek. Natural harbour.
 - 12) Kochi port : Natural harbour. Handles agro exports and crude imports.
 - 13) Ennore Port : Auxillary port of Chennai port. Artificial harbour.
- The ports in descending order of cargo handled are 1. Kandla 2. Vishakapatnam 3. JNPT 4. Mumbai 5. Chennai 6. Paradip 7. Marmugao 8. New Mangalore 8. Haldia 10. Tuticorin 11. Kochi 12. Ennore 13. Kolkata

Indian Shipping : India has the largest merchant shipping fleet in the developing world and ranks 19th in the world.

Shipbuilding Industry : Biggest shipyard : Kochi shipyard limited. The other important shipyards are Hindustan Shipyard Ltd. at Vishakapatnam, Hoogly Dock and Port Ltd. with two units at Sakia and Nazirgunge in Howrah, Garden Reach Shipbuilding Yard at Kolkata and Bombay Shipyard which includes Mazagaon Docks Ltd. (to construct battleships for the Indian Navy. The Western India Shipyard Ltd. has ship repair facilities at Marmugao.

Indian Railways: Indian rail network is the fourth largest in the world after USA, China and Russia. Indian Rail accounts for 30% of freight traffic of India. Indian railways is organised into 16 zones. Among the 16 rail zones, the northern zone (headquarters -New Delhi) has the longest rail route length. The important rail works are : Chittaranjan Loco Works - Burdwan, W. Bengal. Makes electric locos. Diesel Loco works - Varanasi; produces diesel engines. Integral Coach Factory - Perambur (near Chennai) – produces all types of coaches. Rail Coach Factory - Kapurthala (Punjab) – produces all types of coaches. Bharat Earth Movers (Bangalore) - manufactures broad guage coaches. The new rail coach factory at Lalgung, Rae Bareli (U.P.), has been commissioned. It is the third of its kind after Integral Coach Factory, Perumbur and Rail Coach Factory, Kapurthala. In budget 2010-11, new undertaking proposed are Rail Axle Factory at Jalpaiguri, Refrigerated Container Factory at Budge Budge (near Kolkata) and Rail Wagon Factories at Bardhaman and Haldia.

Inland Waterways : National Waterway no. 1 - Allahabad-Haldia. 1620 kms. National Waterway no. 2 - Sadia-Dhubri. 891 kms. National Waterway no. 3- Kottapuram- Kollam. Includes West Coast Canal (168 kms), Champakara Canal (23 kms), Udyogamandal Canal (14 kms). India has 14352 kms of navigable waterways of which 5200 kms are navigable by motorized craft

MINERAL RESOURCES OF INDIA

Fossil Fuel Resources :

Coal : India stands 5th in world reserves of coal and is the 3rd largest producer in the world. India's bituminous coal deposits are contained in Gondwana rocks. The states with the largest reserves of coal (of all categories) are 1. Jharkhand 2. Odisha 3. Chhattisgarh 4. W. Bengal. The largest producer of coal is Jharkhand and the largest producer of lignite is T. Nadu. The main coalfields of India are : Damodar valley coalfields : These include the coalfields of Jharkhand and W. Bengal. These are Giridih, Jharia, Bokaro, Karanpura, Ramgarh and the Raniganj coalfields. The Mahanadi valley coalfields : These include the coalfields of Orissa, M.P., and Chattisgarh. These include Talcher, Sambalpur, Korba, Raigarh and Sonepat. The Son valley coalfields : These are in M.P., Jharkhand and Chattisgarh. These include Singrauli coalfields, Sohagpur, Umaria, Auranga, Daltongunj and Hullar. The Godavari - Wardha Valley Coalfields : These occur in AP and Maharashtra. The Wardha valley fields of Maharashtra are in Kamptee, Umner and Ballarshah. The Godavari valley coalfields of AP include the Singareni fields (like the Kothagudem and Ramagundem fields).

Coalfieds of the Northeast : The coalfields of the northeast occur in younger rock formations and hence the coal deposits are younger and hence of inferior quality. These occur in A) Assam - Maibum fields and Mikir fields. B) Meghalaya - The coalfields are in Jayanti and Bapung. C) Nagaland - The coalfields are in Tiru valley and Borjan. D) Arunachal Pradesh - The main fields occurs in Namchik.

Lignite Deposits : These occur in rocks of tertiary period of the Mesozoic era. The largest reserves of lignite are in 1. T. Nadu. The Lignite deposits of T.Nadu are at Neyveli, those of Rajasthan at Palana (Bikaner), and those of Gujarat occur in Kutch and Bharuch.

Petroleum and Natural Gas: India's 27 sedimentary basins with an area of 1.72 million sq km are potentially hydrocarbon bearing. Around 60% of the prognosticated reserves are in offshore areas. India has 0.6% of world reserves and is the 22nd largest producer of oil in the world.

The important oil basin are : Bombay High : Contains around 60% of Indian reserves. Important oilfields are South Bassein, Panna, Ratna, and Heera. Cambay Basin (Gujarat) : Accounts for around 20% of India's reserves. Important oilfields are : Nawagam, Ankaleshwar, Lunej, Kalol and Gandhar.

Assam Basin : Accounts for around 19% of India's reserves. The important fields are Nahorkatiya, Moran, Lukwa, Digboi and Kiliboi. The other occurrences are : Tripura : Natural gas at Gojalia. Krishna – Godavari Basin (AP) : It is both onshore and offshore. Important fields are Ravva, Mori and Kaikalur. Cauvery Basin (Tamil Nadu) : It is both onshore and offshore. The important fields are Narimanam, Nannilam and Bhuvanagiri. The largest producer of petroleum crude and natural gas is Maharashtra.

Iron Ore: Orissa accounts for largest reserves of high grade iron ore. The main mines are Gurumahisani (Mayurbhanj) Kiriburu (Keonjhar) and Daitari (Cuttack). Jharkhand has large reserves. The main mines are in Noamundi and Gua (Singhbhum). The main mines in Chattisgarh are Bailadilla (in Bastar) and Dhalli – Rajhara (Durg). In Karnataka the reserves are in Kemangundi and Kudremukh (Bababudan hills, Chickmagalur). In Maharashtra the mines are in Lohara and Pipalgaon (Chandrapur) and Ratnagiri district. The largest producer of iron ore in India presently is Odisha. India has the fourth largest reserves after China, Australia and Brazil.

Manganese: India has the third largest reserves and is the third largest producer in the world. The distribution of manganese ore is in : Orissa : Manganese ore occurs in Keonjhar and Koraput districts. In M.P. the important mines are in Balaghat and Chhindwara. In Maharashtra, huge deposits of manganese occur in Nagpur and Bhandara. In Karnataka, the important mines are in Shimoga, Tumkur, Chitradurga districts. In A.P. the

important mines are in Srikakulam and Vishakapatnam districts. The largest producer of manganese is Orissa.

Chromite (Ore of Chromium): India has the 5th largest reserves in the world. The chief mining areas are : Orissa : Sukinda (Cuttack) has very large reserves. Naushahi (Keonjhar) is another important mining region. In Jharkhand the chief mines are in Jojahatu in Singhbhum district. In Karnataka, chromite chiefly occurs in Hassan and Mysore. The largest producer of chromite is Orissa.

Bauxite: India has the 5th largest reserves in the world and is the third largest producer. It is an ore mineral of aluminium. The distribution is : Orissa : Mainly occurs in Kalahandi, Koraput and Sambalpur. Chattisgarh : Main mines are in Amarkantak plateau (Bilaspur and Raigarh districts) and Bailladilla (Bastar). Jharkhand : The chief mines are in Palamu district and Lohardaga district. Gujarat : Huge deposits occur in Banaskantha, Kutch and Jamnagar. M.P. : Main mines are in Katni (Jabalpur). The largest producer of bauxite is Orissa.

Copper: The important mining centres are : Jharkhand : The chief mines are Mosabani and Rakka (Singhbhum district). Rajasthan : Khetri in Jhunjhunu and Dariba in Alwar district. M.P. : Malanjhkand in Balaghat is the main mining centre. Karnataka : Ingladhal in Chitradurga is the main centre. A.P. : Agnigundala (Guntur) and Mailaram (Khammam) are the main centres. M.P. is the largest producer of copper.

Lead: The chief mining centres are : Rajasthan : Mochia – Mogra mines (Zawar mines in Udaipur) and Dariba – Rajpur (in Bhilwara dist.). A.P. : The chief centre is Agnigundala (Guntur). The largest producer is Rajasthan.

Zinc: India has the 4th largest reserves in the world. The chief mining centres are : Rajasthan : Zawar mines (Udaipur) and Dariba (Bhilwara). A.P. : Chief centre is Agnigundala (Guntur). The largest producer is Rajasthan.

Gold: The chief centres are : Karnataka : Kolar Gold Fields (Kolar) and Hutt Gold Field (Raichur) are important mines . A.P. : Ramagiri Gold Fields in Anantapur. Kerala : Gold occurs in

Kozhikode and Wynad districts. The leading producer is Karnataka.

Mica: India is the world's largest producer of sheet mica. The chief mining regions are: Jharkhand: It is a major supplier of block mica. Koderma district is important. A.P. : The Gudur mica belt (Nellore) is the main centre. Rajasthan : The chief mines are in Bhilwara, Udaipur and Jaipur districts. Bihar : The main mining regions are in Gaya, Monghyr and Bhagalpur. The largest producer of mica is A.P.

Magnesite: It mainly occurs in Uttaranchal : It mainly occurs in Almora and Pithorgarh. Tamil Nadu: It mainly occurs in Chalk Hills of Salem district. Karnataka : It mainly occurs in Mysore and Hassan districts. The largest producer of magnesite is T.Nadu.

Gypsum: It mainly occurs in : Rajasthan : The deposits are large at Nagaur. The other mines are in Jodhpur and Jaisalmer. Uttaranchal : Gypsum mainly occurs in Dehradun, Garhwal and Nainital districts. The largest producer is Rajasthan.

Graphite: It is an allotrope of carbon. The chief centres are : Orissa : It mainly occurs in Koraput and Dhenkanal districts. A.P. : The chief centres are in Khammam and Vishakapatnam districts. Orissa is the largest producer.

Sillimanite: It is a refractory mineral and is fibrous. Large reserves of sillimanite occur in Kerala, Orissa and Meghalaya. The largest producer is Orissa.

Kyanite: It is a fibrous mineral. India has the largest deposits in the world. The largest producer is Jharkhand.

Barytes: It is the ore mineral for barium. India's largest deposits occur in Mangampeta in Cuddapah (A.P.) and other deposits occur in Alwar (Rajasthan). A.P. is the biggest producer.

Diamonds: These occur in rocks called Kimberlites. The chief diamond occurrences are : M.P. : Majhgawan mines in Panna is the chief centre. Chattisgarh : The diamonds occur near Raipur. M.P. is the largest producer of diamonds.

Nuclear Minerals of India: Pitchblende occurs in Narwa Pahar, Dantupa, Jaduguda in Jharkhand. Mineral monazite occurs in Monghyr and Gaya in Bihar and also in the black sands off the coasts of Ganjam and Cuttack. The black sands of the east coasts off Visakhapatnam contain Ilmenite, Monazite and Zircon. The black sands of Malabar contain Monazite, Zircon, Ilmenite and Thorianite. Uraninite occurs in Udaipur, Alwar and Jhunjhunu in Rajasthan.

Thumullapalle in Kadapa of Andhra Pradesh has India's largest reserves of Uranium. UCIL has commissioned the mine and processing facility in 2012. Banduhurang in Singhbhum of Jharkhand is a large open cast Uranium mine.

India's status in mineral output : India ranks 2nd in Barytes, 3rd in Coal, 4th in Iron Ore, 5th in Manganese Ore and Zinc, 6th in Bauxite Ore and 10th in Magnesite Ore in terms of production in the world.

Mineral Output of India : The largest minerals produced by India are 1. Coal 2. Iron Ore 3. Oil and Gas and 4. Lignite.

INDIAN INDUSTRY

Iron and Steel : The first modern steel plant to produce steel was Sakchi, Jamshedpur in 1907. The **major steel plants are:** Bhilai (Durg dist. Chattisgarh) - set up with Russian help. Bokaro (Jharkhand) - set up with Russian help. Rourkela (Sundargarh district, Orissa) - set up with German help. Durgapur (Burdwan district, W. Bengal) - set up with U.K.'s help. TISCO (Jamshedpur, Jharkhand) - A private sector steel plant. The first modern steel plant in India set up in 1907. Produced pig iron in 1908 and steel in 1913. Indian Iron and Steel Company (IISCO) - Has three units at Burnpur, Hirapur and Kulti. Vishweshwaraya Iron and Steel Works Limited (VISL) - at Bhadravati in Shimoga district of Karnataka. Makes use of power from Jog Falls hydro power project. The **New Steel Plants are :** Vishakapatnam Steel Plant (Rashtriya Ispat Nigam Ltd.). Set up in the 6th plan. Is India's first shore based steel plant. Salem Steel Plant - set up in the 6th plan. It is a major producer of stainless steel. Vijayanagar Steel Plant (located at Hospet, Bellary, Karnataka). Kothagudem Steel Plant (A.P.). First major sponge iron plant. Daitari Steel Plant near Paradwip (Cuttack, Orissa) - India's second shore based plant. Bhandara Steel Plant (Nagpur, Maharashtra). India is the 4th biggest producer of Crude Steel in world.

Copper Industry : Hindustan Copper Ltd. Came into being in 1967 as a public sector undertaking. It took over Indian Copper Corporation in 1972. HCL produces finished copper at A) Indian Copper Complex, Maubhander, Ghatsila, Jharkhand and B) Khetri Copper Complex in Jhunjhunu district (Rajasthan). Its other units producing copper ore are : Malanjhkhanda Copper Project - Balaghat, M.P. Rakka Copper Project - Singhbhum, Jharkhand, Dariba Copper Project (Alwar, Rajasthan).

Lead and Zinc Industry : First lead was made at Tundoo. Hindustan Zinc Ltd. (HZL) was set up in 1966. The HZL has been disinvested by the government and the current shareholding of the government is 29.54%. HZL with its headquarters at Udaipur, operates three lead and zinc mines at Zawar (Udaipur) the Dariba mines (Alwar) and Rampura mines

(Bhilwara), all in Rajasthan. HZL operates the Debari Zinc Smelter (Udaipur), Chanderiya Lead-Zinc Smelter (Chittorgarh, Rajasthan) and the Vishakapatnam Smelter (A.P.). The HZL also runs the lead smelter at Tundoo (Dhanbad, Jharkhand).

Aluminium Smelting Industry: First alumina plant was set up at Jaykaynagar in W. Bengal. Bharat Aluminium Company was set up in 1965 as the first aluminium producing PSE. It runs the Korba Aluminium Complex (Bilaspur, Chattisgarh) and the Bhindanbaag Complex in Asansol in W. Bengal. In 2001, the government transferred 51% of its equity and management control to Sterilite Industries Ltd. Hindustan Aluminium Company Ltd. (HINDALCO) has a unit at Renukoot (Mirzapur, U.P.) National Aluminium Company (NALCO) set up in 1981 is the biggest producer of aluminium in India. It has two smelters - the Damanjodi plant (Koraput, Orissa) and the Angul Plant (Angul district, Orissa). Indian Aluminuium Company Ltd. (INDALCO) has units at Belgaum (Karnataka) Alupuram (Kerala), Hirakud (Orissa) and an Alumina plant at Muri (Jharkhand). The private sector Madras Aluminium Company (MALCO) runs a plant at Mettur in Tamil Nadu.

Cotton Textile Industry: Cotton textile industry in India's largest organised industry. The cotton textile industry accounts for 4% of India's GDP and 14% of India's industrial output. The first cotton mill was set up at Fort Glaster, Howrah, West Bengal in 1818. The first modern mill was set up in Bombay in 1851. The largest producer of cotton cloth is Maharashtra. Bombay with 57 mills is a major centre in Maharashtra and Ahmedabad with 67 mills is a major centre in Gujarat. Tamil Nadu has the largest number of mills. The largest centre is Coimbatore.

Jute Industry: India is the largest producer of raw jute and jute goods in the world and the second largest exporter of jute goods in the world. The first jute was produced at Rishra, West Bengal in 1855. West Bengal has the largest number of jute mills (mostly along banks of Hooghly). West Bengal accounts for 73% of output and 72% of the mills.

Silk: India is the only country in the world to produce all commercial varieties of silk - Mulberry silk. Tropical Tasar, Oak

Tasar, Eri and Muga. India is the world's second largest producer of raw silk after China. The first modern silk mill was set up at Howrah in 1883. Karnataka accounts for 70% of raw silk output. It produces mulberry silk. Important centres are Bangalore, Mysore, Kolar, Mandya. Assam is the chief producer of muga silk. Jharkhand is the chief producer of tasar silk.

Woollen Textiles: India is the 7th largest producer of wool in the world. The first modern woollen mill was set up at Kanpur in 1876. Punjab has the largest number of mills. Important centres are Dhariwal, Amristar, Ludhiana. The largest producer of woolen textiles is Punjab. The top Wool producing states of India are Rajasthan and Jammu & Kashmir.

Cement Industry: India is the 2nd largest producer of cement in the world after China. The top producers of Cement in India are A.P., Rajasthan and Karnataka. The first cement mill was set up at Chennai in 1904. The largest producer of cement is M.P.

Sugar Industry: Second largest agro-based industry in India. India is the second largest producer of sugar after Brazil. The first sugar mills arose in eastern U.P. The first white sugar mill was set up at Coimbatore, T.N. The largest producer of sugar is Maharashtra.

Oil Refineries: The public sector refineries are : Indian Oil Corporation Ltd. (IOCL) - has refineries at Guwahati and Digboi (Assam), Barauni (Bihar), Koyali (Gujarat), Haldia (W. Bengal), Mathura (UP) and Panipat (Haryana). Chennai Petroleum Corporation Ltd. Is a subsidiary of IOCL. It has two refineries at Manali and Nagapattanam (both in T. Nadu). Bongaigaon Refineries and Petrochemicals is a subsidiary of IOCL. It runs the refinery at Bongaigaon (Assam). Mangalore Refineries and Petrochemicals Ltd. (MRPL). The refinery is at Mangalore (Karnataka). Hindustan Petroleum Corporation Ltd. (HPCL)- has refineries at Mumbai and Vishakapatnam. Bharat Petroleum Corporation Ltd. (BPCL) - has a refinery at Mumbai. Kochi Refinery Ltd. (KRL) is a subsidiary of BPCL and operates the refinery at Kochi (Kerala). Numaligarh Refinery Ltd. (Assam) - It is a subsidiary of BPCL and runs the Numaligarh refinery (Assam). The Mani Refinery Ltd. (Tatipaka, A.P.) is owned by

ONGC. The Jamnagar Refinery is India's biggest refinery and belongs to Reliance Industries Ltd.

Paper Industry: The first paper mill was set up at Serampore, West Bengal in 1812. The important centres of paper industry in India are : Ballarpur and Sangli - Maharashtra, Sirpur (in Kagznagar) and Rajhamundry (A.P.), Rajkot and Vadodara in - Gujarat, Meerut, Modinagar and Muzzafarnagar - U.P., Baranagore and Titagarh - W. Bengal and Nepanagar (for newsprint) and Indore - M.P. The largest producer of paper in India is Maharashtra.

Match Industry: The first match mill was set up at Ahmedabad in 1921. Tamil nadu has more than two-thirds of the units in the unorganised sector (in Sivakasi, Kovilpatti and Sattur). West Bengal has the largest concentration of match industry in the organized sector.

Heavy Electrical Machinery Industry : The BHEL, set up in 1964, is one of the top power equipment manufacturers of the world. It's six units are located at Bhopal (M.P.) Bangalore (Karnataka), Tiruchirapalli (T. Nadu), Ramchandrapuram (Hyderabad, A.P.) Haridwar (Uttarakhand) and Jammu (J & K).

Salient Features of Census – 2011

Introduction : The population of India at 0.00 hours on March 31, 2011 according to provisional population totals of census 2011 was 1,210,193,422 compared to 1,028737,436 in 2001. The absolute increase in 2001-2011 was 181 million, slightly lower than the population of Brazil. At present, a little more than one out of every 6 persons in the world is from India. China accounts for 19.4% of world population while India accounts for 17.5%. The share of other countries is USA - 4.5%, Indonesia-3.4%, Brazil - 2.8%, Pakistan - 2.7%, Bangladesh - 2.4%, Nigeria-2.3%, Russian Federation-2% and Japan-1.9%. The rest of the world accounts for 41.2% of world population. India with 2.4% of world's surface area accounts for 17.5% of world population.

Growth Rate of India's Population in 2001-2011. The average annual growth rate of India's population in 2001-2011 was 1.64% (It was 1.97% per annum in 1991-2001). The progressive growth rate over 1901 population is 407.64% in 2001-2011. Decadal Growth Rate of population (2001-2011).

The decadal growth of population in 2001-2011 over 2001 was 17.64% (compared to 21.54% in 1991-2001). The states of India with highest decadal growth are 1. Meghalaya (27.8%) 2. Arunachal (25.9%), 3. Bihar (25.1%), 4. Jammu and Kashmir (23.7%) 5. Mizoram (22.8%) 6. Chhattisgarh (22.6%) 7. Jharkhand (22.3%), 8. Rajasthan (21.4%) 9. M.P. (20.3%) and 10. U.P. (20.1%). The National Capital Territory of Delhi registered a decadal growth of 21%. The least decadal growth was recorded by Nagaland where it was minus 0.5%. Among the union territories, the highest decadal growth was shown by Dadra and Nagar Haveli while the least was recorded by Lakshadweep.

Average Annual Growth Rate of Population of States in 2001-2011: The average annual population growth rate of states as per census 2011 in the decade 2001-11 is as follows. The states with the highest growth rates are 1. Meghalaya (2.49% p.a.) 2. Arunachal Pradesh (2.33% p.a.) 3. Bihar (2.26% p.a.) 4. Jammu and Kashmir (2.15% p.a.) 5. Mizoram (2.07% p.a.) 6. Chhattisgarh

(2.06% p.a.) 7. Jharkhand (2.04% p.a.) 8. Rajasthan (1.96% p.a.) 9. M.P. (1.87% p.a.) and 10. Haryana (1.83% p.a.). The average annual growth rate of National Capital Territory of Delhi in 2001-11 was 1.92% p.a. The ranking of union territories is 1. Dadra and Nagar Haveli (4.51% p.a.) 2. Daman and Diu (4.38% p.a.) 3. Puducherry (2.48% p.a.) 4. Andaman and Nicobar (0.65% p.a.) 5. Lakshadweep (0.61% p.a.). The least growth rate was shown by Nagaland in the census-2001-11.

Share of States in India's population by census-2011: The most populated states of India by census-2011 are 1) U.P.-16.49%, 2) Maharashtra-9.29%, 3) Bihar-8.58%, 4) W.Bengal-7.55%, 5) A.P.-7.00%, 6) M.P.-6%, 7) T. Nadu-5.96%, 8) Rajasthan-5.67%, 9) Karnataka-5.05% and 10) Gujarat-4.99%. Sikkim is the least populated state. Among the union territories, the largest population size is in Puducherry and the smallest population size is in Lakshadweep. (The descending order of population size for union territories is Puducherry, Chandigarh, Andaman and Nicobar, Dadra and Nagar Haveli, Daman and Diu and Lakshadweep). The largest population among the Northeastern States is in Assam followed by Tripura, Meghalaya, Manipur, Nagaland, Arunachal Pradesh and Mizoram.

III Density of Population : The following terms are used in describing density in demography

- 1. Arithmetic Density – The overall inhabitants per square km
- 2. Agricultural Density – the agricultural population per unit area of arable farming land
- 3. Physiological Density – the overall population per unit area of arable land.

The population density of India as per census 2011 is 364.9 people per square km. The states with the highest population density by census 2011 are 1. W. Bengal 2. Bihar 3. Kerala 4. U.P. The state with the least population density is Arunachal Pradesh (17 per square km). Among union territories, the most densely populated is Delhi (9340 persons per square km) followed by Chandigarh (9252 per sq. km) Puducherry (2598 per sq. km), Lakshadweep (2013 per sq. km.), Dadra and Nagar Haveli (491 per sq. km.) Daman and Diu (112 per sq. km.) and Andaman and Nicobar (46 per sq. km.) The density of population of India increased in every census decade except in 1911 – 1921 when it came down from 82 per sq. km in 1911 to 81 per sq. km in 1921

IV. Sex Ratio : The sex ratio as per 2011 census is 940 per 1000 males. The sex ratio improved marginally over that of 2001 census. The states with the highest sex ratio as per census 2011 are 1. Kerala (1084 per 1000 males) 2. T. Nadu (995 per 1000 males) 3. A.P. (992 per 1000 males) 4. Chhattisgarh (991 per 1000 males). The least sex ratio was in Haryana (877 per 1000 males). The states showing the least sex ratio as per census 2011 are 1. Haryana (877 per 1000 males) 2. Jammu and Kashmir (883 per 1000 males) 3. Sikkim (889 per 1000 males) 4. Punjab (893 per 1000 males). The sex ratio among the union territories as per census 2011 was highest in 1. Puducherry (1038 per 1000 males) 2. Lakshadweep (946 per 1000 males) 3. Delhi (866 per 1000 males) 4. Chandigarh (818 per 1000 males) 5. Dadra and Nagar Haveli (775 per 1000 males) 6. Daman and Diu (618 per 1000 males). The sex ratio declined in Dadra and Nagar Haveli, Daman and Diu and Lakshadweep over 2001 census but improved in rest of the union territories with the highest improvement recorded in National Capital Territory of Delhi followed by Chandigarh.

V. Literacy Rate : The literacy rate improved in the census decade 2001-2011 (from 64.8% in 2001 to 74.04% in 2011). A notable thing is the sharp increase in the female literacy rate in the decade 2001-2011. The states with the highest male literacy rates as per census 2011 were 1. Kerala (96%) 2. Mizoram (93.7%) 3. Goa (92.8%) 4. Tripura (92.2%). The least literacy rate was in Bihar (73.5%). Among the union territories, the highest literacy rate was shown by 1. Lakshadweep (96.1%) 2. Puducherry (92.1%) 3. Daman and Diu (91.5%) 4. Delhi (91%) 5. Andaman and Nicobar (90.1%) and 6. Dadra and Nagar Haveli (86.5%)

Female literacy rate was 65.46% in 2011. The highest female literacy rate among states was in 1. Kerala (92%) 2. Mizoram (89.4%) 3. Tripura (83.1%) 4. Goa (81.8%). The least female literacy rate among states was shown by 1. Lakshadweep (96.1%) 2. Puducherry (92.1%) 3. Daman and Diu (91.5%) 4. Delhi (91%) 5. Andaman and Nicobar (90.1%) and 6. Dadra and Nagar Haveli (86.5%). The least female literacy rate was shown by Rajasthan (52.7%) followed by Bihar (53.3%). Among union territories, the female literacy rate in descending order as per census 2011 is 1. Lakshadweep (88.2%) 2. Andaman and Nicobar (81.8%) 3. Chandigarh (81.4%) 4. Puducherry (81.2%) 5. Delhi (80.9%) 6. Daman and Diu (79.6%) and Dadra and Nagar Haveli (65.9%). The

General literacy rate for India was 74.04% while the male and female literacy rates for India were 82.14% and 65.46% respectively. The states with the highest literacy rates by census 2011 were 1. Kerala (93.9%) 2. Mizoram (91.6%) 3. Tripura (87.8%) and 4. Goa 87.4%).

Urbanisation : The census decade 2001-2011 saw an increase of 91 million people in the urban settlements of India. The population increase in 2001-2011 was 181.4 million people of which rural population increased by 90.4 million and urban population by 91 million. Thus, in census 2001-2011, more number of people were added in urban than rural areas. The growth in rural population is steadily declining since 1991. Four states recorded a decline in rural population in 2001-2011 which where Kerala (decline by 26%), Goa (decline by 19%), Nagaland (decline by 15%) and Sikkim (decline by 5%). However largest increase in rural population was recorded by Meghalaya (increase by 27%) in the census decade 2001-2011.

It may be noted that U.P. has the largest share in India's rural population – it accounts for 18% of India's rural population (excluding the union territories). Sikkim has the least share in India's rural population (a little less than 0.1% of India's rural population, excluding the union territories). Maharashtra has the largest share in India's urban population (13.5% of India's urban population, excluding the union territories) while Sikkim has the least share in India's urban population.

Urban population as a percent of state population is highest in 1. Goa (62.1%) 2. Mizoram (51.5%) 3. Tamil Nadu (48.4%) 4. Kerala (47.7%). The state with the least percent of urban population as part of its total population by Census 2011 was Himachal Pradesh (10.1%). However in terms of absolute size of urban population, it is Maharashtra (with 50.8 million urban people) followed by U.P. (44.4 million urban people), Tamil Nadu (34.9 million urban people) and W. Bengal (29.1 million urban people). The least size of urban population was in Sikkim (0.15 million people). Among the union territories – the share of urban population of total population is highest in Delhi (97.5%) followed by Chandigarh (97.2%), Lakshadweep (78%), Daman and Diu (75.1%) Dadra and Nagar Haveli (46.6%) and Andaman and Nicobar

(35.6%). In terms of absolute size of urban population among union territories the ranking is Delhi (16.3 million) followed by Chandigarh, Puducherry, Daman and Diu, Dadra and Nagar Haveli, Andaman and Nicobar and Lakshadweep.



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ENVIRONMENT

Wetlands: Wetlands in India are distributed in different geographical regions, ranging from the Himalaya to the Deccan plateau. The variability in climatic conditions and topography is responsible for significant diversity. Based on their origin, vegetation, nutrient status and thermal characteristics, they are classified into following different types:

Glaciatic Wetlands (e.g., Tso Moriri in Jammu and Kashmir, Chandertal in Himachal Pradesh). Tectonic Wetlands (e.g., Nilnag in Jammu and Kashmir, Khajjiar in Himachal Pradesh, and Nainital and Bhimtal in Uttarakhand). Oxbow Wetlands (e.g., Dal Lake, Wular Lake in Jammu and Kashmir and Loktak Lake in Manipur and some of the wetlands in the river plains of Brahmaputra and Indo-Gangetic regions. Deepor Beel in Assam, Kabar in Bihar, Surahtal in Uttar Pradesh). Lagoons (e.g., Chilka in Orissa). Crater Wetlands (Lonar lake in Maharashtra). Salt Water Wetlands (e.g., Pangong Tso in Jammu and Kashmir and Sambhar in Rajasthan). Urban Wetlands (e.g., Dal Lake in Jammu and Kashmir, Nainital in Uttarakhand and Bhoj in Madhya Pradesh). Ponds / Tanks, Man-made Wetlands (e.g., Harike in Punjab and Pong Dam in Himachal Pradesh). Reservoirs (e.g., Idukki, Hirakud dam, Bhakra Nangal dam). Mangroves (e.g., Bhitarkanika in Orissa). Coral reefs (e.g., Lakshadweep)

Ramsar Site: The Ramsar Convention (The Convention on Wetlands of International Importance especially as Waterfowl Habitat signed in Ramsar, Iraq in 1971) is an international treaty for the conservation and sustainable utilization of wetlands. Andhra Pradesh (Kolleru Lake), Assam (Deepor Beel), Himachal Pradesh (Pong Dam Lake, Renuka Wetland, Chandertal Wetland), Jammu & Kashmir (Wular Lake, Tso Moriri, Hokera Wetland, Surinsar – Mansar Lakes), Kerala (Ashtamudi Wetland, Sasthamkotta Lake, Vembanad – Kol), Madhya Pradesh (Bhoj Wetland), Manipur (Loktak Lake), Orissa (Chilika lake, Bhitarkanika Mangroves), Punjab (Harike Lake, Kanjli Lake, Ropar Lake), Rajasthan (Sambhar Lake, Keoladeo National Park), Tamilnadu (Point Calimere Wildlife and Bird Sanctuary), Tripura (Rudrasagar Lake), Uttar Pradesh (Upper Ganga River (Brijighat to Narora Stretch), West Bengal (East Kolkata Wetlands).

Biosphere Reserves: The programme of biosphere Reserve was initiated under the 'Man & Biosphere' (MAB) programme of UNESCO in 1971. The purpose of the formation of the biosphere reserve is to conserve in-situ all forms of life, along with its support systems, in their totality, so that it could serve as a referral system for monitoring and evaluating changes in natural ecosystems. The first biosphere reserve of the world was established in 1979. Since then the network of biosphere reserves has increased to 531 in 105 countries across the world. Presently, there are 15 existing biosphere reserves in India. The biosphere reserves of India are : Achanakamar – Amarkantak (Chhattisgarh and M.P.), Agasthyamalai (Kerala), Dehang – Dibang (Arunachal Pradesh), Dibru – Saikhowa (Assam), Great Nicobar (Andaman and Nicobar), Gulf of Mannar, Khangchendzonga (Sikkim, Assam), Nanda Devi (Uttarakhand), Nilgiri (Tamil Nadu, Kerala and Karnataka), Nokrek (Meghalaya), Pachmarhi (M.P. & Chhattisgarh), Sunderbans (West Bengal), Kutch (Gujarat).

Tiger Protection: The Tiger Reserves in India are : Manas, Kaziranga, Nameri (Assam), Nagarjunasagar and the new one declared in 2012 i.e., in Adilabad (Andhra Pradesh), Namdapha, Pakke (Arunachal Pradesh), Valmiki (Bihar), Indravati, Undanti – Sitandadi, Achanakmar (Chhattisgarh), Palamu (Jharkhand), Periyar, Parambikulam (Kerala), Bandipur, Bhadra, Dandeli-Anshi, Nagarhole (Karnataka), Tadoba-Andhari, Pench, Melghat, Sahyadri (Maharashtra), Bandhavgarh, Kanha, Satpura, Panna, Sanjay-Dubri, Pench (Madhya Pradesh), Dampa (Mizoram), Satkosia, Simlipal (Orissa), Ranthambore, Sariska (Rajasthan), Kalakad-Mundanthurai, Mudumalai, Annamalai (Tamil Nadu), Corbett (Uttarakhand), Dudhwa (Uttar Pradesh), Buxa, Sunderbans (West Bengal).

Mangrove Sites in India: West Bengal (Sunderbans), Orissa (Bhitarkanika, Mahanadi, Suvarnarekha, Devi-Kauda, Dhamra, Mangrove Genetic Resources Centre, Chilka), Andhra Pradesh (Coringa, East Godavari, Krishna), Tamil Nadu (Pichavaram, Muthupet, Ramnad, Pulicat, Kazhuveli), Andaman & Nicobar (North Andaman, Great Nicobar), Kerala (Vembanad, Kannur), Karnataka (Coondapur, Dakshin Kannad/Honnnavar, Karwar), Goa (entire Coastal Goa), Maharashtra (Achra-Ratnagiri, Devgarh-Vijay Durg, Veldur, Kundalika-Revdanda, Mumbra-Diva, Vikroli, Shreevardhan,

Vaitarna, Vasai-Manori, Malvan), Gujarat (Gulf of Kutch, Gulf of Khambhat, Dumas-Ubhrat).

Coral Reefs: The four major coral reef areas identified for intensive conservation and management are : 1. Gulf of Mannar, 2. Gulf of Kutch 3. Lakshadweep and 4. Andaman and Nicobar Islands.



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