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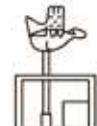
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Unit-5



**Sustainable Development
and Environmental Ethics**

CHAPTER - 18 - SUSTAINABLE DEVELOPMENT

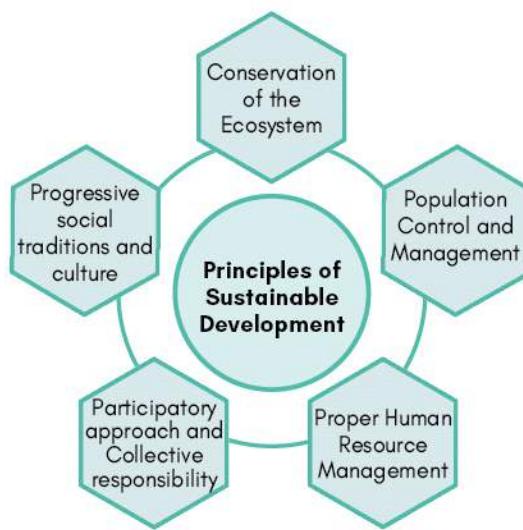
18. Sustainable Development

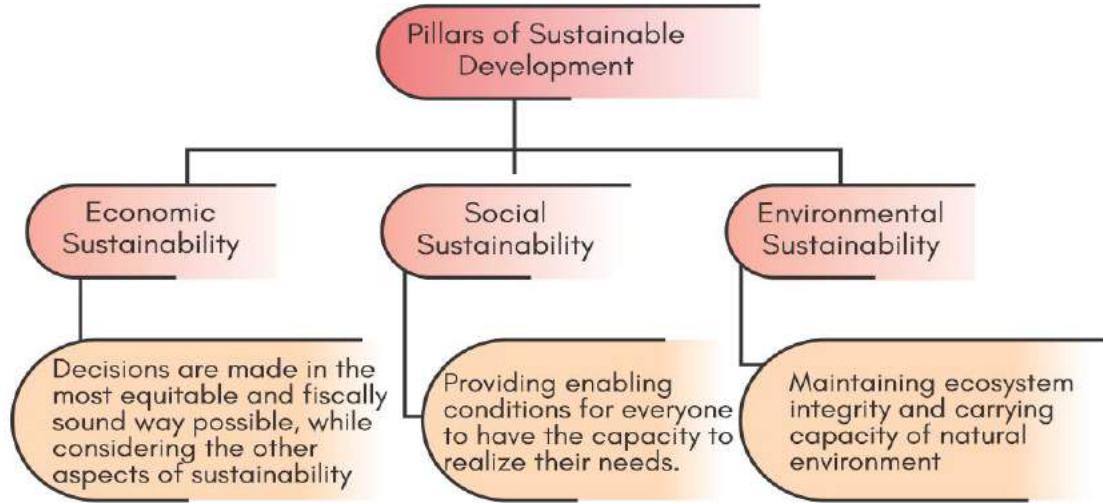
18.1. The concept of Development

- Development is defined as 'an evolutionary process in which the human capacity increases in terms of initiating new structures, coping with problems, adapting to continuous change, and striving purposefully and creatively to attain new goals.'
- It is a multi-dimensional process that involves major changes in social structures, attitudes, and institutions, as well as economic growth, reduction of inequality, and eradication of absolute poverty. Several theories have been put forward to explain the concept of development.
 - **Modernisation Theory:** The Modernization Theory of development distinguishes between two main categories of society in the world, namely the traditional and modern societies. The theory argues that the traditional societies are entangled by norms, beliefs and values, which are hampering their development. Therefore, in order to progress, the traditional societies must emulate the culture of modern societies, which is characterised by accumulation of capital and industrialization which are compatible with development.
 - **World Systems Theory:** The World Systems Theory posits that international trade specialization and transfer of resources from the periphery (less developed countries) to the core (developed countries) stifle development in the periphery by making them rely on core countries. The World Systems Theory perceives the world economy as an international hierarchy of unequal relations and that the unequal relations in the exchange between the Third World and First World countries is the source of First World surplus.
 - **Globalisation Theory:** Globalization Theory originates from the global mechanisms of deeper integration of economic transactions among the countries . However, apart from the economic ties, other key elements for development interpretation as far as globalisation is concerned are the cultural links among nations, In this cultural orientation, one of the cardinal factors is the increasing flexibility of technology to connect people around the world. Therefore, open and easy communication among nations has created grounds for cultural homogenisation, thereby creating a single global society.

18.2. Sustainable Development (SD)

- SD is a core concept within global development policy and agenda. It provides a mechanism through which **society can interact with the environment while not risking damaging the resource for the future.**
- Thus, it is a development paradigm as well as concept that calls for improving living standards without jeopardising the earth's ecosystems or causing environmental challenges such as deforestation and water and air pollution that can result in problems such as climate change and extinction of species.





18.3. History of Sustainable Development

- As far back as 1789, Malthus postulated that **human population tended to grow in a geometric progression**, while **subsistence could grow in only an arithmetic progression**, and for that matter, population growth was likely to outstrip the capacity of the natural resources to support the needs of the increasing population. Therefore, if measures were not taken to check the rapid population growth rate, exhaustion or depletion of natural resources would occur, resulting in misery for humans.
- With time, global concerns heightened about the non-renewability of some natural resources which threaten production and long-term economic growth resulting from environmental degradation and pollution.
- The concept of sustainable development received its first major international recognition in **1972 at the UN Conference on the Human Environment** held in Stockholm. Although the term was not referred to explicitly, the international community agreed to the notion—now fundamental to sustainable development—that both development and the environment hitherto addressed as separate issues, could be managed in a mutually beneficial way.
- The World Commission on Environment and Development, chaired by Gro Harlem Brundtland of Norway, renewed the call for SD, culminating in the development of the **Brundtland Report** entitled “**Our Common Future**” in 1987.
 - The report **defined SD** as development that meets the needs of current generation without compromising the ability of future generation to meet their own needs.
 - Central to the **Brundtland Commission Report** were two key issues:
 - ✓ The **concept of needs**, in particular the essential needs of the world’s poor (to which overriding priority should be given); and

Limits to Growth Theory

The Limits to Growth (LTG) is a 1972 report on the exponential economic and population growth with a finite supply of resources, **commissioned by the Club of Rome**.

The research team came to the following conclusions:

- Given business as usual, i.e., no changes to historical growth trends, the limits to growth on earth would become evident by 2072, leading to "sudden and uncontrollable decline in both population and industrial capacity". This includes the following:
 - Global Industrial output per capita reaches a peak around 2008, followed by a rapid decline
 - Global Food per capita reaches a peak around 2020, followed by a rapid decline
 - Global Services per capita reaches a peak around 2020, followed by a rapid decline
 - Global population reaches a peak in 2030, followed by a rapid decline
- Growth trends existing in 1972 could be altered so that sustainable ecological and economic stability could be achieved.

- ✓ The **idea of limitations** imposed by the state of technology and social organisation on the environment's ability to meet present and future needs.

Student Notes:

18.3.1. UN Conference on Environment and Development (UNCED)

- United Nations Conference on Environment and Development (UNCED), also called Earth Summit, 1992, conference was held at Rio de Janeiro, Brazil, to reconcile worldwide economic development with protection of the environment.
- By means of treaties and other documents signed at the conference, most of the world's nations nominally committed themselves to the pursuit of economic development in ways that would protect the Earth's environment and nonrenewable resources.
- The Earth Summit resulted in the following documents:
 - o Rio Declaration on Environment and Development
 - o Agenda 21
 - o Forest Principles

UN Commission on Sustainable Development (CSD)

- It is responsible for **monitoring implementation of UNCED decisions**.
- It was established by the UN General Assembly in December 1992.
- At its eleventh session in 2003, the Commission decided on a multi-year work programme consisting of review and policy years.
- At the United Nations Conference on Sustainable Development (Rio+20), Member States agreed to establish a high level political forum that will subsequently replace the Commission on Sustainable Development

(i) Rio Declaration on Environment and Development

- The Rio Declaration on Environment and Development, often shortened to Rio Declaration, consisted of 27 principles intended to guide countries in future sustainable development. Referring to the "integral and interdependent nature of the Earth, "our home", the Rio Declaration proclaims 27 principles.

1992 Rio Declaration on Environment and Development : 27 Principles



| | | | |
|--|--|---|--|
| 1. The role of humans. | 8. Reduction of Unsustainable Patterns of Prod. and Consumption | 15. Precautionary principle | 22. Ind. Peoples have a Vital Role |
| 2. State sovereignty | 9. Capacity Building for Sust. Development | 16. Internalization of Environmental Costs | 23. People under Oppression |
| 3. The Right to development | 10. Public participation | 17. Environmental Impact Assessments | 24. Warfare |
| 4. Environment Protection in the Dev. Process | 11. National Environmental Legislation | 18. Notification of Natural Disaster | 25. Peace, Development and Environmental Protection |
| 5. Eradication of Poverty | 12. Supportive and Open International Economic System | 19. Prior and Timely Notification | 26. Resolution of Environmental Disputes |
| 6. Priority for the Least Developed | 13. Compensation for Victims of Pollution and other Envir. Damage | 20. Women have a Vital Role | 27. Cooperation between State and People |
| 7. State Cooperation to Protect Ecosystem | 14. State Cooperation to Prevent environmental dumping | 21. Youth Mobilization | |

(ii) Agenda 21

- It outlines actions that governments, international organisations, industries and the community can take to achieve sustainability.
- It is divided into four sections:
 - **Social and Economic dimensions:** include combating poverty, changing consumption patterns, population and demographic dynamics, promoting health, promoting sustainable settlement patterns, integrating environment and development into decision making.
 - **Conservation and Management of Resources for development:** includes atmospheric protection, combating deforestation, protecting fragile environments, conservation of biological diversity (biodiversity), and control of pollution.
 - **Strengthening the Role of Major Groups:** includes the roles of children, youth, women, NGOs', local authorities, business and workers.
 - **Means of Implementation:** includes science, technology transfer, education, international institutions and mechanisms and financial mechanisms.

(iii) Forest Principles

- The Forest Principles (also Rio Forest Principles, formally the Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests) is a 1992 document produced at the Earth Summit.
- It makes several recommendations for conservation and sustainable development forestry.
- The Montréal Process, also known as the Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests, was started in 1994 as a result of the Forest Principles.

18.3.2. World Summit on Sustainable Development 2002

World Summit on Sustainable Development (WSSD) held in Johannesburg for a 10-year assessment of the Rio outcomes (Rio +10).

The Summit gives a political statement in the form of a "**Johannesburg Declaration**", to be agreed by world leaders, reaffirming their commitment to work towards sustainable development.

18.4. Millennium Development Goals

- At the Millennium Summit in September 2000 the largest gathering of world leaders in history adopted the UN Millennium Declaration, committing their nations to a new global partnership to reduce extreme poverty and setting out a series of time-bound and quantified targets, with a deadline of 2015, that have become known as the Millennium Development Goals.



18.4.1. Criticisms of MDGs

- **Top-down and straight jacket approach:** They are charged with neglecting issues in developed countries, not considering the real needs in recipient countries, particularly those of marginalised populations. One

of the causes of this is, its utilisation of a donor-driven design failed to tackle the root causes of poverty and underdevelopment.

- There were no goals or commitments for developed countries and no compulsion for members to follow the MDGs. Also there was no indication of what happens if goals are unmet at the end of the target period.
- Incomplete agenda:** The MDGs have also been criticised for the dimensions they have omitted. Critics argue, for example, that the goals do not place enough emphasis on sustainable development, and leave out crucial issues such as 'peace, security and disarmament' as well as 'Human rights, democracy and good governance'. Moreover, they cover only some dimensions of multidimensional poverty.

- Improper target setting:**

Some goals at the global level were unrealistic right from the start (e.g. MDG 2, which demands total enrolment in primary education worldwide), while others demonstrate low ambitions, at least at the global level (e.g. MDG1, which asks for halving the share of people that suffer from income poverty and which according to the World Bank has already been achieved). Some MDGs cannot even be measured – either because no indicators or targets were set, or because for certain indicators no data is available.

- Non-uniform achievement of targets:** There are huge disparities across and within countries. Sub-Saharan Africa is the

epicentre of crisis and a widespread shortfall for most of the MDGs. Asia is the region with the fastest progress, but even there hundreds of millions of people remain in extreme poverty. Within countries, poverty is greatest for rural areas, though urban poverty is also extensive, growing, and underreported by traditional indicators.

- Focus on output rather than outcome:** Some MDGs measure outputs or inputs rather than outcomes or impacts of development. MDG2, for example measures only the intake of education, regardless of its quality or relevance for economic, social and political life.

- MDGs neglect distributive issues:** For instance, when a particular country lowers its child mortality rate, then MDG 4 does not capture whether this is due to improvements in the health of the most disadvantaged or others that are better off in terms of child survival. For policy makers it may be cheaper and hence more attractive to invest in the health of the latter rather than those at the bottom of the pyramid.

| MDGs and Target-Summary of progress achieved by India | |
|--|---|
| GOAL 1: ERADICATE EXTREME POVERTY AND HUNGER | |
| TARGET 1: Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day | Achieved |
| TARGET 2: Halve, between 1990 and 2015, the proportion of people who suffer from hunger | In progress |
| MDG 2: ACHIEVE UNIVERSAL PRIMARY EDUCATION | |
| TARGET 3: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling | In progress |
| MDG 3: PROMOTE GENDER EQUALITY AND EMPOWER WOMEN | |
| TARGET 4: Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015 | Achieved |
| MDG 4: REDUCE CHILD MORTALITY | |
| TARGET 5: Reduce by two-thirds, between 1990 and 2015, the Under - Five Mortality Rate | Nearly achieved. |
| MDG 5: IMPROVE MATERNAL HEALTH | |
| TARGET 6: Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio | In progress |
| MDG 6: COMBAT HIV/AIDS, MALARIA AND OTHER DISEASES | |
| TARGET 7: Have halted by 2015 and begun to reverse the spread of HIV/AIDS | Achieved |
| TARGET 8: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases | Achieved |
| MDG 7: ENSURE ENVIRONMENTAL SUSTAINABILITY | |
| TARGET 9: Integrate the principle of sustainable development into country policies and programmes and reverse the loss of environmental resources. | In progress |
| TARGET 10: Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation | Achieved for the indicator of drinking water. In progress for the indicator of Sanitation |
| TARGET 11: By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers | The pattern not statistically discernible |
| MDG 8: DEVELOP A GLOBAL PARTNERSHIP FOR DEVELOPMENT | |
| TARGET 18: In cooperation with the private sector, make available the benefits of new technologies, especially information and communications | Achieved |

18.4.2. UN Conference on Sustainable Development: Rio+20, 2012

Student Notes:

- Rio+20 resulted in a focused political outcome document which contains clear and practical measures for implementing sustainable development.
- Member States decided to launch a process to develop a set of **Sustainable Development Goals (SDGs)**, which will **build upon the Millennium Development Goals** and converge with the post 2015 development agenda.
- The Conference also adopted ground-breaking **guidelines on green economy policies**. Governments also decided to establish an intergovernmental process under the General Assembly to prepare options on a strategy for sustainable development financing.
- Governments also agreed to strengthen the United Nations Environment Programme (UNEP) on several fronts. They also agreed to establish a high-level political forum for sustainable development.
- Governments also adopted the 10-year framework of programmes on sustainable consumption and production patterns to designate a Member State body to take any necessary steps to fully operationalize the framework.
- The Conference also took forward-looking decisions on a number of thematic areas, including energy, food security, oceans, cities, and decided to convene a Third International Conference on Small Islands Developing States (SIDS) in 2014.
- **Themes of the Conference:** The Conference focused on two themes: (a) a green economy in the context of sustainable development poverty eradication; and (b) the institutional framework for sustainable development.
- **Seven priority areas:** The preparations for Rio+20 highlighted seven areas which needed priority attention; these included decent jobs, energy, sustainable cities, food security and sustainable agriculture, water, oceans and disaster readiness.

In the Rio+20 outcome document, member States agreed that sustainable development goals (SDGs) must:

- Be based on Agenda 21 and the Johannesburg Plan of Implementation.
- Fully respect all the Rio Principles.
- Be consistent with international law.
- Build upon commitments already made.
- Contribute to the full implementation of the outcomes of all major summits in the economic, social and environmental fields.
- Focus on priority areas for the achievement of sustainable development, being guided by the outcome document.
- Address and incorporate in a balanced way all three dimensions of sustainable development and their inter-linkages.
- Be coherent with and integrated into the United Nations development agenda beyond 2015.
- Not divert focus or effort from the achievement of the Millennium Development Goals.
- Include active involvement of all relevant stakeholders, as appropriate, in the process.

18.5. The Sustainable Development Goals

- As part of this new development roadmap, the UN approved the 2030 Agenda (SDGs), which are a call to action to protect the planet, end poverty and guarantee the well-being of people. The 17 SDGs primarily seek to achieve the following summarised objectives.
 - Eradicate poverty and hunger, guaranteeing a healthy life
 - Universalize access to basic services such as water, sanitation and sustainable energy
 - Support the generation of development opportunities through inclusive education and decent work
 - Foster innovation and resilient infrastructure, creating communities and cities able to produce and consume sustainably.

- Reduce inequality in the world, especially that concerning gender
- Care for the environmental integrity through combatting climate change and protecting the oceans and land ecosystems
- Promote collaboration between different social agents to create an environment of peace and ensure responsible consumption and production
- The SDGs are a universal call to action to end poverty, protect the planet and **ensure that all people enjoy peace and prosperity by 2030**.
- Adopted by 193 countries, the SDGs came into effect in January 2016, and aim to foster economic growth, ensure social inclusion and protect the environment.
- They encourage a spirit of partnership among governments, private sector, research, academia and civil society organisations (CSOs)—with support of the UN. This partnership is meant to ensure that the right choices are made now to improve life, in a sustainable way, for future generations.
- **Agenda 2030** has five overarching themes, known as the five Ps: people, planet, prosperity, peace and partnerships, which span across the 17 SDGs.
- They are intended to tackle the root causes of poverty, covering areas such as hunger, health, education, gender equality, water and sanitation etc.



It can be argued from the SDGs that, sustainable development aims at achieving social progress, environmental equilibrium and economic growth.

18.5.1. Differences between MDGs and SDGs

- SDGs benefit from the valuable lessons learned from MDGs. These also carry forward the unfinished agenda of MDGs for continuity and sustain the momentum generated while addressing the additional challenges of inclusiveness, equity, and urbanization and further strengthening global partnership by including CSOs and private sector. They reflect continuity and consolidation of MDGs while making these more sustainable by strengthening environmental goals.
- There are seven major differences in MDGs and SDGs;

| SDGs | MDGs |
|---|---|
| SDGs have evolved after a long and extensive consultative process including 70 Open Working Groups, Civil Society Organizations, thematic consultations, etc. | MDGs were drawn up by a group of experts in the 'basement of UN headquarters' |

| | | |
|--|---|----------------|
| SDGs include 17 goals with 169 targets. | MDGs were focused with only 8 goals, 21 targets and 63 indicators | Student Notes: |
| All countries, developed or developing, are expected to work towards achieving SDGs | Focus on developing countries with funding came from rich countries | |
| The pillars of human development, human rights and equity are deeply rooted in SDGs and several targets seven explicitly refer to people with disabilities, six to people in vulnerable situations, and two to non-discrimination. | These were not even mentioned in the MDGs | |
| SDGs have one comprehensive goal emphasizing well-being and healthy living including Non communicable diseases. | MDGs had 3 direct health goals, 4 targets and 15 indicators with emphasis on child, maternal mortality and communicable diseases. | |
| For the SDGs, the baseline is from 2015 estimates. It may be revised as more recent data becomes available. | MDGs had a time span of 25 years though adopted in 2002 baseline data for the year 1990 was used and some of the baselines were revised subsequently which shifted 'the goal post'. | |
| The CSOs can play an important role to hold governments accountable at the local level. | MDGs had no concrete role for the Civil Society Organizations (CSOs). | |
| Means of Implementation (MoI) governmentally negotiated, global architecture and monitoring system being shaped. | MoI, monitoring and follow up not defined in advance. | |

18.6. India and SDGs

18.6.1 Strategy and Initiatives taken

- Localization of SDGs is at the core of India's SDG implementation and monitoring strategy. In the federal governance structure, the States play a pivotal role in designing, executing, and monitoring development policies and interventions. Therefore, States and UTs are the key drivers of the SDGs, while NITI Aayog and the central ministries collaborate with them in this endeavor. It is of paramount importance that the wide range of initiatives to implement and localize the SDGs being taken by the State governments and UTs, finds a mention here:

Role of NITI Aayog

- NITI Aayog has been entrusted with the role to co-ordinate 'Transforming our world: the 2030 Agenda for Sustainable Development' (called as SDGs).
- The task at hand for NITI Aayog is not merely to periodically collect data on SDGs but to act proactively to fructify the goals and targets not only quantitatively but also maintaining high standards of quality.
- It works closely with these States, enabling them in establishing SDG monitoring systems and supporting them in forging partnerships for building institutions, capacity, knowledge and convergence.
- SDG India Index:** NITI Aayog undertook extensive exercise of measuring India and its States' progress towards the SDGs for 2030, culminating in the development of the first SDG India Index - Baseline Report 2018.

- Awareness development on SDGs:** It is critical to generate awareness of all stakeholders to facilitate participatory and inclusive implementation of SDGs. The States have devised their own strategies for sensitizing elected representatives and officials at the state/district/local levels, as well as CSOs and communities.
- Preparing Vision Documents and action plans to guide their efforts on the SDGs:** It charted out interlinkages across sectors as well as various departments and developed a context and purpose for synergy. So far, 23 states have prepared their Vision documents that are based on the SDGs.

- **Aligning local development plans with SDGs:** Local governments – both rural and urban – are best placed to ‘put people first’ and ensure ‘no one is left behind’. In India, 29 functions related to socio-economic development are devolved to local governments. Consequently, many of the 17 SDGs are directly related to activities carried out by local governments. Several initiatives have been and are being taken to cast local development plans in the SDG framework.
- **Identifying the State-specific indicators for monitoring of the SDGs:** A substantial amount of data is needed to be produced and analysed on the SDGs, posing a significant challenge for the government statistical systems. While data-driven decision making has become the norm, decisions are often taken based on scanty data due to unavailability of data as well as lack of a comprehensive indicator framework. Development of State-specific and District-specific indicators based on the NIF bridges this gap substantially. However, more work is required to collect data that is disaggregated and is available at a higher frequency.
- **‘Leave No One Behind’:** All States have made this principle the leading actionable and monitorable parameter in programme implementation. A number of States and UTs have taken initiatives to conduct vulnerability mapping and reinforce people’s participation in various development programmes to make them truly inclusive. Special initiatives have been taken to address the needs of the vulnerable population groups such as women, persons with disabilities, Scheduled Castes and Scheduled Tribes, etc. Like at the national level, social insurance and entitlement-based programmes have been multiplied in States and UTs, targeting the vulnerable social groups.
- **Preparing capacity building resources and tools:** Development of capacity building aids and learning materials have been prioritized by various State governments. Different forms of resources have been used such as – comics for children, written IEC materials on SDGs, manuals, training modules, e-learning modules, information booklets and tools/toolkits, targeting different audience.
- **Aligning the State budgets with the SDGs:** Budgets provide a concrete measure of real commitment to the goals, while information on actual spending shows whether governments have followed through on the planned budget expenditure. Aligning budgets with SDGs facilitates identification of resource gaps and preparation of multipronged strategies to rationalize expenditure prioritisation, augment revenue and improve resource efficiency.
- **Building partnerships:** States are increasingly building partnerships with various stakeholders, such as multi-lateral organisations, academia, civil society organisations, and private sector to achieve the whole gamut of development targets.
- NITI Aayog and the UN in India joined hands to prepare a compendium of early lessons in localization of SDGs in collaboration with States and UTs. Special attention is being given to the adoption, implementation, monitoring and financing of SDGs in States which have been historically backward in development. There is consensus on all levels that unless these States make significant progress, India will find it challenging to achieve its SDG targets on time.

18.6.2. Challenges

The four major challenges that need to be addressed for achieving the SDGs are as follows:

- **Challenges in financing SDGs:**
 - With the emergence of the Covid-19 pandemic, SDG financing gap has widened by an estimated \$400 billion in developing countries, adding to the pre-COVID shortfall of \$2-2.5 trillion per annum. The financing gap for SDGs in India has widened further and development progress made under millennial development goals also are on verge of reversal.

- Heightened geopolitical tensions around trade and technology, growing external debt, unmet expectations of public private collaboration and lack of business models supporting SDGs are some key issues facing the financing of SDGs.
- **Maintaining peace** is essential for development. A threat to international peace and stability by nonstate actors is emerging as a major factor for both developed and developing countries. The recent crisis in Syria has forced 12 million people to leave their homes and made them refugees.
- **Measuring progress:** A number of targets in the SDGs are not quantified. The indicators for measuring progress have not yet been identified. Even if they limit to two indicators per target there will be 338 indicators to monitor and report. "Having 169 targets is like having no targets at all." Measurability will depend on the availability of data and capacity to measure them.
- **Accountability:** There was a lack of accountability for inputs into MDGs at all levels. This challenge needs to be addressed in SDGs.

About SDG Financing

- **Addis Ababa Action Agenda 2015**, provides a global framework for financing sustainable development that aligns all financing flows and policies with economic, social and environmental priorities.
- India occupies a key role in determining the success of the SDGs globally and it **needs \$2.64 trillion investment** to meet SDGs.
- India needs to **increase its SDG spending by an additional 6.2% of its GDP** until 2030.

SDG financing Initiatives:

- **SDG Financing Lab** is an **OECD-led initiative** that strives to inform decision-makers and policy leaders on how to ensure the resources needed to achieve the 2030 Agenda.
- **SDG Fund** is an international multi-donor and multi-agency development mechanism created in 2014 by the **United Nations** to support sustainable development activities.

Student Notes:

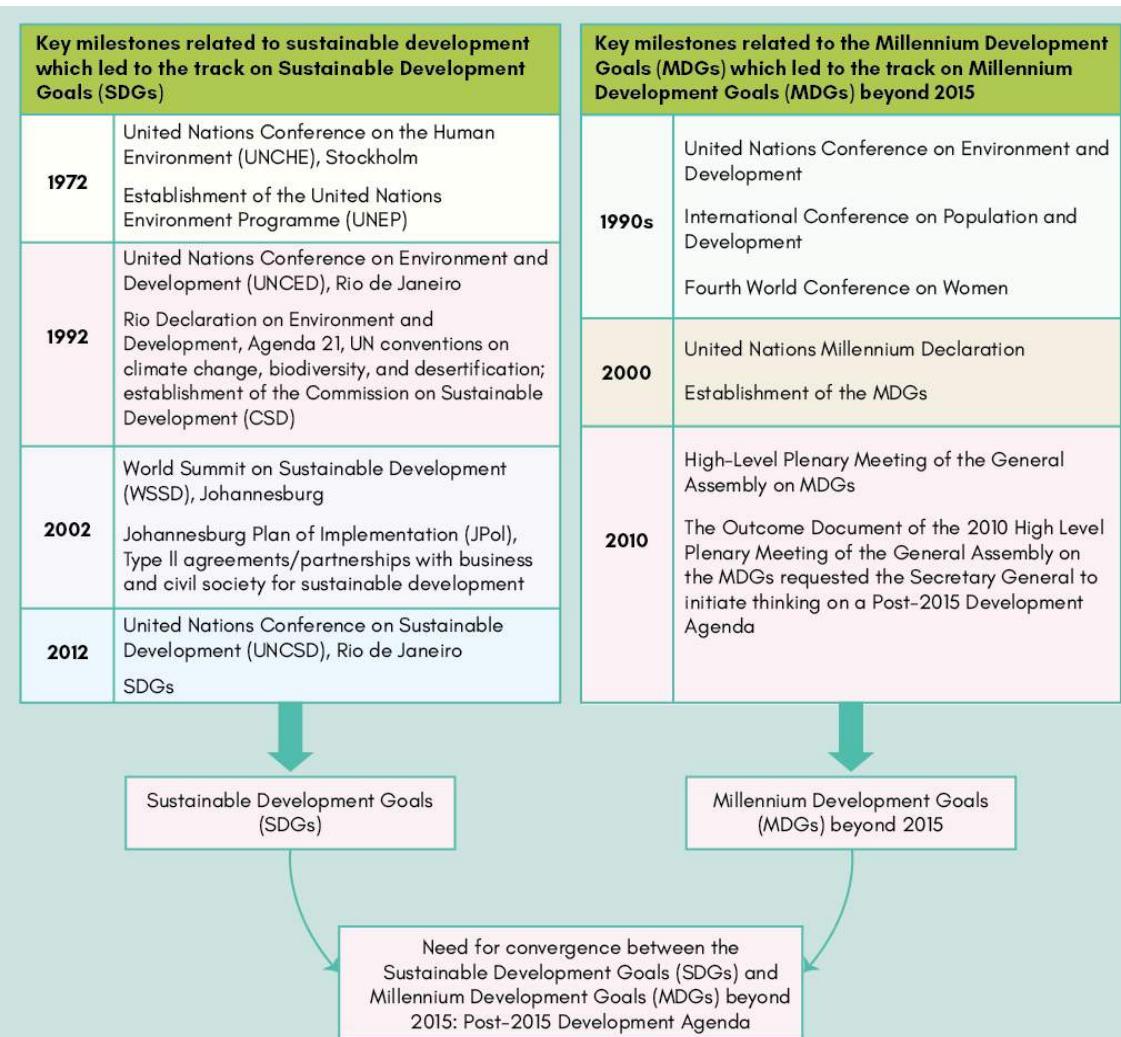
The lack of priority in funds allocation within country budget has also been a problem during MDGs. Similar lack of accountability exists at ministry, state, and local administration level. If we take SDGs seriously the accountability needs to be strengthened at all levels.

18.7. Way Forward

- By the force of intent and strategic versatility, the SDGs are expected to bring about a transformative impact on the development implementation process as well as the outcomes. Beyond the comfort zone of a 'business-as-usual' approach, new strategies, institutional mechanisms and partnerships are necessary to yield the desired results. The SDG India Index will be computed every year, based on the refinements of indicators and data methodologies so that the yearly progress of the States/ UTs can be closely monitored and gaps can be addressed, the natural aspiration being to graduate towards a more dynamic monitoring and evaluation framework.
- As India prepares to present its second Voluntary National Review during the United Nations' High Level Political Forum in July 2020, a conscious effort has been made to move from a "whole-of-government" approach to a "whole-of-society" approach, with extensive engagement with not only Central ministries, State/ UT governments, local governments, but also civil society organisations, think tanks, UN agencies, and the private sector on a gamut of cross-connected issues pertaining to the Agenda 2030.
- A comprehensive capacity building programme for the States, U.Ts, local governments is being designed in partnership with the UN system. The training modules will extensively cover developing SDG monitoring framework, identifying and designing indicators, localisation, and dashboards.
- NITI Aayog has initiated collaboration with IMF on estimating the financial cost of achieving key SDGs. As the next step of the collaboration, SDG financing exercise with select States is planned.
- Special attention is being given to the adoption, implementation, monitoring and financing of SDGs in States which have been historically backward in development. There is consensus

on all levels that unless these States make significant progress, India will find it challenging to achieve its SDG targets on time. NITI Aayog has started working closely with these States, enabling them in establishing SDG monitoring systems and supporting them in forging partnerships for building institutions, capacity, knowledge and convergence.

Student Notes:



Key milestones leading to Sustainable Development Goals (SDGs) and Millennium Development Goals (MDGs) beyond 2015

Green Economy

A green economy is defined as **low carbon, resource efficient and socially inclusive**. In a green economy, growth in employment and income are driven by public and private investment into such economic activities, infrastructure and assets that allow reduced carbon emissions and pollution, enhanced energy and resource efficiency, and prevention of the loss of biodiversity and ecosystem services.

The notion of green economy **does not replace sustainable development**, but creates a new focus on the economy, investment, capital and infrastructure, employment and skills and positive social and environmental outcomes across Asia and the Pacific.

The three main areas for the current work on Green Economy are:

- Advocacy of macro-economic approach to sustainable economic growth through regional, sub-regional and national fora
- Demonstration of Green Economy approaches with a central focus on access to green finance, technology and investments
- Support to countries in terms of development and mainstreaming of macro-economic policies to support the transition to a Green Economy

Partnership for Action on Green Economy (PAGE)

- It was launched in 2013 as a response to the call at Rio+20 to support those countries wishing to embark on greener and more inclusive growth trajectories.
- PAGE seeks to put sustainability at the heart of economic policies and practices to advance the 2030 Agenda for Sustainable Development and supports nations and regions in reframing economic policies and practices around sustainability to foster economic growth, create income and jobs, reduce poverty and inequality, and strengthen the ecological foundations of their economies.
- PAGE brings together five UN agencies – UN Environment, International Labour Organization, UN Development Programme, UN Industrial Development Organization, and UN Institute for Training and Research – whose mandates, expertises and networks combined can offer integrated and holistic support to countries on inclusive green economy, ensuring coherence and avoiding duplication.
- PAGE represents a mechanism to coordinate UN action on green economy and to assist countries in achieving and monitoring the emerging Sustainable Development Goals, especially SDG 8: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all."

Student Notes:

The role of Green Economy, Sustainable Consumption and Production and Resource Efficiency for Sustainable Development

Sustainable Consumption and Production aims to improve production processes and consumption practices to reduce resource consumption, waste generation and emissions across the full life cycle of processes and products – while Resource Efficiency refers to the ways in which resources are used to deliver value to society and aims to reduce the amount of resources needed, and emissions and waste generated, per unit of product or service. The Green Economy provides a macro-economic approach to sustainable economic growth with a central focus on investments, employment and skills.

```

graph TD
    RE[Resource efficiency  
Achieving greater wellbeing whilst reducing resource use and emissions] --- SCP[SCP  
Policies, tools and practices that support a green economy approach]
    RE --- GE[Green economy  
A macro-economic approach  
Focus on investing in green economic activities, infrastructure and skills]
    
```

18.8. UPSC Previous Year Questions

Mains

1. Examine the effect of economic development on environmental degradation in India. (2004)
2. How has the Indian State tackled the trade-off between environment and development ? (2005)
3. Explain the concepts "Environmental Sustainability" and "Sustainable Development of People"? (2012)
4. What are the economic significances of discovery of oil in Arctic Sea and its possible environmental consequences? (2015)
5. "Policy contradictions among various competing sectors and stakeholders have resulted in inadequate 'protection and prevention of degradation' to environment." Comment with relevant illustrations. (2018)
6. Define the concept of carrying capacity of an ecosystem as relevant to an environment. Explain how understanding this concept is vital while planning for sustainable development of a region. (2019)

1. What is Rio+20 Conference, often mentioned in the news? (2015)
- It is the United Nations Conference on Sustainable Development
 - It is a Ministerial Meeting of the World Trade Organization
 - It is a Conference of the Inter-governmental Panel on Climate Change
 - It is a Conference of the Member Countries of the Convention on Biological Diversity

Answer: (a)

2. With reference to 'Agenda 21', sometimes seen in the news, consider the following statements: (2016)

- It is a global action plan for sustainable development.
- It originated in the World Summit on Sustainable Development held in Johannesburg in 2002.

Which of the statements given above is/are correct?

- 1 only
- 2 only
- Both 1 and 2
- Neither 1 nor 2

Answer: (a)

3. The Partnership for Action on Green Economy (PAGE), a UN mechanism to assist countries transition towards greener and more inclusive economies, emerged at: (2018)

- The Earth Summit on Sustainable Development 2002, Johannesburg
- The United Nations Conference on Sustainable Development 2012, Rio de Janeiro
- The United Nations Framework Convention on Climate Change 2015, Paris
- The World Sustainable Development Summit 2016, New Delhi

Answer: (b)

18.9. Vision IAS Previous Year Questions

1. ***Describe the ongoing efforts for protection of environment and biodiversity in the light of the views of Gandhiji on sustainable development.***

Answer:

- With a current economy that is resilient and an ecology that is fragile, India is genuinely looking for ways to achieve sustainable development as it was defined at the Stockholm Summit — development that is economically sound, socially relevant and environment-friendly
- India's interest in leading the global agenda on environment in general and biodiversity (the variety of life on earth that ranges from all the plants, animals, microbes and other living systems) in particular is globally recognised.
- India hosted one of the largest environment/biodiversity events in the history of humankind: the 11th Conference of Parties to the Convention on Biological Diversity (CBD-COP 11) in October 2012.
- With almost near-global membership, the Convention on Biological Diversity is hailed as the most progressive multilateral environmental agreement that offers a unique opportunity to operationalise the principles of sustainable development.
- Gandhiji's vision was so forward-looking and inclusive that almost all of what we intend to define and re-define, and at the same time struggle to realise, was noted, analysed, linked and suggested by this great human being decades before
- Gandhiji's famous quote, "the earth provides enough to satisfy every man's needs, but not every man's greed," is such a perfect summation of the principles of ethics and justice, as elaborated under justice in exchange, distributive justice, corrective justice and retributive justice.

- Distinguishing between the needs and wants of human society, the Gandhian vision and philosophy are finding new breath in today's discourses related to reducing consumerism, respect for nature and ensuring equitable development.
- Sanitation, maternal health, primary education, gender balance, reduction of hunger, and ensuring partnerships for development formed the basis for Gandhi's life and practice long before the Millennium Development Goals were designed.
- His antyodaya approach is something that will remain the basis for sustainable development not just in 2012 but many decades and centuries to come.
- India is one of the first countries to enact a national legislation that considers these principles through the Biological Diversity Act of 2002.
- The Biological Diversity Act of 2002 that deals with decentralised governance and management of biological resources, attempts to work at the level of the panchayat to make rural livelihoods secure, suggests balancing of conservation with sustainable use, applies the principles of ethics and equity, and promotes the economics of permanence through varied partnerships.
- Constitutional provisions for Sustainable Development in DPSP and in our Fundamental Duties
- initiative taken by Govt for sustainable development like Environment Protect Act, 1986, Tiger Conservation Programme, Giving people more say in the development projects etc.

2. *Climate change threatens sustainable development, impairs socio-economic development and reinforces cycles of poverty across the globe. In this context, discuss the utility of climate risk insurance as an instrument within a comprehensive climate risk management system.*

Approach:

- In the first part of the question, link the climate change effects to sustainable development, socio economic development and poverty.
- In the second part, with the help of proviso of climate risk insurance, show how the scheme can foster sustainable development, socio-economic development and alleviate poverty.

Answer:

Climate change refers to the change in climate pattern from mid-20th century onwards owing to increasing level of carbon dioxide. It has been adversely affecting sustainable development, socio-economic development and well-being of people due to reasons such as:

- Impact on cropping patterns and yield by changes in temperature, precipitation & glacial run off etc. affect people at lower strata through increasing stress on water resources.
- Rise in sea level leading to existential threat to millions living on small islands.
- Loss of biodiversity disturbs natural habitats, food chain etc.
- Increase in communicable diseases, new infections, water borne diseases.

The absence of economic safety nets which could cushion the adverse impact of these climate-related disasters remains a serious concern because the risks often fall more heavily on those least able to reduce or recover from them. Any comprehensive climate risk management system include prevention, risk reduction, risk retention and risk transfer such as insurance schemes. The climate risk insurance has the following utilities:

- **Risk assessment:** Insurance acts as a catalyst for risk assessment. It can facilitate regional and international data analysis such as establishing data standards, methods and data repositories.
- **Protecting the vulnerable:** Insurance provides timely finance, which improves financial liquidity shortly after a disaster, reduces distress sale of assets and enable rapid recovery. It prevents people from slipping into poverty. It has the potential to protect approximately 400 million most vulnerable people against climate risk.
- **Lessen financial repercussions of volatility:** by creating a space of certainty within which investments, planning and development activities can be undertaken. This can help to unlock opportunities and may help increase savings, increase investments in higher-return activities and improve credit worthiness helping people or small enterprises in escaping poverty.
- **Increase climate resilience:** People are enabled to better absorb shocks. It will help generate sustainable solutions to fight against climate change since it strives for the climate induced disaster prevention and spreads the climate risk across time.
- **Spurs transformation:** Insurance reshapes the way risks are managed and driving more structured decision-making. Risk awareness also encourages risk-reducing behaviour, fosters a culture of risk management and increases the demand for insurance coverage
- **Reduces disparity:** It will help in reducing socio-economic disparity as it will dampen the disparity at different levels as it protects at individual, community, country, regional (international) and global level.

Thus, climate risk insurance is a key financial instrument to address residual risk but it is only one step in a systematic process. Effective risk management includes improving the understanding of disaster risks, reduce and transfer risk, respond to events and disasters as well as continually improve disaster preparedness.

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CHAPTER - 19 - SUSTAINABLE AGRICULTURE

Student Notes:

19. Sustainable Agriculture

19.1. Introduction

- The term "sustainable agriculture" is defined as an **integrated system of plant and animal production practices** having a site-specific application that will, over the long term:
 - Satisfy human food and fiber needs
 - Enhance environmental quality and the natural resource
 - Make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls
 - Sustain the economic viability of farm operations
 - Enhance the quality of life for farmers and society as a whole.
- There are several **key principles associated** with sustainability in agriculture:
 - The **incorporation of biological and ecological processes** such as nutrient cycling, soil regeneration, and nitrogen fixation into agricultural and food production practices.
 - Using **decreased amounts of non-renewable and unsustainable inputs**, particularly environmentally harmful ones.
 - Using the **expertise of farmers** to both productively work the land as well as to promote the self-reliance and self-sufficiency of farmers.
 - Solving agricultural and natural resource problems through the **cooperation and collaboration of people** with different skills. The problems tackled include pest management and irrigation.
- It "considers long-term as well as short-term economics because sustainability is readily defined as forever, that is, agricultural environments that are designed to promote endless regeneration". It balances the need for resource conservation with the needs of farmers pursuing their livelihood. It is considered to be reconciliation ecology, accommodating biodiversity within human landscapes.



19.2. Agricultural Emissions in India

Student Notes:

| | |
|--|--|
| Contribution: <ul style="list-style-type: none">In India, agriculture and livestock accounts for 18% of gross national GHG emissions, the third-highest sector after energy and industry. Most of this takes place from states like Punjab, Haryana, UP, Bihar, West Bengal etc. | Sources: <ul style="list-style-type: none">Enteric fermentation: Microbes in the digestive tract, or rumen, decompose and ferment food, producing methane as a by-product.Rice cultivation: GHG emissions from rice cultivation consist of methane gas from the anaerobic decomposition of organic matter in paddy fields due to standing water in the rice fields.Manure management: GHG emissions from manure management consist of methane and nitrous oxide gases from aerobic and anaerobic manure decomposition processes.Synthetic fertilisers: GHG emissions from synthetic fertilisers such as urea consist of nitrous oxide gas from synthetic nitrogen additions to managed soils due to volatilisation.Crop residues: GHG emissions from crop residues consist of nitrous oxide gas deriving from the decomposition of nitrogen in crop residues and burning of crop residues.Energy use: Irrigation uses highly inefficient water pumps and accounts for around 70% of the energy consumption of agriculture causing emissions of carbon dioxide, methane and nitrous oxide gases associated with fuel burning and the generation of electricity used in agriculture. |
| Impact: <ul style="list-style-type: none">Pollution:<ul style="list-style-type: none">Short-lived climate pollutants (SLCPs) such as black carbon materials and particulate matter PM10 and PM2.5 are generated due to burning of stubbles.Fertilisers rich in nitrogen can pollute water and threaten aquatic ecosystems.Greenhouse gases: Use of excess nitrogenous fertilizers, paddy cultivation and enteric fermentation components which causes global warming. | |

19.3. Sustainable Production Practices

Sustainable production practices involve a variety of approaches. Specific strategies must take into account topography, soil characteristics, climate, pests, local availability of inputs and the individual grower's goals.

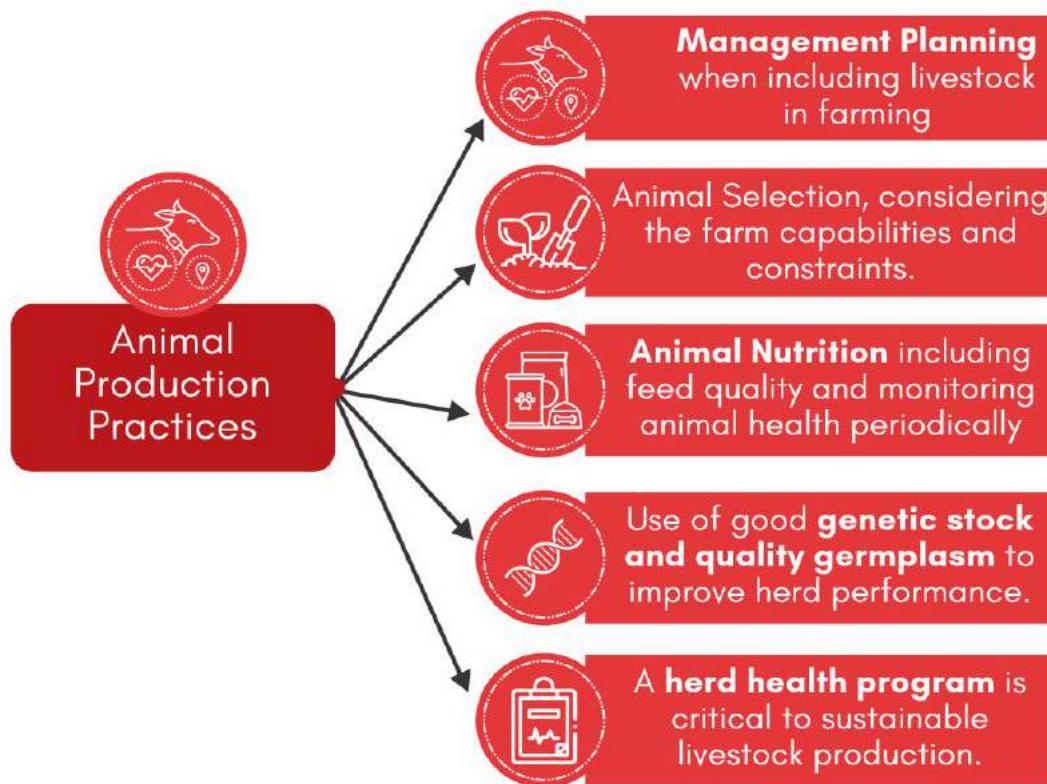
19.3.1. Plant Production Practices

Despite the site-specific and individual nature of sustainable agriculture, several general principles can be applied to help growers select appropriate management practices:

- Selection of species and varieties that are well suited to the site and to conditions on the farm.
- Diversification of crops (including livestock) and cultural practices to enhance the biological and economic stability of the farm:**
 - Diversified farms are usually more economically and ecologically resilient. While monoculture farming has advantages in terms of efficiency and ease of management, the loss of the crop in any one year could put a farm out of business and/or seriously disrupt the stability of a community dependent on that crop.
 - Properly managed, diversity can also buffer a farm in a biological sense. For example, in annual cropping systems, crop rotation can be used to suppress weeds, pathogens and insect pests.
 - Also, cover crops can have stabilizing effects on the agroecosystem by holding soil and nutrients in place, conserving soil moisture with mowed or standing dead mulches, and by increasing the water infiltration rate and soil water holding capacity.
 - Optimum diversity may be obtained by integrating both crops and livestock in the same farming operation.
- Management of the soil to enhance and protect soil quality through methods like:**

- Using cover crops, compost and/or manures
- Reducing tillage
- Avoiding traffic on wet soils
- Maintaining soil cover with plants and/or mulches
- Conditions in most California soils (warm, irrigated, and tilled) do not favor the buildup of organic matter. Regular additions of organic matter or the use of cover crops can increase soil aggregate stability, soil tilth, and diversity of soil microbial life.
- **Efficient and humane use of inputs**
 - Many inputs and practices used by conventional farmers are also used in sustainable agriculture. Sustainable farmers, however, maximize reliance on natural, renewable, and on-farm inputs. Equally important are the environmental, social, and economic impacts of a particular strategy.
 - Converting to sustainable practices does not mean simple input substitution. Frequently, it substitutes enhanced management and scientific knowledge for conventional inputs, especially chemical inputs that harm the environment on farms and in rural communities. The goal is to develop efficient, biological systems which do not need high levels of material inputs.
- **Consideration of farmer's goals and lifestyle choices:**
 - Management decisions should reflect not only environmental and broad social considerations, but also individual goals and lifestyle choices. For example, adoption of some technologies or practices that promise profitability may also require such intensive management that one's lifestyle actually deteriorates. Management decisions that promote sustainability, nourish the environment, the community and the individual.

19.3.2. Animal Production Practices



19.4. Sustainable Agricultural Practices

19.4.1. Mulching

- Mulch is simply a protective layer of a material that is spread on top of the soil. Mulches can either be organic -- such as grass clippings, straw, bark chips, and similar materials -- or

inorganic -- such as stones, brick chips, and plastic. Both organic and inorganic mulches have numerous benefits. Mulching enriches and protects soil, helping provide a better growing environment.

- Organic mulches also improve the condition of the soil. As these mulches slowly decompose, they provide organic matter which helps keep the soil loose. This improves root growth, increases the infiltration of water, and also improves the water-holding capacity of the soil. Organic matter is a source of plant nutrients and provides an ideal environment for earthworms and other beneficial soil organisms.
- While inorganic mulches have their place in certain landscapes, they lack the soil improving properties of organic mulches. Inorganic mulches, because of their permanence, may be difficult to remove if you decide to change your garden plans at a later date. Therefore, this tip sheet is limited to the use of organic mulches.
- Mulching Materials:** Materials used as mulches vary and depend on a number of factors. Use takes into consideration availability, cost, appearance, the effect it has on the soil—including chemical reactions and pH, durability, combustibility, rate of decomposition, how clean it is—some can contain weed seeds or plant pathogens. A variety of materials are used as mulch:

- Organic residues:** grass clippings, leaves, hay, straw, kitchen scraps comfrey, shredded bark, whole bark nuggets, sawdust, shells, woodchips, shredded newspaper, cardboard, wool, animal manure, etc. Many of these materials also act as a direct composting system, such as the mulched clippings of a mulching lawn mower, or other organics applied as sheet composting.
- Compost:** fully composted materials are used to avoid possible phytotoxicity problems. Materials that are free of seeds are ideally used, to prevent weeds being introduced by the mulch.
- Old carpet (synthetic or natural):** makes a free, readily available mulch.
- Rubber mulch:** made from recycled tire rubber.
- Plastic mulch:** crops grow through slits or holes in thin plastic sheeting. This method is predominant in large-scale vegetable growing, with millions of acres cultivated under plastic mulch worldwide each year (disposal of plastic mulch is cited as an environmental problem but there are also degradable plastic mulches).
- Rock and gravel** can also be used as a mulch. In cooler climates the heat retained by rocks may extend the growing season.

Significance of Mulching

- Protects the soil from erosion
- Reduces compaction from the impact of heavy rains
- Conserves moisture, reducing the need for frequent waterings
- Maintains a more even soil temperature
- Prevents weed growth

19.4.2. Zero Tillage

- Tillage is an agriculture land preparation through mechanical agitation which includes digging, stirring and overturning. Zero tillage is the process where the crop seed will be sown through drillers without prior land preparation and disturbing the soil where previous crop stubbles are present. Zero tillage not only reduce the cost of cultivation it also reduces the soil erosion, crop duration and irrigation requirement and weed effect which is better than tillage. Zero Tillage (ZT) also called No Tillage or Nil Tillage.
- The advantages of Zero tillage include:
 - Reduction in the crop duration and thereby early cropping can be obtained to get higher yields.
 - Reduction in the cost of inputs for land preparation and therefore a saving of around 80%.
 - Residual moisture can be effectively utilized and number of irrigations can be reduced.
 - Dry matter and organic matter get added to the soil.

- Environmentally safe - Greenhouse effect will get reduced due to carbon sequestration.
- No tillage reduces the compaction of the soil and reduces the water loss by runoff and prevent soil erosion.
- As the soil is intact and no disturbance is done, No Till lands have more useful flora and fauna
- The natural resources are precious and therefore demand an effective and sustainable use. Zero tillage is a potential technology in this scenario. Although the drawback of use of non-selective herbicide is more, it still causes less effect than the conventional method of farming. In zero tillage, more returns can be achieved and timely crop can be grown with higher yields.

Zero Tillage in India

- No Till approach started from 1960s by farmers in India. The zero-tillage system is being followed in the Indo-Gangetic plains where rice-wheat cropping is present. Wheat will be planted after rice harvest without any operation.
- The green revolution paved the way for the rice-wheat production system in the north-western parts of India. But in due course of time, the yields of rice and wheat become stagnant due to inappropriate soil and water management system and late planting of wheat, as in the hot season rice is being grown and in the winter wheat follows the rice.
- In 1990's the zero tillage came to mitigate the problem, by planting the wheat by drilling without any land preparation and tillage.
- The success of zero tillage depends on the machinery to drill seed in the uncultivated land. In late 1980's, CIMMYT introduced a prototype for drilling the seed. In India, the first localized seed drill was manufactured by GB Pant University with a motor to reduce the cost and make it available and affordable.

19.4.3. Agro-Ecology

- Agroecology is an integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems. It seeks to optimize the interactions between plants, animals, humans and the environment while taking into consideration the social aspects that need to be addressed for a sustainable and fair food system.
- The major agroecological principles include:
 - **Recycling:** Preferentially use local renewable resources and close as far as possible resource cycles of nutrients and biomass.
 - **Input reduction:** Reduce or eliminate dependency on purchased inputs. Soil health. Secure and enhance soil health and functioning for improved plant growth, particularly by managing organic matter and by enhancing soil biological activity.
 - **Animal health:** Ensure animal health and welfare.
 - **Biodiversity:** Maintain and enhance diversity of species, functional diversity and genetic resources and maintain biodiversity in the agroecosystem over time and space at field, farm and landscape scales.
 - **Synergy:** Enhance positive ecological interaction, integration, and complementarity amongst the elements of agroecosystems (plants, animals, trees, soil, water).
 - **Economic diversification:** Diversify on-farm incomes by ensuring small-scale farmers have greater financial independence and value addition opportunities while enabling them to respond to demand from consumers.
 - **Co-creation of knowledge:** Enhance co-creation and horizontal sharing of knowledge

10 Elements of Agroecology

- Diversity; synergies; efficiency; resilience; recycling; co-creation and sharing of knowledge (describing common characteristics of agroecological systems, foundational practices and innovation approaches)
- Human and social values; culture and food traditions (context features)
- Responsible governance; circular and solidarity economy (enabling environment)

The 10 Elements of Agroecology are **interlinked and interdependent**.

- including local and scientific innovation, especially through farmer-to-farmer exchange.
- **Social values and diets:** Build food systems based on the culture, identity, tradition, social and gender equity of local communities that provide healthy, diversified, seasonally and culturally appropriate diets.
- **Fairness:** Support dignified and robust livelihoods for all actors engaged in food systems, especially small-scale food producers, based on fair trade, fair employment and fair treatment of intellectual property rights.
- **Connectivity:** Ensure proximity and confidence between producers and consumers through promotion of fair and short distribution networks and by re-embedding food systems into local economies.
- **Land and natural resource governance:** Recognize and support the needs and interests of family farmers, smallholders and peasant food producers as sustainable managers and guardians of natural and genetic resources.
- **Participation:** Encourage social organization and greater participation in decision-making by food producers and consumers to support decentralized governance and local adaptive management of agricultural and food systems.

19.4.4. Organic Farming

- FSSAI has issued regulation on organic farming in India. The regulations include:
 - **Definition**
 - ✓ **Organic Agriculture:** A system of farm design and management to create an eco-system of agriculture production without the use of synthetic external inputs such as chemicals, fertilisers, pesticides and synthetic hormones or genetically modified organisms.
 - ✓ **Organic Farm Produce:** the produce obtained from organic agriculture.
 - ✓ **Organic Food Means:** Food products that have been produced in accordance with specified standards for organic production.
 - **Mandatory labeling of Organic food** which should convey full and accurate information on the organic status of the product. There will be penalties on non-compliance of regulation.
 - **Approval authority:** Organic food products should carry a certification mark or a quality assurance mark given by



- ✓ National Programme for Organic Production (NPOP)
- ✓ Participatory Guarantee System for India (PGS-India)
- ✓ Voluntary logo from the FSSAI that marked its produce as 'organic.'

Student Notes:

CERTIFICATION CONFUSION

For any food to be sold as organic in India, whether fresh produce or packaged product, it must be certified via one of two systems. That road can be long, winding and often expensive.

NATIONAL PROGRAMME FOR ORGANIC PRODUCTION (NPOP)



Adopted in 2001 and administered by the Ministry of Commerce & Industry, it was originally meant for exports



Under this programme, one of 28 third-party certifiers must check that a farm is free of manufactured chemicals (fertilizers, insecticides, herbicides hormones and pesticides).



In case of processed food, the certifier checks that the produce came from an NPOP-certified farm and was processed by a NPOP-certified processor.



Certified foods carry the India Organic logo. The standards are recognized by the European Commission, America's USDA, and Switzerland.

THE CATCH

- **Third party certification** is expensive and must be renewed annually.
- **So the programme** is restricted to big companies, ones, that work with farmers over thousands of acres, and earn revenues largely from exporting non-perishables - oilseeds, processed food, cereals, tea spices and pulses.

PARTICIPATORY GUARANTEE SYSTEM FOR INDIA (PGS-INDIA)



Practised in 38 countries and recognized by the Union Ministry of Agriculture & Farmers Welfare since 2018, it certifies clusters of small farmer (two and five acres each)



Five or more growers who live close to each other form a group and get trained in organic farming under a government scheme.



Then, with help from Regional Councils (India now has 562), farmers inspect each other's holdings. Should a grower violate any norms, their produce is not sold through the group.



India now has 6,646 PGS groups, covering about 2.1 lakh farmers

THE CATCH

- **The system is poorly founded**, farmers are often trained badly and the system does little to create a long-term market for organic produce.
- **The PGS is not recognized** by the US and European Union, two big markets for organic food. So small farmers still cannot sell their produce abroad.
- **They can't sell their food to NPOP - certified processors either**. This means they often have little incentive to stay organic.

19.4.5. Zero Budget Natural Farming (ZBNF)

- It is a natural farming technique in which farming is done **without use of chemicals** and **without using any credits** or spending any money on purchased inputs.
- ZBNF **reduces the cost of production down to zero** due to **utilisation of all the natural resources** available in and around the crops. Farmers use earthworms, cow dung, urine, plants, human excreta and other biological fertilizers for crop protection.
- It has been **developed by Subhash Palekar**.

Student Notes:

Core Principles of ZBNF

1. BEEJAMRUTHAM

Microbial seed coating through cow urine and dung based formulations.

2. JEEVAMRUTHAM

Enhance soil microbiome through application of cow dung, cow urine and other local ingredients

3. COVER CROPS and MULCHING:

Ground to be kept covered with crops and also crop residues

4. WAAPHASA

Fast build up of soil humus through ZBNF leads soil aeration



- Government of Andhra Pradesh is implementing Zero-Budget Natural Farming (ZBNF) Programme.

19.4.6. Intensive Agricultural Practices

- Intensive farming practices which are thought to be sustainable have been developed to slow the deterioration of agricultural land and even regenerate soil health and ecosystem services. These developments may fall in the category of organic farming, or the integration of organic and conventional agriculture.
- Pasture cropping** involves planting grain crops directly into grassland without first applying herbicides. The perennial grasses form a living mulch under-story to the grain crop, eliminating the need to plant cover crops after harvest. The pasture is intensively grazed both before and after grain production. This intensive system yields equivalent farmer profits (partly from increased livestock forage) while building new topsoil and sequestering up to 33 tons of CO₂/ha/year.
- Biointensive agriculture** focuses on maximizing efficiency such as per unit area, energy input and water input.
- Agroforestry** combines agriculture and orchard/forestry technologies to create more integrated, diverse, productive, profitable, healthy and sustainable land-use systems.
- Intercropping** can increase yields or reduce inputs and thus represents (potentially sustainable) agricultural intensification. However, while total yield per acre is often increased, yields of any single crop often diminish. There are also challenges to farmers relying on farming equipment optimized for monoculture, often resulting in increased labor inputs.
- Vertical farming** is intensive crop production on a large scale in urban centers, in multi-story, artificially-lit structures, for the production of low-calorie foods like herbs, microgreens, and lettuce.
- An integrated farming system is a progressive, sustainable agriculture system such as zero waste agriculture or integrated multi-trophic aquaculture, which involves the interactions of multiple species. Elements of this integration can include:
 - Intentionally introducing flowering plants into agricultural ecosystems to increase pollen- and nectar-resources required by natural enemies of insect pests.
 - Using crop rotation and cover crops to suppress nematodes in potatoes.
 - Integrated multi-trophic aquaculture is a practice in which the by-products (wastes) from one species are recycled to become inputs (fertilizers, food) for another.

- Holistic management was originally developed for reversing desertification. Holistic planned grazing is similar to rotational grazing but accentuates the four principles of the water cycle, the mineral cycles (including the carbon cycle), energy flow and ecology.

Student Notes:

System of Rice Intensification

- The System of Rice Intensification (SRI) is a farming methodology aimed at increasing the yield of rice produced in farming. It is a low-water, labor-intensive method that uses younger seedlings singly spaced and typically hand weeded with special tools. It was developed in 1983 by the French Jesuit Father Henri de Laulanié in Madagascar.
- SRI concepts and practices have continued to evolve as they are being adapted to rain-fed (unirrigated) environments and with transplanting being sometimes replaced by direct-seeding. The central principles of SRI are:
 - Rice field soils should be kept moist rather than continuously saturated, minimizing anaerobic conditions, as this improves root growth and supports the growth and diversity of aerobic soil organisms.
 - Rice plants should be planted singly and widely spaced to permit root and canopy growth to keep all leaves photosynthetically active.
 - Rice seedlings should be transplanted when young, less than 15 days old with just two leaves, quickly, shallowly, and carefully, to avoid trauma to roots and minimize transplant shock.
- The Kadiramangalam System of Rice Intensification:** Developed and practiced in the village by Mr S. Gopal of the Cauvery Delta zone of Tamil Nadu State. This system has been developed using SRI ideas and practices, such that it is suited to local conditions in the Cauvery Delta region.
 - Concern of farmers in SRI method of planting :** Very young seedlings (when planted as in SRI) will be desiccated by the intense sun and continuous wind.
 - A potential solution to their problem :** Transplanting very young seedlings in clumps of five for their first two weeks out of the nursery gives them some protection against sun and wind. Re-transplanting them singly after two weeks means that they are then stronger and able to grow vigorously with no mortality.
 - Drawback in the method:** Additional labour requirement for the second transplanting. However, farmers feel that the increased yield will cover the additional labor cost.
 - Outcome :** The yield obtained in this system was on an average 7.5 t/ha.

Sustainable Sugarcane Initiative

- The Sustainable Sugarcane Initiative (SSI) is an innovative set of agronomic practices that involves using less seeds, raising seeds in a nursery, and following new planting methods, with wider seed spacing, and better water and nutrient management to increase the cane yields significantly.
- SSI methods can increase sugarcane yields by at least 20% with 30% less water and a 25% reduction in chemical inputs. The SSI method of sugarcane cultivation was evolved from the principles of '**More with Less**' followed in SRI (System of Rice Intensification) and introduced in India by the WWF-ICRISAT collaborative project in 2009.
- Benefits of SSI to farmers**
 - Less seed: Saving in seed material
 - Healthy seedling of 25-35 days old from nursery
 - Wide spacing: Go for inter cropping
 - Water saving: Easy for drip, low cost
 - Less cost for transplantation
 - Adapting to new varieties
 - Intercrop provides an additional income
- Benefits of SSI to millers**
 - Increase recovery
 - Improves the raw material supply
 - Improves the profitability.
 - Increases the efficiency of mills- more systematic supply during the season.

19.4.7. Permaculture

- Permaculture is an innovative framework for creating sustainable ways of living. It is a practical method of developing ecologically harmonious, efficient and productive systems that can be used by anyone, anywhere.

- It is the conscious design and maintenance of agriculturally productive ecosystems which have the diversity, stability, and resilience of natural ecosystems.
- It is the harmonious integration of landscape and people — providing their food, energy, shelter, and other material and non-material needs in a sustainable way. The term was coined by **Bill Mollison** in 1978
- **Significance of Permaculture**
 - **Environment friendly:** It discourages uses of chemical and pesticide and promotes the uses of eco-friendly means to maintain soil health and increase productivity.
 - **Decrease Global warming:** Increasing area under permaculture from current 108 million acres to 1 billion acres by 2050 could result in a total reduction of 23.2 gigatons of CO₂, from both sequestration and reduced emissions.
 - **Promotion of Traditional practice:** It incorporates traditional farming practices with modern technological and scientific knowledge to create efficient systems. It can also reduce the dependency of farmers on multi-national companies for genetically modified seeds.
 - **Improve income:** Instead of monoculture, permaculture uses polyculture where a diverse range of vegetation and animals are utilised to support each other to create a selfsustaining system.
- Permaculture tackles how to grow food, build houses and create communities, and minimise environmental impact at the same time. Its principles are being constantly developed and refined by people throughout the world in very different climates and cultural circumstances.

Student Notes:

19.4.8. Vertical Farming Systems

- Vertical farming is cultivating and producing crops/ plants in vertically stacked layers and vertically inclined surfaces. The entire world is on the verge of population explosion and there is a gravest challenge of feeding the population. The population explosion has led to the decreased per capita land.
- In 1915, Gilbert Ellis Bailey coined the term “vertical farming” and wrote a book titled “Vertical Farming”. In the early 1930s, William Frederick Gerick pioneered hydroponics at the University of California at Berkley.
- **Advantages of vertical farming**
 - The first and the major advantage of vertical farming is producing extremely high yields per available land or area.
 - Producing the food throughout the year without the risk of vagaries of nature like floods, heavy rains, uneven rains, hail and snowfall, drought, dry spells, extreme high temperatures, cold waves, epidemics of pest and diseases, etc.
 - It reduces the cost over transporting loads of food grains from rural area to urban areas and reduce the spoilage occurring therein. Fossil fuel consumption in transporting the farm produce to cities from village places is also reduced to a greater extent. Vertical farming uses 70 to 95 % less water compared to traditional farming
 - 90%less or no soil is needed in vertical farming and thereby no pest and disease infestations.
 - Pesticide free or organic food is produced as there is no use of pesticides.
 - Due to reduced food supply chain, consumers get the fresh produce with all its original nutrient qualities.
 - High productivity per unit area i.e. almost 80% more harvest per unit of area in vertical farming.
 - It will lead to greening of the urban areas and help to reduce the rising temperatures and mainly the air pollution in cities.
- **Disadvantages of vertical farming**
 - Initial high cost for establishing the vertical farming system is the major problem. It will include the cost erecting the structures along with its automation like Computerized and

- monitoring systems, remote control systems and software's, automated racking and stacking systems, programmable LED lighting systems, climate control system, etc.
- High energy cost as growing plant is entirely with artificial lights.
- The excess nutrients used in vertical farming may interfere and contaminate the main urban water system if not taken care of.
- LED lighting systems emit heat though small amount will create problem of maintaining the temperatures especially in summer months and may overload the air conditioning systems which will again incur high energy cost.
- Lot of garbage, plant residues, etc. will be generated around the buildings with vertical farming which needs to be dispose off properly.
- Skilled workforce will be unavailable initially and will need to be trained

Systems of Vertical farming

1. Hydroponics:

- It is a method of growing food in water using mineral nutrient solutions without soil. The basic advantages of this method is that it reduces soil-related cultivation problems like soil borne insects, pest and diseases.

2. Aeroponics

- In aeroponics, there is no growing medium and hence, no containers for growing crops. In aeroponics, mist or nutrient solutions are used instead of water. As the plants are tied to a support and roots are sprayed with nutrient solution, it requires very less space, very less water and no soil.

3. Aquaponics

- It is a bio-system that integrates recirculated aquaculture (fish farming) with hydroponic vegetable, flower, and herb production to create symbiotic relationships between the plants and the fish.
- It achieves this symbiosis through using the nutrient-rich waste from fish tanks to "fertigate" hydroponic production beds. In turn, the hydroponic beds also function as bio-filters that remove gases, acids, and chemicals, such as ammonia, nitrates, and phosphates, from the water.
- Simultaneously, the gravel beds provide habitats for nitrifying bacteria, which augment the nutrient cycling and filter water. Consequently, the freshly cleansed water can be recirculated into the fish tanks.

- Vertical farming is definitely a solution to critical problems in Indian farming like lack of supply or oversupply of farm produce, overuse of pesticides, overuse of fertilizers, deteriorating soils and even the unemployability.
- But there are challenges like acceptance of vertical farming by Indian farming community. Indian farmers are facing various problems like lack of electricity supply throughout the day, assurance of minimum support prices, no control over market glut, water scarcity, etc. The initial huge cost of infrastructure for a large-scale farm is a major hurdle for implementing vertical farming in India. Vertical farming in India has to face other challenges like public awareness, inclusiveness of farming community, technical know-how, cost incurred in managing and mainlining the vertical farm systems, and also its economic viability.

19.4.9. Hydroponics

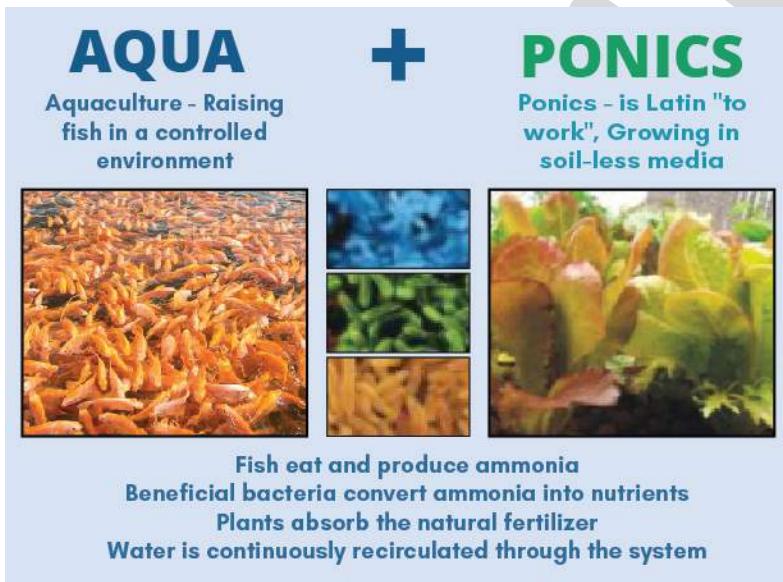
- Hydroponics is the cultivation of plants without using soil. Hydroponic flowers, herbs, and vegetables are planted in inert growing media and supplied with nutrient-rich solutions, oxygen, and water. This system fosters rapid growth, stronger yields, and superior quality. When a plant is grown in soil, its roots are perpetually searching for the necessary nutrition to support the plant. If a plant's root system is exposed directly to water and nutrition, the plant does not have to exert any energy in sustaining itself. The energy the roots would have expended acquiring food and water can be redirected into the plant's maturation. As a result, leaf growth flourishes as does the blooming of fruits and flowers.
- **Functioning of a Hydroponic System:**
 - Hydroponic systems work by allowing minute control over environmental conditions like temperature and pH balance and maximized exposure to nutrients and water. Hydroponics operates under a very simple principle: provide plants exactly what they

need when they need it. Hydroponics administer nutrient solutions tailored to the needs of the particular plant being grown. They allow you to control exactly how much light the plants receive and for how long. pH levels can be monitored and adjusted. In a highly customized and controlled environment, plant growth accelerates.

- By controlling the environment of the plant, many risk factors are reduced. Plants grown in gardens and fields are introduced to a host of variables that negatively impact their health and growth. Fungus in the soil can spread diseases to plants. Wildlife like rabbits can plunder ripening vegetables from your garden. Pests like locusts can descend on crops and obliterate them in an afternoon. Hydroponic systems end the unpredictability of growing plants outdoors and in the earth. Without the mechanical resistance of the soil, seedlings can mature much faster. By eliminating pesticides, hydroponics produce much healthier and high-quality fruits and vegetables. Without obstacles, plants are free to grow vigorously and rapidly.

Student Notes:

19.4.10. Aquaponics



- **Benefits associated with Aquaponics**

- Aquaponics relies on the recycling of nutrient-rich water continuously. In aquaponics, there is no toxic run-off.
- Aquaponics uses 1/10th of the water of soil-based gardening and even less water than hydroponics or recirculating aquaculture.
- No harmful petrochemicals, pesticides or herbicides can be used. It's a natural ecosystem.
- Aquaponic systems can be put anywhere, use them outside, in a greenhouse, in your basement, or in your living room. By using grow-lighting, and space can become a productive garden.
- Instead of using dirt or toxic chemical solutions to grow plants, aquaponics uses highly nutritious fish effluent that contains all the required nutrients for optimum plant growth. Instead of discharging water, aquaponics uses the plants, naturally occurring bacteria, and the media in which they grow in to clean and purify the water, after which it is returned to the fish tank. This water can be reused indefinitely and will only need to be topped-off when it is lost through transpiration from the plants and evaporation.

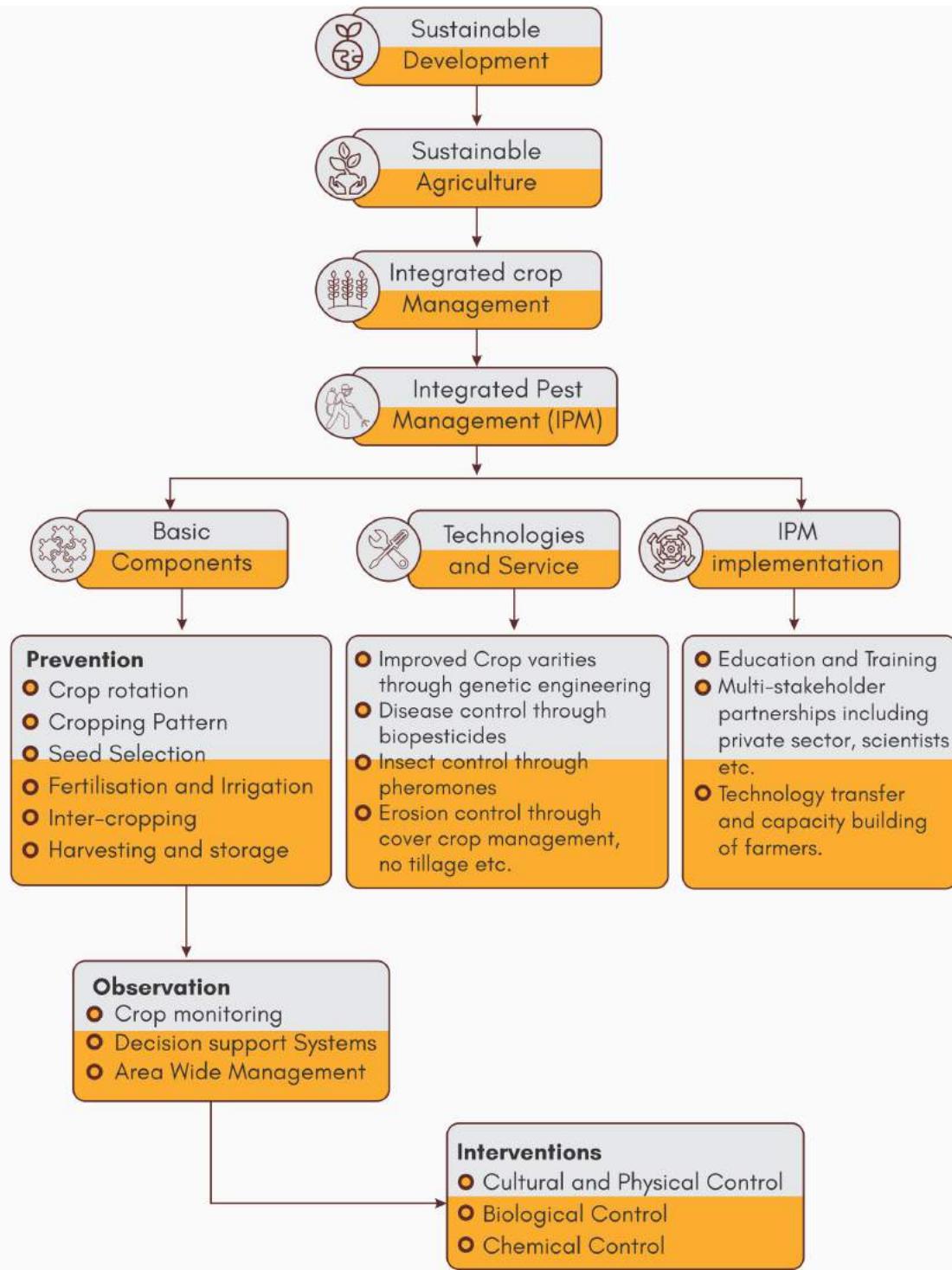
19.4.11. Integrated Pest Management (IPM)

Student Notes:

- IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the environment.
- The most effective, long-term way to manage pests is by using a combination of methods that work better together than separately. Approaches for managing pests are often grouped in the following categories.
 - Biological control:** Biological control is the use of natural enemies—predators, parasites, pathogens, and competitors—to control pests and their damage. Invertebrates, plant pathogens, nematodes, weeds, and vertebrates have many natural enemies.
 - Cultural controls:** Cultural controls are practices that reduce pest establishment, reproduction, dispersal, and survival. For example, changing irrigation practices can reduce pest problems, since too much water can increase root disease and weeds.
 - Mechanical and physical controls:** Mechanical and physical controls kill a pest directly, block pests out, or make the environment unsuitable for it. Traps for rodents are examples of mechanical control. Physical controls include mulches for weed management, steam sterilization of the soil for disease management, or barriers such as screens to keep birds or insects out.
 - Chemical control:** Chemical control is the use of pesticides. In IPM, pesticides are used only when needed and in combination with other approaches for more effective, long-term control. Pesticides are selected and applied in a way that minimizes their possible harm to people, non-target organisms, and the environment.

Components of IPM

- Pest identification.
- Monitoring and assessing pest numbers and damage.
- Preventing pest problems.
- Using a combination of biological, cultural, physical/mechanical and chemical management tools.
- After action is taken, assessing the effect of pest management.



Miscellaneous Practices

Over decades of science and practice, several key sustainable farming practices have emerged—for example:

- **Rotating crops and embracing diversity:** Planting a variety of crops can have many benefits, including healthier soil and improved pest control. Crop diversity practices include inter cropping (growing a mix of crops in the same area) and complex multi-year crop rotations.
- **Planting cover crops:** Cover crops, like clover or hairy vetch, are planted during off-season times when soils might otherwise be left bare. These crops protect and build soil health by preventing erosion, replenishing soil nutrients, and keeping weeds in check, reducing the need for herbicides.
- **Integrating livestock and crops:** Industrial agriculture tends to keep plant and animal production separate, with animals living far from the areas where their feed is produced, and crops growing far away from abundant manure fertilizers. A growing body of evidence shows that a smart integration of crop and animal production can be a recipe for more efficient, profitable farms.

- **Managing whole systems and landscapes:** Sustainable farms treat uncultivated or less intensively cultivated areas, such as riparian buffers or prairie strips, as integral to the farm—valued for their role in controlling erosion, reducing nutrient runoff, and supporting pollinators and other biodiversity.

Student Notes:

19.5. Government Initiatives

19.5.1. National Mission on Sustainable Agriculture

- National Mission for Sustainable Agriculture (NMSA) aims at making agriculture more productive, sustainable, remunerative and climate resilient by promoting location specific integrated /composite farming systems; soil and moisture conservation measures; comprehensive soil health management; efficient water management practices and mainstreaming rainfed technologies.
- **NMSA will have following objectives:**
 - To make agriculture more productive, sustainable, remunerative and climate resilient by promoting location specific Integrated/Composite Farming Systems;
 - To conserve natural resources through appropriate soil and moisture conservation measures;
 - To adopt comprehensive soil health management practices based on soil fertility maps, soil test based application of macro & micro nutrients, judicious use of fertilizers etc.;
 - To optimize utilization of water resources through efficient water management to expand coverage for achieving ‘more crop per drop’;
 - To develop capacity of farmers & stakeholders, in conjunction with other ongoing Missions e.g. National Mission on Agriculture Extension & Technology, National Food Security Mission, National Initiative for Climate Resilient Agriculture (NICRA) etc., in the domain of climate change adaptation and mitigation measures;
 - To pilot models in select blocks for improving productivity of rainfed farming by mainstreaming rainfed technologies refined through NICRA and by leveraging resources from other schemes/Missions like Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), Integrated Watershed Management Programme (IWMP), RKVY etc.; and
 - To establish an effective inter and intra Departmental/Ministerial co-ordination for accomplishing key deliverables of National Mission for Sustainable Agriculture under the aegis of NAPCC.

Mission Interventions

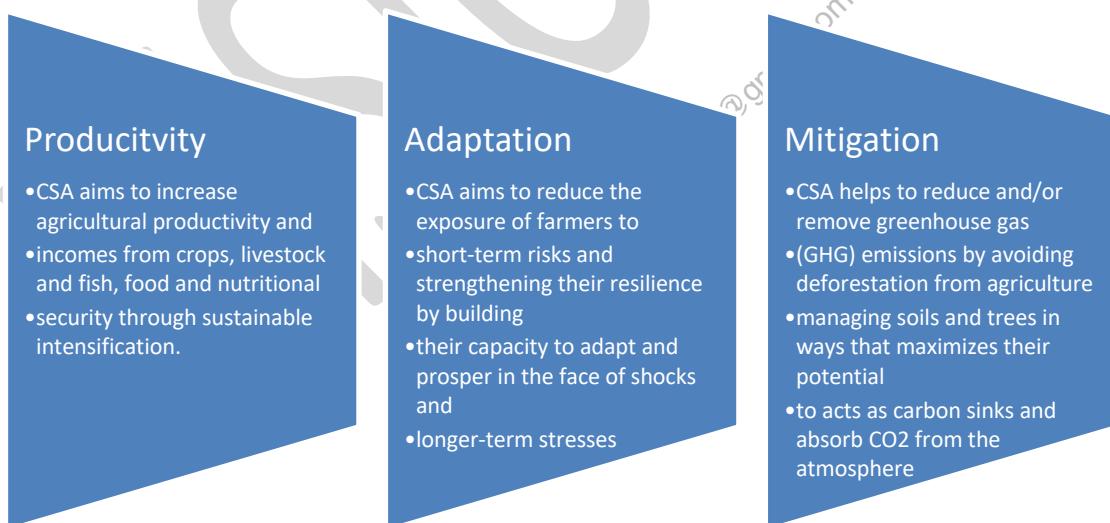
- **Rainfed Area Development (RAD):** RAD will adopt an area based approach for development and conservation of natural resources along with farming systems. This component has been formulated in a ‘watershed plus framework’, i.e., to explore potential utilization of natural resources base/assets available/created through watershed development and soil conservation activities/interventions under MGNREGS, NWDPRA, RVP&FPR, RKVY, IWMP etc.
- **On Farm Water Management (OFWM):** OFWM will focus primarily on enhancing water use efficiency by promoting efficient on-farm water management technologies and equipment. This will not only focus on application efficiency but, in conjunction with RAD component, also will emphasize on effective harvesting & management of rainwater.
- **Soil Health Management (SHM):** SHM will aim at promoting location as well as crop specific sustainable soil health management including residue management, organic farming practices by way of creating and linking soil fertility maps with macro-micro nutrient management, appropriate land use based on land capability, judicious application of fertilizers and minimizing the soil erosion/degradation.
- **Climate Change and Sustainable Agriculture: Monitoring, Modeling and Networking (CCSAMMN):** CCSAMMN will provide creation and bidirectional (land/farmers to research/scientific establishments and vice versa) dissemination of climate change related information and knowledge by way of piloting climate change adaptation/mitigation research/model projects in the domain of climate smart sustainable management practices and integrated farming system suitable to local agro-climatic conditions.

- To achieve the objectives the programme will have the following **strategy**:
 - Promoting integrated farming system covering crops, livestock & fishery, plantation and pasture based composite farming for enhancing livelihood opportunities, ensuring food security and minimizing risks from crop failure through supplementary/ residual production systems;
 - Popularizing resource conservation technologies (both on-farm and off-farm) and introducing practices that will support mitigation efforts in times of extreme climatic events or disasters like prolonged dry spells, floods etc.
 - Promoting effective management of available water resources and enhancing water use efficiency through application of technologies coupled with demand and supply side management solutions;
 - Encouraging improved agronomic practices for higher farm productivity, improved soil treatment, increased water holding capacity, judicious use of chemicals/ energy and enhanced soil carbon storage;
 - Creating database on soil resources through land use survey, soil profile study and soil analysis on GIS platform to facilitate adoption of location and soilspecific crop management practices & optimize fertilizer use;
 - Promoting location and crop specific integrated nutrient management practices for improving soil health, enhancing crop productivity and maintaining quality of land and water resources;
 - Involving knowledge institutions and professionals in developing climate change adaptation and mitigation strategies for specific agro climatic situations and promoting them through appropriate farming systems.

Student Notes:

19.5.2. Climate Smart Agriculture

- Food and Agricultural Organization of the United Nations (FAO)**, defines CSA as “agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals”.
- The **three pillars** of CSA are:



- The features of Climate smart agriculture include:
 - CSA maintains ecosystems services: Ecosystems provide farmers with essential services, including clean air, water, food and materials. It adopts a landscape approach that builds upon the principles of sustainable agriculture but goes beyond the narrow sectoral approaches that result in uncoordinated and competing land uses, to integrated planning and management
 - CSA has multiple entry points at different levels: it goes beyond single technologies at

- the farm level and includes the integration of multiple interventions at the food system, landscape, value chain or policy level.
- CSA is context specific: It consider how different elements interact at the landscape level, within or among ecosystems and as a part of different institutional arrangements and political realities.
 - CSA engages women and marginalised groups: It involve all local, regional and national stakeholders in decision-making to identify the most appropriate interventions and form the partnerships and alliances needed to enable sustainable development.

National Innovations on Climate Resilient Agriculture (NICRA)

- It's a network project of the Indian Council of Agricultural Research (ICAR) launched in 2011.

Objectives

- To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies.
- To demonstrate site specific technology packages on farmers' fields for adapting to current climate risks.
- To enhance the capacity building of scientists and other stakeholders in climate resilient agricultural research and its application.
- The project consists of four components viz. Strategic Research, Technology Demonstration, Capacity Building and Sponsored/ Competitive Grants.

Green Ag Project

- The government has launched a Global Environment Facility (GEF) assisted project namely, "**Green – Ag: Transforming Indian Agriculture for global environment benefits and the conservation of critical biodiversity and forest landscapes**" in collaboration with the Food and Agriculture Organisation (FAO) in high-conservation-value landscapes of five States.
- It aims to bring at least 104,070 ha of farms under sustainable land and water management and ensure 49 million carbon dioxides equivalent sequestered or reduced through sustainable land use and agricultural practices.
- The regions where the project will be implemented are :
 - **Madhya Pradesh**: Chambal Landscape,
 - **Mizoram**: Dampa Landscape,
 - **Odisha**: Simlipal Landscape,
 - **Rajasthan**: Desert National Park Landscape and
 - **Uttarakhand**: Corbett-Rajaji Landscape.
- The project seeks to mainstream biodiversity, climate change and sustainable land management objectives and practices into Indian agriculture.
- The overall objective of the project is to catalyze transformative change of India's agricultural sector to support achievement of national and global environmental benefits and conservation of critical biodiversity and forest landscapes.
- The project will support harmonization between India's agricultural and environmental sector priorities and investments so that the achievement of national and global environmental benefits can be fully realized without compromising India's ability to strengthen rural livelihoods and meet its food and nutrition security.

Global Alliance for Climate-Smart Agriculture

- It is an inclusive, voluntary and action-oriented multi-stakeholder platform on Climate-Smart Agriculture (CSA).
- It was launched on 23 September 2014 at the UN Climate Summit.

19.5.3. Soil Health Card Scheme

- A Soil Health Card is used to assess the current status of soil health and, when used over time, to determine changes in soil health that are affected by land management. A Soil Health Card displays soil health indicators and associated descriptive terms. The indicators are typically based on farmers' practical experience and knowledge of local natural resources. The card lists soil health indicators that can be assessed without the aid of technical or laboratory equipment.

- It is a printed report that a farmer will be handed over for each of his holdings. It will contain the status of his soil with respect to **12 parameters**, namely N,P,K (Macro-nutrients); S (Secondary- nutrient); Zn, Fe, Cu, Mn, Bo (Micro - nutrients); and pH, EC, OC (Physical parameters). Based on this, the SHC will also indicate fertilizer recommendations and soil amendment required for the farm.
- Benefits of the Soil Health Card Scheme**
 - It monitors the soil of the farmers well and will give them a formatted report. So, they can decide well which crops they should cultivate and which ones they should skip.
 - The authorities monitor the soil on a regular basis. One in every 3 years, they provide a report to farmers. So, farmers need not worry if the nature of the soil changes due to certain factors. Also, they will always have updated data about their soil.
 - The work of the government does not stop at listing down measures required to improve the quality of the soil. In fact, they also employ experts to help farmers in carrying out the corrective measures.
 - Farmers get a proper soil health record, thanks to the Soil Health Card Scheme. Also, they can study the soil management practices. Accordingly, they can plan the future of their crops and land.
 - Generally, in government schemes, the person carrying out the study for a particular farmer gets changed. But in the Soil Health Card Scheme, the government is paying attention that the same person carries out soil analysis for a farmer. This further enhances the effectiveness of the scheme.
 - The soil card will give the farmers a proper idea of which nutrients their soil is lacking. And hence, which crops they should invest in. They will also tell which fertilizers they need. So, ultimately, the crop yield will see a rise.
 - The main aim behind the scheme was to find out the type of particular soil. And then provide ways in which we can improve it. Even if a soil has some limitations, we can do something to get the most out of it. And that is what the government is trying to do with the help of this scheme.

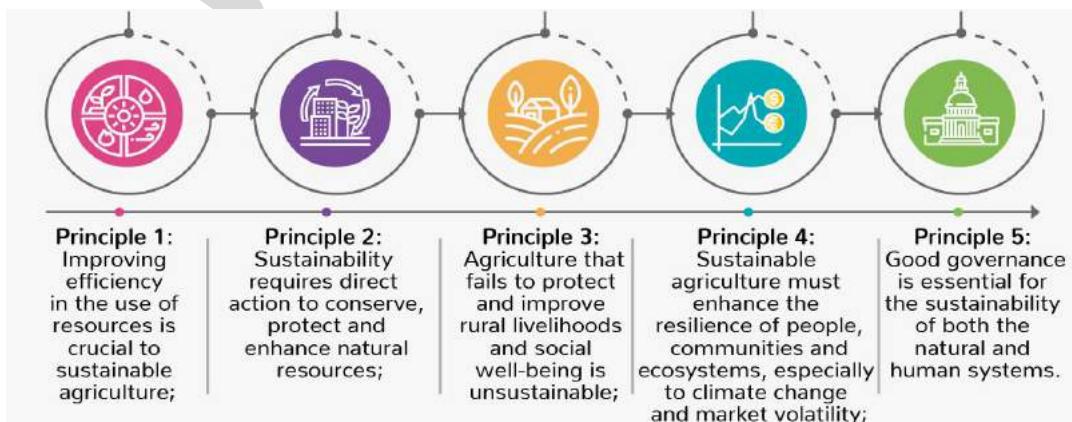
Student Notes:

19.5.4. Other Miscellaneous Steps

- Mandatory neem coating of urea since 2015 to reduce nitrous oxide emissions.
- Creating sustainable and climate-resilient agricultural systems is part of India's plan to meet pledge to the UNFCCC to reduce the emissions intensity of its GDP by up to 35% by 2030, compared to 2005 levels.
- India has installed 200,000 solar water pumps and another 2.5 million are planned to reduce emissions from energy use in agriculture.

19.6. Way Forward

- The challenges outlined above give rise to five key principles for guiding the strategic development of new approaches and the transition to sustainability:



- In order to cope with the rapid pace of change and increased uncertainty, sustainability must be seen as a process, rather than a singularly defined end point to be achieved. This, in turn, requires the development of technical, policy, governance and financing frameworks that support agricultural producers and resource managers engaged in a dynamic process of innovation. In particular:
 - Policies and institutions are needed that provide incentives for the adoption of sustainable practices, to impose regulations and costs for actions that deplete or degrade natural resources, and to facilitate access to the knowledge and resources required;
 - Sustainable agricultural practices must make full use of technology, research and development, though with much greater integration of local knowledge than in the past. This will require new and more robust partnerships between technical and investment oriented organizations;
 - Evidence-based planning and management of the agricultural sectors requires suitable statistics, geospatial information and maps, qualitative information and knowledge. Analysis should focus on both production systems and the underlying natural and socio-economic resources;

Student Notes:

The challenges relating to stocks and utilization rates of natural resources often transcend national boundaries. International governance mechanisms and processes must support sustainable growth (and the equitable sharing of benefits) in all agriculture sectors, protecting natural resources and discouraging collateral damage.

19.7. UPSC Previous Year Questions

Mains

- Sikkim is the first ‘Organic State’ in India. What are the ecological and economical benefits of Organic State? (2018)

Prelims

- Consider the following statements : (2017)
The nation-wide ‘Soil Health Card Scheme’ aims at
 - expanding the cultivable area under irrigation.
 - enabling the banks to assess the quantum of loans to be granted to farmers on the basis of soil quality.
 - checking the overuse of fertilizers in farmlands.
 Which of the above statements is/are correct?
 (a) 1 and 2 only
 (b) 3 only
 (c) 2 and 3 only
 (d) 1, 2 and 3

Solution: B

- Which of the following practices can help in water conservation in agriculture? (2017)
 - Reduced or zero tillage of the land
 - Applying gypsum before irrigating the field
 - Allowing crop residue to remain in the field
 Select the correct answer using the code given below :

 (a) 1 and 2 only
 (b) 3 only
 (c) 1 and 3 only
 (d) 1, 2 and 3

Solution: C

3. With reference to the 'Global Alliance for Climate Smart Agriculture (GACSA)', which of the following statements is/are correct? (2018)

1. GACSA is an outcome of the Climate Summit held in Paris in 2015.
2. Membership of GACSA does not create any binding obligations.
3. India was instrumental in the creation of GACSA.

Select the correct answer using the code given

- (a) 1 and 3 only
- (b) 2 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

Solution: B

4. With reference to the circumstances in Indian agriculture, the concept of "Conservation Agriculture" assumes significance. Which of the following fall under the Conservation Agriculture? (2018)

1. Avoiding the monoculture practices
2. Adopting minimum tillage
3. Avoiding the cultivation of plantation crops
4. Using crop residues to cover soil surface
5. Adopting spatial and temporal crop sequencing/crop rotations

Select the correct answer using the code given below:

- (a) 1, 3 and 4
- (b) 2, 3, 4 and 5
- (c) 2, 4 and 5
- (d) 1, 2, 3 and 5

Solution: c

5. With reference to organic farming in India, consider the following statements: (2018)

1. The National Programme for Organic Production' (NPOP) is operated under the guidelines and directions of the Union Ministry of Rural Development.
2. The Agricultural and Processed Food Products Export Development Authority' (APEDA) functions as the Secretariat for the implementation of NPOP.
3. Sikkim has become India's first fully organic State.

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 3 only
- (d) 1, 2 and 3

Solution: B

6. What is/are the advantage/advantages of zero tillage in agriculture? (2020)

1. Sowing of what is possible without burning the residue of the previous crop.
2. Without the need for nursery of rice saplings, direct planting of paddy seeds in the wet soil is possible.
3. Carbon sequestration in the soil is possible.

Select the correct answer using the code given below:

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 3 only
- (d) 1, 2 and 3

Solution: D

Student Notes:

7. In the context of India, which of the following is/are considered to be practice(s) of eco-friendly agriculture? (2020)

1. Crop diversification
2. Legume intensification
3. Tensiometer use
4. Vertical farming

Select the correct answer using the code given below:

- (a) 1, 2 and 3 only
- (b) 3 only
- (c) 4 only
- (d) 1, 2, 3 and 4

Solution: D

Student Notes:

19.8. Vision IAS Previous Year Test Series Questions

1. *Livestock farming not only contributes to climate change but is also affected by it. Elaborate the statement and discuss some measures that can be taken to make livestock farming more sustainable as well as resilient.*

Approach:

- Briefly comment on the role of livestock in the Indian economy.
- Write the impacts of livestock farming on climate change and vice-versa.
- Suggest measures to make livestock farming sustainable and resilient.

Answer:

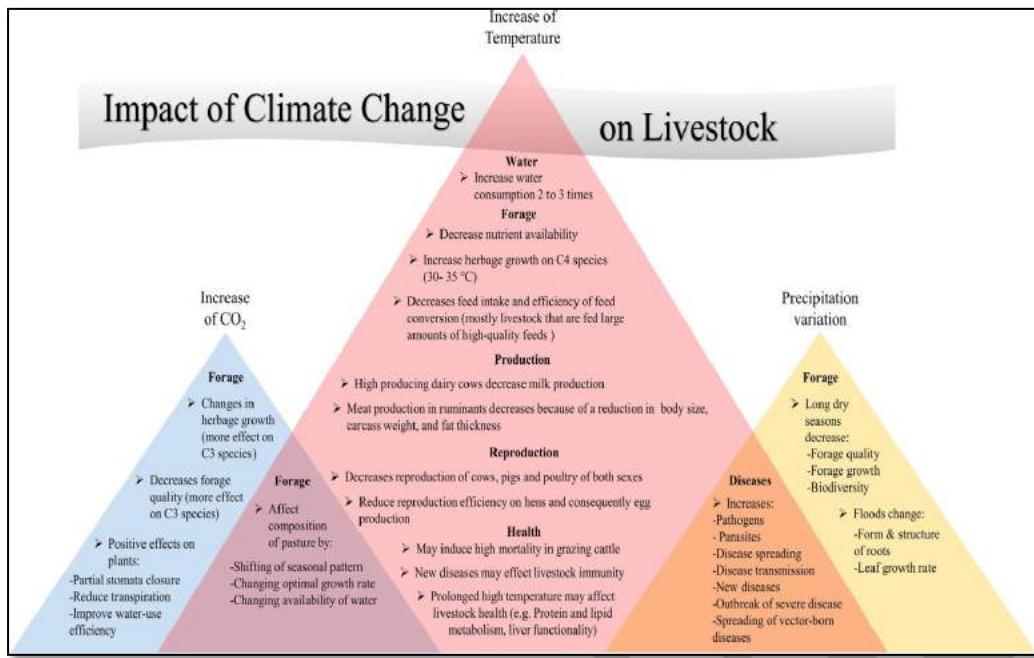
Livestock farming is the rearing of animals such as cattle, chicken, goats, horses etc. for food and for other human uses and contributes significantly to agricultural gross production value.

Livestock farming and climate change

As per the FAO, Livestock supply chain contributes approximately **14.5% of human-induced greenhouse gas (GHG) emissions**. The major emissions include **Methane**, which is mainly produced by enteric fermentation in animals as well as **Nitrous oxide**, arising from manure storage and the use of organic/inorganic fertilizers. Moreover, significant emissions also emanate from resultant land use change during feed production and processing, manufacturing and use of fertilizers and pesticides etc.

On the other hand, livestock farming is also affected due to climate change in several ways:

- Heat stress leads to **reduced milk and meat production**, impairment of embryo development and increase in **embryonic mortality** in cattle.
- Affects **species composition**, which is an important determinant of livestock productivity.
- **Increase in variety of health risks** due to wetter and warmer climate.
- For maintaining their body temperature, animals generally initiate compensatory and adaptive mechanisms, thus possibly impacting their **productive potential**.
- Irregular water availability may impact **forage productivity and quality**.



Measures to make livestock farming sustainable and resilient

- Undertake well planned breeding programmes and conservation of animal genetic diversity** to improve adaption of livestock to changing environments, resistance to stress or shocks.
- Adjusting grazing pressure** by balancing spatial and temporal presence of livestock, fertilization and nutrient management, introduction of species such as legumes etc.
- Better integrating livestock into the circular bio-economy** by recycling and recovering nutrients and energy from animal waste.
- Increasing productivity and resilience** of existing livestock by improving feed quality and establishing adequate veterinary infrastructure for reducing the incidence and impact of diseases, parasites and insect burdens.
- Strengthening the knowledge and evidence base** through scientific assessment of the impact of climate change on the livestock sector and developing a nationwide guideline framework for livestock management.

These along with other measures such as training farmers in scientific rearing practices, use of weather information and weather-index based insurance to improve resilience etc. can help improve long-term sustainability and resilience of livestock farming to climate change.

2. **A growing livestock sector augurs well for the low income households to augment their income and escape poverty. Discuss. Further, suggest some strategies for ensuring sustainable livestock sector growth in India.**

Approach:

- Introduce by highlighting the present status of livestock sector in India.
- Discuss in brief how a growing livestock sector can help to increase income of low income households and alleviate poverty.
- Enumerate some of the strategies for ensuring sustainable livestock sector growth in India.
- Conclude on the basis of the above points.

Livestock plays an important role in the Indian economy. About **20.5 million people depend upon livestock** for their livelihood. Livestock sector contributes around **4.11% Gross domestic product (GDP)** and **25.6% of total Agriculture GDP**. In fact, livestock is the fastest growing sector. Its contribution to the total output of the agriculture sector increased from 15 per cent in 1981-82 to 26 per cent in 2010-11. About **73 percent** of the total household in the rural area own some form of livestock of which around **three quarters are small and marginal farmers**.

The growing livestock sector can augment the income of the low income households and alleviate poverty in following ways:

- **Additional source of income:** Farmers and landless labourers can earn extra income from animal husbandry. In the arid and semi-arid regions, livestock sector is the main source of family income. These animals serve as moving banks and assets, which provide economic security to the owners.
- **Employment:** It provides employment even during lean agricultural season to those who are dependent upon agriculture for their livelihoods.
- **Nutritional security:** The livestock not only contributes towards improving nutritional security and also reduces rural poverty by preventing additional expenditure for food by households.
- **Equitable distribution:** The rural poor have limited opportunities in crop production. In comparison, livestock wealth is more equitably distributed, and the expanding demand for animal food products generates significant opportunities for the poor to escape poverty through diversifying and intensifying livestock production.
- **Social security:** The animals offer social security to the owners in terms of their status in the society, which also acts as a guard against getting driven into poverty.
- **Resilience to climate change:** As livestock is less prone to global warming and climate change, it can be considered more reliable than rain-fed agriculture. Livestock production and marketing can help stabilize the food supplies and provide individuals and communities with a buffer against economic shocks and natural disasters.

Further, the returns of livestock sector are quick. Losses, if any, are recovered soon and even the **low income households can also afford it**. However, its potential has not yet been fully realized. India's livestock productivity is 20-60 per cent lower than the global average because of number of constraints like lack of access to modern livestock services, poor marketing support, lack of credit support, etc. Following steps can be taken for ensuring sustainable livestock sector growth in India:

- **Overcoming feed and fodder scarcity** and improvements in delivery of animal health and breeding services.
- **Technology** will be a key driver of growth and concerted efforts will be needed to generate and disseminate yield-enhancing and yield-saving technologies.
- **Public spending** needs to be increased to re-energize the livestock sector.
- **Strengthening linkages** between production and markets through institutions such as cooperatives, producers' associations and contract farming.
- **Institutional support** in terms of credit and insurance is meager and needs to be strengthened.
- **Government needs to take efforts** to promote the sector by measures like establishing the Indian Council of Veterinary and Animal Science Education and Research, Schemes like Operation Flood, Kamdhenu scheme, etc.
- Further, the governments and industry should prepare producers for a **quality-driven competition** in the domestic as well as global market.

The extent to which growth in livestock production can be accelerated would depend on how technology, institutions and policies address constraints facing the livestock sector.

3. ***Agroforestry is seen as a solution to meet the challenges of food, nutrition, energy, employment and environment security. Elucidate.***

Student Notes:

Approach:

- Provide brief introduction about agroforestry.
- Discuss its potential to provide food, nutrition, energy, employment and environment security.

Answer:

Agroforestry is the way of farming practices which integrates tree and shrubs growing with crop production and animal farming system. This is obtained either by planting trees on agricultural land or by cropping (for example after thinning) on forested land. The government has envisaged this programme in 1973 on the backdrop of realization that forests are under pressure because of growing population resulting in degraded land use.

The practice of agroforestry involves sustainable use of land resources and has following advantages:

- **Income:** Agroforestry can increase farm profitability by increasing the net output from combined tree, crop and livestock;
- **Wind Breaks:** The crops and livestock are protected from the damaging effects of wind making them more productive
- **Diversification:** The new products add to the financial diversity and flexibility of the farming enterprise.
- **Forest area:** It increases forest area thus restores ecological balance and provides environment security.
- **Rural needs:** It enables people to meet basic needs of rural people by providing food, fodder, fiber, fuel and green manure. Thus providing nutrition, energy and food to associated people.
- **Conservation:** Agroforestry helps to conserve and protect natural resources by, for example, mitigating non-point source pollution, controlling soil erosion, and creating wildlife habitat.
- **Soil quality:** It ensures sustainable use of land, thus enriching soil fertility. It also provides protection against soil erosion.
- **Employment:** It helps in generation of employment by providing employment especially in lean season thus overall enhancing economic prospect of people.
- **Pollution control:** It also controls pollution it helps in afforestation which increases overall pollutant absorbing capacity of the environment.

In the emerging challenges of climate change and shrinking land holdings, the agroforestry offers huge potential of income to rural economy. To make it prevalent, the farmers need to be provided with expert guidance and proper inputs such as seeds and technologies.

CHAPTER - 20 - ENVIRONMENT IMPACT ASSESSMENT

Student Notes:

20. Environment Impact Assessment

- Environment Impact Assessment or EIA can be defined as the study to predict the effect of a proposed activity/project on the environment. A decision making tool, EIA compares various alternatives for a project and seeks to identify the one which represents the best combination of economic and environmental costs and benefits.
- EIA systematically examines both beneficial and adverse consequences of the project and ensures that these effects are taken into account during project design.
- It helps to
 - identify possible environmental effects of the proposed project,
 - proposes measures to mitigate adverse effects and
 - predicts whether there will be significant adverse environmental effects, even after the mitigation is implemented.
- By considering the environmental effects of the project and their mitigation early in the project planning cycle, environmental assessment has many benefits, such as protection of environment, optimum utilisation of resources and saving of time and cost of the project.
- Properly conducted EIA also lessens conflicts by promoting community participation, informing decision makers, and helping lay the base for environmentally sound projects.
- Benefits of integrating EIA have been observed in all stages of a project, from exploration and planning, through construction, operations, decommissioning, and beyond site closure.

20.1. Evolution of EIA

| | Development of EIA |
|--|---|
| Pre-1970s | <ul style="list-style-type: none">• Project review based on the technical/engineering and economic analysis.• Limited consideration given to environmental consequences. |
| Early/Mid-1970s | <ul style="list-style-type: none">• EIA introduced by NEPA in 1970 in US.• Basic principle: Guidelines, procedures including public participation requirement instituted.• Major public inquiries help shape the process's development. |
| Late 1970s and Early 1980s | <ul style="list-style-type: none">• Use of EA by developing countries (Brazil, Philippines, China, Indonesia)• Strategic Environment Assessment (SEA), risk analysis included in EA processes.• Greater emphasis on ecological modelling, prediction and evaluation methods.• Provision for public involvement.• Coordination of EA with land use planning processes. |
| Mid 1980s to end of decade | <ul style="list-style-type: none">• Increasing efforts to address cumulative effects.• World Bank and other leading international aid agencies establish EA requirements.• Spread of EIA process in Asia. |
| 1990s | <ul style="list-style-type: none">• Increased use of GIS and other information technologies. Sustainability principal and global issues receive increased attention.• India also adopted the EIA formally.• Formulation of EA legislation by many developing countries.• Rapid growth in EA training. |
| <p>Definition of SEA: Policy tool to assess the environmental consequences of development policies, plans and programmes.</p> <p>Definition of risk assessment: An instrument for estimating the probability of harm occurring from the presence of dangerous conditions or materials at a project site. Risk represents the likelihood and significance of a potential hazard being realized.</p> | |

20.2. History of EIA in India

- The Indian experience with Environmental Impact Assessment began over 20 years back. It started in 1976-77 when the Planning Commission asked the Department of Science and Technology to examine the river-valley projects from an environmental angle. This was subsequently extended to cover those projects, which required the approval of the Public Investment Board.
- Till 1994, environmental clearance from the Central Government was an administrative decision and lacked legislative support.
- On 27 January 1994, the Union Ministry of Environment and Forests (MEF), Government of India, under the Environmental (Protection) Act 1986, promulgated an EIA notification making Environmental Clearance (EC) mandatory for expansion or modernisation of any activity or for setting up new projects listed in Schedule 1 of the notification. Since then there have been 12 amendments made in the EIA notification of 1994.

20.3. EIA Process

- The stages of an EIA process will depend upon the requirements of the country or donor. However, most EIA processes have a common structure and the application of the main stages is a basic standard of good practice.

- Various steps of the EIA process are presented in brief below:

- Project Proposal:**

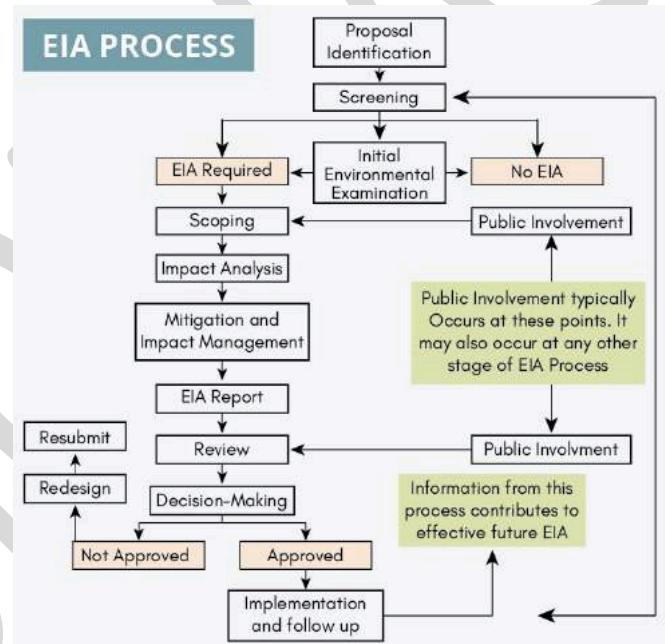
- ✓ Any proponent embarking on any major development project shall notify IAA (Impact Assessment Agency) in writing by the submission of a project proposal. The project proposal shall include all relevant information available including a land-use map in order to move to the next stage which is screening. The submission of a project proposal signifies the commencement of the EIA process.

- Screening:**

- ✓ Screening helps to clear those types of projects, which from past experience are not likely to cause significant environmental problems. The activity may take one of the following several forms:
 - Measurements using simple criteria such as size or location.
 - Comparing the proposal with list of projects rarely needing an EIA (e.g. schools) or definitely needing one (e.g. coal mines).
 - Estimating general impacts (e.g. increased in infrastructure needed) and comparing these impacts against set thresholds.
 - Doing complex analyses, but using readily available data.

- Preliminary Assessment:**

- ✓ If screening does not clear a project, the developer may be required to undertake a preliminary Assessment. This involves sufficient research, review of available data and expert advice in order to identify the key impacts of the project on the local environment, predict the extent of the impacts and briefly evaluate their



- importance to decision makers.
- ✓ The preliminary assessment can be used to assist early project planning (for instance, to narrow the discussion of possible sites) and it can serve as an early warning to the serious environmental problems that the project may cause. It is in the developer's interest to do a preliminary assessment since, in practice, this step can clear projects of the need for a full EIA.
- **Scoping:**
 - ✓ Scoping is a process of detailing the terms of reference of EIA. It has to be done by the consultant in consultation with the project proponent and guidance, if need be, from Impact Assessment Agency. The Ministry of Environment and Forests has published guidelines for different sectors, which outlines the significant issues to be addressed in the EIA studies.
 - ✓ Quantifiable impacts are to be assessed on the basis of magnitude, prevalence, frequency and duration and non-quantifiable impacts (such as aesthetic or recreational value), significance is commonly determined through the socio-economic criteria.
 - ✓ After the areas, where the project could have significant impact, are identified, the baseline status of these should be monitored and then the likely changes in these on account of the construction and operation of the proposed project should be predicted.
- **Impact Prediction and Assessment of Alternatives**
 - ✓ Impact prediction is a way of mapping the environmental consequences of the significant aspects of the project and its alternatives. For every project, possible alternatives should be identified and environmental attributes compared.
 - ✓ Alternatives should cover both project location and process technologies. Alternatives should then be ranked for selection of the best environmental optimum economic benefits to the community at large.
 - ✓ Once alternatives have been reviewed, a mitigation plan should be drawn up for the selected option and is supplemented with an Environmental Management Plan (EMP) to guide the proponent towards environmental improvements. The EMP is a crucial input to monitoring the clearance conditions and therefore details of monitoring should be included in the EMP.
- **EIA Report**
 - ✓ An EIA report should provide clear information to the decision-maker on the different environmental scenarios without the project, with the project and with project alternatives. The proponent prepares detailed Project report and provides information in logical and transparent manner. The IAA examines if procedures have been followed as per MoEF notifications.
- **Public Hearing**
 - ✓ After the completion of EIA report the law requires that the public must be informed and consulted on a proposed development after the completion of EIA report. The State Pollution Control Boards will conduct the public hearing before the proposals are sent to MOEF for obtaining environmental clearance.
 - ✓ Any one likely to be affected by the proposed project is entitled to have access to the Executive Summary of the EIA. The affected persons may include: (a) Bonafide local residents; (b) Local associations; (c) Environmental groups: active in the area; (d) Any other person located at the project site/sites of displacement. They are to be given an opportunity to make oral/written suggestions to the State Pollution Control Board as per Schedule IV.
- **Decision-Making**
 - ✓ Decision-making process involve consultation between the project proponent (assisted by a consultant) and the impact assessment authority (assisted by an expert group if necessary). The decision on environmental clearance is arrived at

- through a number of steps including evaluation of EIA and EMP.
- **Monitoring the Clearance Conditions**
 - ✓ Monitoring has to be done during both construction and operation phases of a project. It is done not just to ensure that the commitments made are complied with but also to observe whether the predictions made in the EIA reports are correct or not.
 - ✓ Where the impacts exceed the predicted levels, corrective action should be taken. Monitoring also enables the regulatory agency to review the validity of predictions and the conditions of implementation of the Environmental Management Plan (EMP).
 - ✓ The Project Proponent, IAA and Pollution Control Boards should monitor the implementation of conditions. The proponent is required to file once in six months a report demonstrating the compliance to IAA.
 - ✓ Above figure shows a general flow diagram of the EIA process, how EIA fits with parallel technical and economic studies and the role of public participation. In some cases, the process may be rapid and some steps in the EIA procedure may be omitted, for example small-scale irrigation schemes.

20.4. EIA Notification, 2006

- **Objectives:** The objectives of EIA Notification, 2006 inter alia include:
 - to formulate a transparent, decentralized and efficient regulatory mechanism to integrate environmental concerns into developmental process with a view to facilitating sustainable development.
 - to ensure incorporation of necessary environmental safeguards at planning stage in the project cycle, so as to ensure minimal impact on different components of environment.
 - to ensure involvement of stakeholders in public consultation process through public hearing and to ascertain the views of the public on the proposed project or activity.
- **Salient Features:** The salient features of EIA Notification, 2006 inter alia include:
 - The EIA Notification, 2006 has categorized the projects into two categories namely; Category 'A' and Category 'B' based on their impact potential.
 - Category 'A' projects will be appraised at the Central level while Category 'B' project at the State level.
 - State level Environment Impact Assessment Authorities and Committees (SEIAAs and SEACs) have been constituted for the purpose of appraisal of Category 'B' projects.
 - The stage of scoping for prescribing terms of reference by the Regulatory Agency for the EIA studies has been incorporated in accordance with the International practice. It is expected to improve the quality of EIA thereby improving the quality of decision making and minimizing the delays.
 - The public consultation process has been made more structured. It has two components i.e. comments through correspondence and by public hearing at site. Provision to videotape the proceedings of the public hearing has been made.
 - NOCs (No-Objection Certificates) from other regulatory agencies such as SPCB etc. are not a pre-requisite for considering application for environmental clearance.

20.5. Issues with the Indian System

- **Screening**
 - Even though some of the industrial set ups do not require EIA as per the statutory norms, they might involve certain technological processes which could be harmful to the environment, as a result of which such enlisted industries could have potential impacts on the environment and on public health.
 - Exempting industries from the EIA requirements based on the investment value of specific projects is not acceptable. There are no specific studies conducted till now which

demonstrate that environmental impacts are always inconsequential for projects under a given value. It is a well established fact that the small scale industries are contributing more pollution with respect to the major industry

- **Formation of EIA Team**

- It is being found that the team formed for conducting EIA studies is lacking the expertise in various fields such as Anthropologists and Social Scientists (to study the social impact of the project) or even wild life experts.

- **Scoping**

- There is a lack of exhaustive ecological and socio-economic indicators for impact assessment.
- Public comments are not taken into account at the early stage, which often leads to conflict at the later stage of project clearance.

- **Base Line Data Collection**

- There is always a lack of reliable data sources.
- The secondary data is also not reliable.
- The data collectors do not pay respect to the indigenous knowledge of local people.
- The credibility of the primary data collected by the data collectors is doubtful.

- **Impact Prediction and Assessment of Alternatives**

- The detail method used for the prediction and evaluation of the project is not mentioned in the report. Limited explanations are given both to quantitative estimation of magnitude of impact and to the assumptions and judgments used in the evaluation of impacts.
- The limited coverage of scoping is confined mainly to direct impacts.
- Details regarding the effectiveness and implementation of mitigation measures are often not provided.
- Often, and more so for strategic industries such as nuclear energy projected, the EMP s are kept confidential for political and administrative reasons
- Emergency preparedness plans are not discussed in sufficient details and the information not disseminated to the communities.

- **EIA Report**

- The reports are generally incomplete and provided with false data. EIA reports ignore several aspects while carrying out assessments and significant information is found to omitted. Many EIA report are based on single season data and are not adequate to determine whether environmental clearance should be granted. All this makes the entire exercise contrary to its very intent.
- The EIA is actually funded by an agency or individual whose primary interest is to procure clearance for the project proposed. There is little chance that the final assessment presented is unbiased, even if the consultant may provide an unbiased assessment that is critical of the proposed project. Some times it is found that a consultancy which is working in the project area has no specialization in the concerned subject.
- The EIA document in itself is so bulky and technical, which makes it very difficult to decipher so as to aid in the decision making process. There are so many cases of fraudulent EIA studies where erroneous data has been used, same facts used for two totally different places etc. This is due to the lack of a centralized baseline data bank, where such data can be crosschecked.
- There is no accreditation of EIA consultants, therefore any such consultant with a track record of fraudulent cases cannot be held liable for discrepancies. It is hard to imagine any consultant after being paid lakh of rupees, preparing a report for the project proponents, indicating that the project is not viable. In nearly every case, the consultants try to interpret and tailor the information looking for ways and means to provide their clients with a report that gives them their moneys worth.

- **Public Hearing Process**

- A number of projects with significant environmental and social impacts have been excluded from the mandatory public hearing process. There are also concerns on how much value is given to opinions expressed during the public hearing.
- Most projects are located in the resource rich tribal and rural areas. Due to the inherent social conditions in such areas, such as lack of literacy and the simple nature of Tribals, people are easily convinced and lured by the prospect of money and jobs. The local environmental and social groups face a uphill task educating the people about the true nature and impacts of the project and getting them to forcefully raise objections and issues of concern.
- Similarly the affected peoples are informed just few days before the stipulated date of public hearing. In many cases it is found out that the owners of the project employs antisocial peoples to suppress the voices of people during the public hearing. The SPCB which are responsible for conducting the public hearings are not equipped in terms of manpower or infrastructure.
- In many cases minutes of public hearing or recommendations of the public hearing panels do not reflect the actual proceedings and objections raised. Further the recommendations of the public hearing panel are only advisory and it is not mandatory for the impact assessment agency to even consider these while granting environmental clearance to projects.

- **Capacity Building**

- There is an urgent need to build capacities of government agencies, communities, NGOs and the judiciary with regard to the implementation of the existing EIA notification. Even in the instances where the provisions allow for peoples participation or monitoring, the lack of information and capacity are great hindrances in implementation.
- For instances, the public hearing panel often has no clue on the scope of their role in environmental clearance process. Judiciary, which is involved in the redressal, is comprised of judges who may not be clued into the environmental issues and their interface with laws. No matter how good the provisions of the law are, their implementation hinges on the capacities of official who are meant to do it.

20.6. Recommendations

- **Independent EIA Authority:**

- Civil society groups have suggested the need for an independent Environmental Impact Assessment authority headed by a judicial officer and comprising of representatives from communities, peoples group, scientists, sociologists and environmentalists. Such body would be independent of the ministry of environment and forests. The decision of this authority would be binding on the MOEF.

- **Sector wide EIA s needed:**

- There is a need to conduct policy-level and sector-wide EIAs in the form of strategic impact assessments (for various sectors including mining , power and so on). This is critical to judge the impacts of macro- economic, developmental and other policies, schemes and programmes.

- **Conduct options Assessment:**

- EIA s should follow only after an options assessment and a least cost plan for a project is done by the state or central government.

- **Creation of an information desk:**

- An information dissemination desk may be assigned within the MOEF which anyone can write to regarding the status of clearance of projects. This desk should be mandated to respond within a maximum of ten days by post/ courier and a maximum of two days by email, to the contact information that has been furnished by the person seeking the information.

- Since all meetings and discussion are documented as electronic data, the officers should furnish this information regarding the status of clearance, with a record of the discussions in the Expert committee on the projects.
- **Environmental Risk Assessment:**
 - New approaches such as Environmental Risk Assessment which enable more flexible and dynamic assessments of direct and indirect impacts must be explored.
 - As part of this process, recognized Safety and Environmental Auditors must compulsorily meet local populations and submit a detailed report of potential risks due to the project.
- **Quality of EIA Reports:**
 - The checklist needs to include impacts on agricultural biodiversity, biodiversity related traditional knowledge and live hoods .Further, cumulative impacts of projects that are technically linked or located in the same ecological region, and impacts of the eventual closure of the project or components of the project should also be incorporated in to the checklist.
 - Finally the list should contain details on a full exploration of alternatives , especially decentralized alternatives, to mega projects .the checklist also needs to cover various kinds of impacts resulting from a particular activity.
- **Public Hearings:**
 - The public hearing should be held for all projects which are likely to have environmental and social impacts. This should be strictly implemented. The scope of the public hearings needs to be widened to at least those projects which require forest clearance under the forest conservation act,1980.
- **Composition of Expert Committees:**
 - The present executive committees should be replaced by experts people from various stakeholder groups , who are reputed in environmental and other relevant fields.
 - The process of selection of those committees should be open and transparent , the minutes of the committee meetings , decisions and advice by these committee should be open to public.
- **Capacity Building:**
 - NGO s, civil society groups and local communities need to build their capacities to use the EIA notification towards better decision making on projects that can impact their local environments and live hoods.
 - Capacities can be built to proactively and effectively use the notification rather than respond in a manner that is seen as negative or unproductive.
- **Monitoring, Compliance and Institutional Arrangements:**
 - The EIA notification needs to build within it an automatic withdrawal of clearance if the conditions of clearance are being violated, and introduce more stringent punishment for noncompliance.
 - At present the EIA notification limits itself to the stage when environmental clearance is granted. The MOEF should set up more regional offices, each with smaller areas of jurisdiction, to effectively monitor the compliance of clearance conditions.
 - It would be useful to have advisory Expert committees at the MOEF regional offices, comprising of ecologists, sociologists, local community members, government officials and representative of local institutions to help with the clearance of projects at the regional levels and monitoring of compliance of conditions.
 - A robust monitoring mechanism should be established by the state department where the central projects involving forest clearance is given out. Such a monitoring body should be given powers to address compliance of both sets of clearance conditions together and to take punitive action against the project proponent in case of non compliance of any of the conditions.
 - Local communities should be brought in to the formal monitoring and reporting process of the compliance of conditions presently done by the regional offices of the MOEF. This

would help the regional office as well since the geographical areas and number of project that comes under each office is vast which affects the efficiency and regularity of the monitoring process.

Student Notes:

20.7. Draft EIA Notification, 2020

- To address unprecedented situation arising from global outbreak of Novel Corona Virus (COVID-19), and to ramp up availability or production of various drugs, Ministry of Environment, Forest and Climate Change has made an amendment to EIA Notification 2006. All projects or activities in respect of bulk drugs and intermediates, manufactured for addressing various ailments, have been re-categorized from the existing Category 'A' to 'B2' category.
- Projects falling under Category B2 are exempted from requirement of collection of Base line data, EIA Studies and public consultation. The re-categorization of such proposals has been done to facilitate decentralization of appraisal to State Level so as to fast track the process. This step of the Govt is with a view to help in increasing the availability of the important medicines/ drugs in the country within short span of time. This amendment is applicable to all proposals received up to 30th September 2020. The states have also been issued advisories to expeditiously process such proposals.
- Further, to ensure expeditious disposal of the proposals within given time-line, Ministry has also advised states to use information technology e.g. video conference, considering the fact that in view of the prevailing situation on ground, appraisal of proposals may not be possible through physical meetings.

Issues involved

- Public Consultation:** It proposes to reduce the period of public consultation hearings to a maximum of 40 days, and reduces from 30 to 20 days the time provided for the public to submit their responses during a public hearing for any application seeking environmental clearance. This can particularly pose a problem to those affected people who are forest dwellers or otherwise do not have access to information and technology and those that are not aware of the process itself.
- Wide discretionary powers to government:** It also allows the central government to declare some areas as "economically sensitive areas" without a public hearing or environmental clearance, and several "red" and "orange"-classified toxic industries could now operate as close as 0-5 km from a Protected Area. The government also gets to decide on the "strategic" tag for any projects for which no information on such projects shall be placed in the public domain. This opens a window for summary clearance for any project deemed strategic without having to explain why.
- Provisions for post-facto project clearance:** Projects that have commenced operations – by way of construction, installation, excavation, production, etc – without obtaining necessary clearances can be legalised after payment of a penalty. Post facto clearance is the violation of the fundamental principles of environmental jurisprudence and is contrary to both the precautionary principle as well as the need for sustainable development.
- Exemptions:** The new draft exempts a long list of projects from public consultation and prior clearance. For example, linear projects such as roads and pipelines in border areas will not require any public hearing. All inland waterways projects and expansion/widening of national highways including roads that cut through forests and dredging of major rivers, will be exempt from prior clearance.
- Baseline data:** The latest draft EIA notification does away with the need to carry out studies covering all seasons in a year. This will lead to less reliable data and projections for pollutants and will mask the full environmental impact of a project.
- Private consultation:** The notification allows project proponents to engage private consultants for preparing the EIA reports propelling a situation where expertise and

technicalities would be adopted to obscure the process and make it difficult to understand – something that should have been open and comprehensible to the communities for the process to be remotely transparent.

Student Notes:

Various provisions of Draft EIA aimed at facilitating the government's doctrine of "ease of doing business". Though the Environmental regulation must balance damage to the environment with sustainable development and possible benefits. Government must incorporate the concerns of all stakeholder before finalising the regulation.

20.8. UPSC Previous Year Questions

1. Environmental Impact Assessment studies are increasingly undertaken before a project is cleared by the Government. Discuss the environmental impacts of coal-fired thermal plants located at coal pitheads. (2014)
2. "In spite of adverse environmental impact, coal mining is still inevitable for development." Discuss (2017)

20.9. Vision IAS Previous Year Questions

1. ***Comment on the state of EIA (Environment Impact Assessment) reports in India. What in your opinion can be done to improve the EIA reporting.***

Answer:

- EIA – What is it?
- Lacunae in EIA- Eg EIA done by third party which is paid by the interested party.
- Some recent cases
- Measure to improve

2. ***Environmental Impact Assessment (EIA) is an important management tool for ensuring optimal use of natural resources for sustainable development. Elaborate.***

Approach:

- Briefly define EIA
- Provide details of each stage of EIA and how it is related to natural resource uses and sustainable development
- Conclude suitably.

Answer:

An environmental impact assessment (EIA) is an assessment of the possible potential impacts (beneficial and adverse) that a proposed project may have on the environment. The complete exercise also involves the solutions to the adverse impacts which ensure that natural resources are used judiciously in a sustainable manner and therefore, promotes sustainable development.

While all industrial projects may have some environmental impacts, all of them may not be significant enough to warrant elaborate assessment procedures. An initial evaluation decides need of such exercise. Projects which alter the landscape, modify forests and stream patterns, manufacturing of environmentally hazardous products, located in ecologically sensitive areas, have high potential of polluting air, soil or water etc. are covered under EIA.

EIA study involves inventorisation of the natural resources available, current environmental setting, impact of projects on natural resources etc. 'Hot Spots' are identified that require immediate remedial action to overcome air, water or land pollution.

During the process, negative impacts on environment are studied extensively. Parts of project which are causing such negative impacts are either replaced with alternative technologies or compensated in some form. For instance, if there is a need to cut down forest, it is possible to plant saplings, though in more quantity, at some other location. However, if such compensatory mechanism is not always available, project has to be shut down.

Governments across the world are putting extra effort to design norms to protect natural resources. Ecological sensitive zones (ESZ) or no-go areas are few policy steps that prohibit construction or mining activities in such zones. These policies act as input in EIA studies.

Methods such as Product environmental life cycle analysis (LCA) is used for identifying and measuring the impact of projects on the environment. Such methods are very helpful in ensuring sustainability of project as well as environment.

In conclusion, sustainable development can be attained only by managing our natural resources in a rightful manner where future generations are not devoid of their natural rights. EIA is a potential tool to preserve natural resources in the industrialized and urbanized world as it minimizes the adverse impact on ecology.

3. *What are the various statutory procedures of conducting Environmental Impact Assessments? How do these procedures ensure public participation in development process?*

Approach:

- Explain the term Environmental Impact Assessment (EIA) briefly.
- Then mention the statutory procedures of conducting EIA.
- The answer below also uses a flow chart to bring about more clarity.
- Finally, mention how public participation becomes an imperative in the development process.

Answer:

EIA is an a priori exercise of forecasting environmental impacts arising out of developmental projects. EIA assists planners and the government in decision-making process by identifying the key impacts and formulating mitigation measures. The results of EIAs are presented in reports known as **Environmental Impact Statements (EIS)**.

Statutory Procedures:

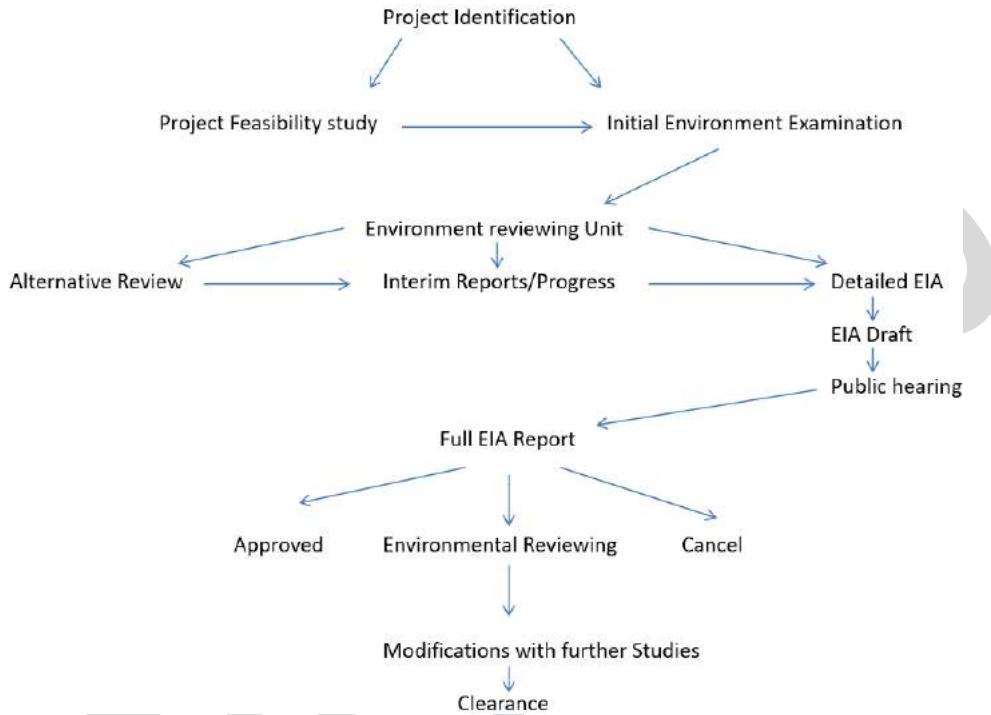
Firstly, **Screening** is done to see if a project requires EIA Clearance as per statutory notifications. This is done on the basis of Scale of investment, Type of investment and Location of investment. After this EIA starts with following steps:

1. **Impact Identification or Scoping:** It involves discussion between EIA experts, agency involved in developmental project and experts of design, construction and operation of project. A final **Term of Reference** is prepared comparing probable impacts and the available baseline data. It brings out the impacts, which deserve further study.
2. **Impact Measurement:** Impact of project and its alternatives are measured with respect to air, noise, water and land quality, biological changes like deforestation, habitat shrinking, impact on breeding and nesting grounds and socio economic impacts like impact on demographic changes, impact on health, economic status etc. using several mathematical models.
3. **Impact Interpretation and Evaluation:** Relative importance of all the impacts are studied and compared to consider only those, which have large impact; thus ensuring sound judgment by decision makers.

- Identification of monitoring requirements and mitigation measures:** Monitoring is done to ensure that legal standards for pollutants are not exceeded. And also, since monitoring provides early warning system of environmental damage so that preventing action can be taken in time. When harmful impacts are identified, the mechanisms to mitigate them are also investigated.
- Communication of Impact information:** All the interpreted data is presented in a form that non-experts can understand and after discussion and approval of local public, the developmental project gets MoEF nod.

Student Notes:

PROCESS OF EIA:



Public Participation in Developmental Process:

The purpose of EIA is not just to assess impacts and complete an environmental impact statement (EIS). Rather it is to improve the quality of decisions.

- Through **informing** the public, the project proponent can make **environmentally sensitive decision** by being aware of a project's potential adverse impacts on the environment.
- Through their **participation**, the project proponent is able to take advantage of the information that citizens contribute towards values, impacts, innovative solutions and alternatives.
- Alienated citizens** tend to **delay** the implementation of the project through time consuming legal action if they feel that their rights are curbed through project implementation. For example, Silent Valley, Tehri Dam, Dahanu.
- Therefore, the project proponent needs to consider not only the risks of including versus avoiding citizen input, but also the potential benefits of establishing a long term co-operative relationship with citizens.

But in India, the public is involved at the hearing stage. Here it is merely a formality as by this time the project proponent has more or less decided to go ahead with the project. The objective of public involvement at this stage may be just to defend a decision that has already been made. So, more effective public participation is need of the hour as currently, it is limited to the public hearing stage, legal action to halt the project or to force the inclusion of mitigation measures.

4. ***Despite wide use and acceptance, Environment Impact Assessment (EIA) has certain shortcomings as a tool for minimising environmental effects of development proposals. Discuss. How is Strategic Environment Assessment (SEA) an improvement over EIA?***

Student Notes:

Approach:

- Briefly explain how EIA has wide use and acceptance to minimize environmental damage, both before and after the execution of a project. There is no need to go into the details of the steps involved in EIA.
- Then explain the shortcomings of EIA when it comes to reducing the actual environmental impact of a project. You can give examples of projects that were in consonance with EIA but ultimately failed to regulate the environmental damage.
- The second part of the question should compare SEA with EIA and conclude suitably.

Answer:

Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, and shape projects to suit the local environment.

However, EIA has often fallen short of meeting these aims.

- It takes place relatively late at the downstream end of the decision making process, after major alternatives and directions have been chosen. Rarely have projects been denied environmental clearance.
- NGOs and communities continue to struggle with fraudulent EIA reports. There is a lack of experts with proper knowledge of EIA processes. Public participation is missing entirely or it is done towards the end of the decision-making process.

Uttarakhand dams which were built after positive EIA reports are examples of projects that have been questioned. Also, CAG reports have pointed at the blatant violation of compulsory afforestation laws by industries that acquire forest land.

Some of these shortcomings can be easily overcome by shifting from EIA to Strategic Environment Assessment (SEA).

| Environment impact assessment | Strategic environment assessment |
|--|--|
| <ul style="list-style-type: none"> • Takes place at end of decision-making cycle • Identifies specific impacts on the environment • Considers limited number of feasible alternatives • Limited review of cumulative effects • Emphasis on mitigating and minimizing impacts • Narrow perspective, high level of detail • Well-defined process, clear beginning and end • Focuses on standard agenda, treats symptoms of environmental deterioration | <ul style="list-style-type: none"> • Takes place at earlier stages of decision making cycle • Also identifies environmental implications, issues of sustainable development • Considers broad range of potential alternatives • Early warning of cumulative effects • Emphasis on meeting environmental objectives, maintaining natural systems • Broad perspective, lower level of detail to provide a vision and overall framework • Multi-stage process, overlapping components, policy level is continuing, iterative • Focuses on sustainability agenda, gets at sources of environmental deterioration |

Therefore SEA covers a wider range of activities or a wider area and often over a longer time span than the environmental impact assessment of projects.

- SEA is being proactive and ‘sustainability driven’, whilst EIA is largely reactive.
- SEA might be applied to an entire sector (such as a national policy on energy for example) or to a geographical area (for example, in the context of a regional development scheme).
- SEA does not replace or reduce the need for project-level EIA, but it can help to streamline and focus the incorporation of environmental concerns (including biodiversity) into the decision-making process.

Student Notes:



CHAPTER - 21 - ENVIRONMENTAL ETHICS

Student Notes:

21. Environmental Ethics

21.1. Introduction

Environmental ethics is a branch of ethics that studies the relation of human beings and the environment and how ethics play a role in this. Environmental ethics believe that humans are a part of society as well as other living creatures, which includes plants and animals. These items are a very important part of the world and are considered to be a functional part of human life. Therefore, it is essential that every human being respects and honors this and use morals and ethics when dealing with these creatures.

Environmental ethics therefore, is the discipline in philosophy that studies the **moral relationship of human beings to**, and also the value and moral status of, the **environment and its non-human contents**.

21.2. Need for Environmental Ethics

- The acts of humans lead to environmental pollution. The stronger **demand for resources** is also a factor that contributes to the problem as we all need food and shelter. When these things are so desired, the natural balance of the environment is disturbed. Engineering developments are resulting in resource depletion and environmental destruction.
- There are several environmental issues that have created havoc on our environment and human life. If ignored today, these ill effects are sure to curb human existence in the near future.
- Various environmental issues have taken a toll on our environment and we've already started seeing some disastrous effects in the form of the effect of health on humans, rise in sea level, depletion of non-renewable resources, melting of glaciers, extinction of species, and many more.
- Given the **rapid pace of environmental decay and the need for inter-generational equity**, environmental ethics has to form the central part of our governance structures.

21.3. Environmental Ethics and Its Principles

Suppose putting out natural fires, culling feral animals or destroying some individual members of overpopulated indigenous species is necessary for the protection of the integrity of a certain ecosystem. Will these actions be morally permissible or even required? Is it morally acceptable for farmers in non-industrial countries to practise slash and burn techniques to clear areas for agriculture? Consider a mining company which has performed open pit mining in some previously unspoiled area. Does the company have a moral obligation to restore the landform and surface ecology? And what is the value of a humanly restored environment compared with the originally natural environment? It is often said to be morally wrong for human beings to pollute and destroy parts of the natural environment and to consume a huge proportion of the planet's natural resources. If that is wrong, is it simply because a sustainable environment is essential to (present and future) human well-being? Or is such behaviour also wrong because the natural environment and/or its various contents have certain values in their own right so that these values ought to be respected and protected in any case?

These are among the questions investigated by environmental ethics. Some of them are specific questions faced by individuals in particular circumstances, while others are more global questions faced by groups and communities. Yet others are more abstract questions concerning the value and moral standing of the natural environment and its non-human components.

There are several approaches or principles to determine how we are to value our environment. It is such a huge field, and it is so vast that it is difficult for one principle to cover all the ground.

Many theories have emerged over the years, and each one has stressed on various principles of environmental ethics. The list below states all the principles that have been predominantly found in those theories.

Student Notes:

- **Anthropocentrism:** It suggests that human beings are the most important beings. All other living beings are but accessories that would assist in their survival. Now, there are two further divisions of anthropocentrism. They are weak anthropocentrism and strong anthropocentrism.
- **Non-Anthropocentrism:** As opposed to anthropocentrism, non-anthropocentrism, this principle gives value to every object, every animal in nature. It is a principle that believes in everything that sustains itself in nature.
- **Psychocentrism:** Psychocentrism is the principle that believes that human beings hold more value in the environment since their mental capacities are better developed and far more complex than any other element in the environment.
- **Biocentrism:** It is a term that holds not only an ecological but also a political value. It is a philosophy that imparts importance to all living beings. In terms of environmental ethics, biocentrism is the principle that ensures the proper balance of ecology on the planet.
- **Holism:** The term holism had been coined by Jan Smuts in his book called Holism and Evolution (1926). Holism considers environment systems as a whole rather than being individual parts of something. It considers these environment systems to be valuable.
- **Resourcism:** The principle of resourcism says that nature is considered to be valuable only because it has resources to provide with. Thus, nature ought to be exploited.
- **Speciesism:** The principle of speciesism justifies the superiority of the human race. Thus, it also justifies the exploitation and maltreatment of animals by humankind.
- **Moral Considerability:** This, too, is an important principle of environmental ethics. Intrinsic value is added to every being, which makes us consider being moral. Moral considerability towards a being means that we agree that all our interactions whatsoever with the being is bound by moral laws.
- **Instrumental Value:** The instrumental value is the value imparted to a being as long as it can serve us with resources.
- **Intrinsic Value:** Intrinsic value is the value attached to a being just for itself and not only for its resourcefulness.
- **Aesthetic Value:** Aesthetic value is imparted to a being by virtue of its looks or its beauty.
- **Animal Liberation or Animal Rights:** As is evident from its name, animal liberation or rights try to secure animal life and ensure their welfare by enforcing certain laws.
- **Animal Welfare:** It ensures that the animals are treated well and humanely.

21.4. Types of Environmental Ethics

21.4.1. Social Ecology

- Social ecology studies relationships between people and their environment, often the interdependence of people, collectives and institutions.
- The concept has been employed to study a diverse array of social problems and policies within the behavioural and social sciences.
- Social ecology has been criticized for its extrapolation from the natural world to human society.
- Ecologists argue that the interdependence and lack of hierarchy within nature provides a grounding for non-hierarchical human societies. However, it is one thing to say how nature is, but quite another to say how society ought to be. Even if we accept that there are no natural hierarchies within nature (which for many is dubious), there are plenty of other aspects of it that most of us would not want to foster in our human society.

Core Principles of Social Ecology

- Multidimensional structure of human environments—physical & social, natural & built features; objective-material as well as perceived-symbolic (or semiotic); virtual & place-based features.
- Cross-disciplinary, multi-level, contextual analyses of people-environment relationships spanning proximal and distal scales (from narrow to broad spatial, sociocultural, and temporal scope).
- Systems principles, especially feedback loops, interdependence of system elements, anticipating unintended side effects of public policies and environmental interventions.
- Translation of theory and research findings into community interventions and public policies.
- Privileging and combining both academic and non-academic perspectives, including scientists and academicians, lay citizens and community stakeholder groups, business leaders and other professional groups, and government decision makers.
- Transdisciplinary values and orientation, synthesizing concepts and methods from different fields that pertain to particular research topics.

Student Notes:

21.4.2. Deep Ecology

- Deep ecology is based in the belief that **humans must radically change their relationship to nature** from one that values nature solely for its usefulness to human beings to one that recognizes that nature has an inherent value.
- Sometimes called an “ecosophy”, deep ecology offers a definition of the self that differs from traditional notions and is a social movement that sometimes has religious and mystical undertones.
- They contend that the mainstream ecological movement is concerned with various environmental issues (such as pollution, overpopulation, and conservation) only to the extent that those issues have a negative effect on an area’s ecology and disrupt human interests. They argue that anthropocentrism, a worldview that contains an instrumentalist view of nature and a view of humanity as the conqueror of nature, has led to environmental degradation throughout the world, and thus it should be replaced with ecocentric (ecology-centred) or biocentric (life-centred) worldviews, where the biosphere becomes the main focus of concern.
- Critics of deep ecology argue that it is just too vague to address real environmental concerns. In its refusal to reject so many worldviews and philosophical perspectives, many have claimed that it is difficult to uncover just what deep ecology advocates. For example, on the one hand, it offers us eight principles that deep ecologists should accept, and on the other it claims that deep ecology is not about drawing up codes of conduct, but adopting a global comprehensive attitude.

Principles of Deep Ecology

- The well-being and flourishing of human and non-human life on Earth have value in themselves (synonyms: intrinsic value, inherent worth). These values are independent of the usefulness of the non-human world for human purposes.
- Richness and diversity of life forms contribute to the realization of these values and are also values in themselves.
- Humans have no right to reduce this richness and diversity except to satisfy vital needs.
- The flourishing of human life and cultures is compatible with a substantially smaller population. The flourishing of non-human life requires a smaller human population.
- Present human interference with the non-human world is excessive, and the situation is rapidly worsening.
- Policies must therefore be changed. These policies affect basic economic, technological and ideological structures. The resulting state of affairs will be deeply different from the present.
- The ideological change will be mainly that of appreciating life quality (dwelling in situations of inherent value) rather than adhering to an increasingly higher standard of living. There will be a profound awareness of the difference between bigness and greatness.
- Those who subscribe to the foregoing points have an obligation directly or indirectly to try to implement the necessary changes.

21.4.3. Eco-feminism

Student Notes:

- Oppression, hierarchy, and spiritual relationships with nature have been central concerns of ecofeminism.
- Ecofeminists assert that there is a connection between the destruction of nature by humans and the oppression of women by men that arises from political theories and social practices in which **both women and nature are treated as objects to be owned or controlled**.
- Ecofeminists aim to establish a central role for women in the pursuit of an environmentally sound and socially just society.
- They have been divided, however, over how to conceive of the relationship between nature and women, which they hold is more intimate and more "spiritual" than the relationship between nature and men.
- Whereas cultural ecofeminists argue that the relationship is inherent in women's reproductive and nurturing roles, social ecofeminists, while acknowledging the relationship's immediacy, claim that it arises from social and cultural hierarchies that confine women primarily to the private sphere.
- Eco-feminism demonstrates an adherence to the strict dichotomy, among others, between men and women. Some eco-feminist critiques note that the dichotomy between women and men and nature and culture creates a dualism that is too stringent and focused on the differences of women and men. In this sense, eco-feminism too strongly correlates the social status of women with the social status of nature, rather than the non-essentialist view that women along with nature both have masculine and feminine qualities, and that just like feminine qualities have often been seen as less worthy, nature is also seen as having lesser value than culture.

Concepts of Eco-feminism

- Modern Science and Eco-feminism:** They view the dominant stream of modern science not as objective science but as a projection of Western men's values. The privilege of determining what is considered scientific knowledge and its usage has been controlled by men, and for the most part of history restricted to men. A common claim within ecofeminist literature is that patriarchal structures justify their dominance through binary opposition, these include but are not limited to: heaven/earth, mind/body, male/female, human/animal, spirit/matter, culture/nature and white/non-white.
- Vegetarian Eco-feminism:** The application of ecofeminism to animal rights has established vegetarian ecofeminism, which asserts that omitting the oppression of animals from feminist and ecofeminist analyses is inconsistent with the activist and philosophical foundations of both feminism (as a "movement to end all forms of oppression") and ecofeminism. It puts into practice "the personal is political," as many ecofeminists believe that "meat-eating is a form of patriarchal domination that suggests a link between male violence and a meat-based diet."
- Materialist Eco-feminism:** A materialist view connects institutions such as labor, power, and property as the source of domination over women and nature. There are connections made between these subjects because of the values of production and reproduction. This dimension of ecofeminism may also be referred to as "social feminism," "socialist ecofeminism," or "Marxist ecofeminism".
- Spiritual/ Cultural Eco-feminism:** It is also called an earth based spirituality which recognizes that the Earth is alive, and that we are an interconnected community. Spiritual ecofeminism is not linked to one specific religion, but is centered around values of caring, compassion, and non-violence.

Declaration of Ethical Principles in relation to Climate Change

The Member States of the United Nations Educational, Scientific and Cultural Organization, meeting in Paris at the thirty-ninth session of the General Conference, from 30 October to 14 November 2017, taking into account the work carried out by the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) on environmental ethics in general and the ethical issues associated with climate change in particular,

- Noting with great concern that there is an urgent imperative to mitigate the causes of climate change, and to adapt to its consequences,

- Noting with concern that climate change exacerbates other threats to social and natural systems, which place additional burdens on the poor and vulnerable,
- Also recognizing that climate change is a common concern for all humankind, and convinced that the global and local challenges of climate change cannot be met without the participation of all people at all levels of society including States, international organizations, sub-national entities, local authorities, indigenous peoples, local communities, the private sector, civil society organizations, and individuals,
- Reiterating that significant contributions should be pursued by all to limit climate change and its effects reflecting equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances, with developed countries continuing to take the lead, and developing countries continuing to enhance their mitigation efforts; recalling the commitment from the Paris Agreement that "developed country Parties shall provide financial resources to assist developing country Parties with respect to both mitigation and adaptation in continuation of their existing obligations under the Convention" and "other Parties are encouraged to provide or continue to provide such support voluntarily",
- Recognizing the need for a transition as quickly as possible to sustainable lifestyles and sustainable economic development,
- Convinced of the need to respond urgently to climate change with effective and comprehensive policies which respect and promote human rights and are informed by ethical principles,
- Emphasizing the importance of including a gender perspective within climate change policies, and
- Recognizing the different needs and access to resources of men and women, as well as the needs of the most vulnerable that include but are not limited to displaced persons and migrants, indigenous peoples, local communities, persons with disabilities, the elderly, youth, and children, as well as gender equality and empowerment of women,
- Also recognizing that meaningful participation of all stakeholders, including the most vulnerable, is essential to effective decision-making to address climate change and its adverse effects,
- Also emphasizing the fundamental importance of science, technological innovation, relevant knowledge, and education for sustainable development for responding to the challenge of climate change, including appropriate local, traditional and indigenous knowledge,
- Further recognizing that not only climate change itself, but also the responses to it, may have important and variable ethical implications at different scales of place and time.

Student Notes:

21.5. The Future of Environmental Ethics

Given the increasing concern for the environment and the impact that our actions have upon it, it is clear that the field of environmental ethics is here to stay. However, it is less clear in what way the discipline will move forward. Having said that, there is evidence for at least three future developments.

- First of all, environmental ethics needs to be and will be informed by changes in the political efforts to ameliorate environmental problems.
- Businesses should take the lead in tackling these problems. Indeed, it may even be in the interests of big business to be active in this way, given the power of consumers. It is quite possible then, that we will see business ethics address many of the same issues that environmental ethics has been tackling. However, the effects of environmental ethics will not be limited to influencing and informing business ethics alone, but will undoubtedly feed into and merge with more mainstream ethical thinking.
- Finally, environmental ethics will of course be informed by our scientific understanding of the environment. Whether it be changes in our understanding of how ecosystems work, or changes in the evidence concerning the environmental crisis, it is clear that such change will inform and influence those thinkers writing on our environmental obligations.

After all, the environment is not something one can remove oneself from. In light of this, once it is recognized that we have environmental obligations, all areas of ethics are affected, including just war theory, domestic distributive justice, global distributive justice, human rights theory and many others. Take global distributive justice as an example: if one considers how climate change will affect people throughout the world so differently – affecting individuals' homes, sanitation,

resistance from disease, ability to earn a living and so on – it is clear that consideration of the environment is essential to such questions of justice.

Student Notes:

Gandhi on Environmentalism

- The ecological scope of non-violence is unlimited. Gandhi's faith in non-violence and vegetarianism made him a votary of conservation of all diversity including all forms of life, societies, cultures, religions, and traditions. Arne Naess, the pioneer of deep ecology argued that ecological preservation is non violent in nature. Naess introduced and Thomas Weber systematized the relation between non-violence, self-realization and mutual dependence of all living beings in the following points.
 - Self-realization presupposes a search for truth.
 - All living beings are one.
 - Himsa (violence) against oneself makes self-realization impossible.
 - Himsa against a living being is himsa against oneself.
 - Himsa against a living being makes complete self-realization impossible.
- Naess used these principles to evolve a broader philosophy of environmentalism i.e, deep ecology. He believed that Gandhi's Utopia is one of the few that shows ecological balance. As Gandhi envisaged, non-violence has the power to solve all our problems, including ecological crisis.
- Many thinkers considered the Indian Environmental Movements like Chipko movement, Narmada Bachao Andolan (NBA) etc. as the living example of Gandhian Environmentalism and they consider Gandhi as a "man with deep ecological view of life, a view much too deep even for deep ecology." The key agenda of the Chipko movement was that carrying forward the "vision of Gandhi's mobilization for a new society, where neither man nor nature is exploited and destroyed, which was the civilizational response to a threat to human survival." All these together made Gandhi an exponent of Indian environmentalism.
- The economic ideas of Gandhi differed from conventional economics and bore close resemblances with ecological economics. The term sustainable development was not much discussed at Gandhi's time, but his ideal vision of the world known as Sarvodaya safeguard the rights of future generations, through the welfare of all.
- Environmental movements in India used Satyagraha as the moral equivalent of war. Forest Satyagraha was first used effectively in Chipko movement to protest against deforestation. Gandhian techniques like padayatras were conducted to save nature. Conflict resolution techniques based on non-violence and self sacrifice were used by environmental activists like Chandi Prasad Bhatt, Baba Amte, Sunderlal Bahuguna, Medha Patkar and others.

Buddha on Environmentalism

- People were not concerned with global environmental change at the time of the Buddha so he did not give teachings specifically on this subject. He did recognise that local communities could be affected by the behaviour of his followers and so, for example, he set rules that monks and nuns should never relieve themselves in or near running water, ie where people would want to wash or drink. Similarly, he also ruled that monks and nuns should not disrupt the established habitat of any other creature, nor kill other living creatures, for example when building new quarters.
- Some forms of Chinese and Japanese Buddhists teach the idea of the inter-relatedness of everything. This means that humans depend on nature and nature depends on humans. Harming one part of this whole is the same as harming all of it. Therefore, if people learn to live simply and in harmony with the world, the whole of the environment will benefit.
- The Buddhist declaration at Assisi stresses the need for all people to have respect for wildlife and for the environment. The main threat to the world so far has been that human beings have been indifferent to the effects of their actions on other creatures. Most Buddhists believe that it is only when this indifference ends, and we become mindful and compassionate, that the world will return to peace, harmony and balance. This will then allow people to live positive lives and break free from the negative effects of craving.
- Buddhist principals treat the mind and body, the self and environment, as inseparable. Environmental destruction is therefore an outer manifestation of an inner affliction. If our thoughts are polluted, then our actions will be polluted too, and so will their consequences.

Jainism and Environmentalism

- The common concerns between Jainism and environmentalism constituted in a mutual sensitivity towards living beings, a recognition of the interconnectedness (Jain's parapsaropagraho jīvānām) of life forms and a programme to augment awareness to respect and protect living systems.

- Jain Agams depict nature in a very unique way as it says that five main elements of nature; Prithvi (land, soil, stones, etc), Jal (Water resources including cloud), Agni (Fire), Vayu (Air) and Aakash (Sky) are living creatures and must be treated as living beings. These five types of elements go on to form five classes of beings (as shown alongside) such as vegetation, trees and plants, fungi and animals. This unique concept of Jainism restricts its followers to harm any creature and eventually leads to limited consumption as well as help in protecting environment.
- Jain scriptures motivate people for minimal consumption. They emphasize on Tyaga (Sacrifice). Jain Sharavaka / Shravikas (Laymen and women) are preached to minimize their Bhoga (Consumables). The seventh vow for Jain households is Bhogopbhog Pariman Vrata (Vow). This vow restricts them from unlimited consuming of natural resources. Moreover, this vow is a Shiksha Vrata (Educational vow). It preaches its observers to learn and educate themselves towards limiting their consumables.
- One of the ways Jain monks or the followers of Jainism, observe non violence is by restraining themselves from eating the roots like potato, radish, carrots, ginger etc, especially during the 4 months of rainy season. The reason behind this is they think that during harvest of these vegetables, earth is dug out and the soil organisms are killed more during rainy season. Jains called this period as "Chaumasa" or "Chaturmas".

Hinduism and Environment

- Hinduism offers a perspective on environmental conservation where there is no separation between the Creator and the created — there is no essential separation between the species homo sapiens and the other species of animals, for example, and indeed between humanity and all of the world around us.
- Hindu scripture, when viewed through an ecological lens, provides a strong foundation for action.
- The cornerstone of this foundation is the teaching that all is Divine and everything is sacred. There are three main ecological concepts that support this:
 - **Vasudeva Sarvam** – The Divine is present in all beings.
 - **Vasudhaiva Kutumbakam** – Everything is part of one interconnected global family, both spiritually and practically.
 - **Sarva Bhuta Hita** – Promoting the welfare of all beings is the highest dharma.
- From the broadest perspective, a Hindu way of approaching ecological challenges is similar to applying the precautionary principle.

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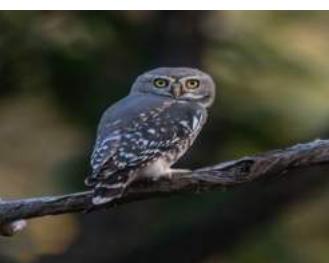
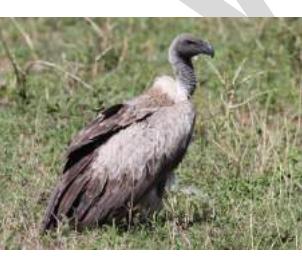
Appendix



APPENDIX I - CRITICALLY ENDANGERED SPECIES OF INDIA

Student Notes:

1. Birds

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| Jerdon's Courser  | <p>The Jerdon's Courser is a nocturnal bird. The species was considered to be extinct until it was rediscovered in 1986 and the area of rediscovery was subsequently declared as the Sri Lankamaleswara Wildlife Sanctuary in Andhra Pradesh.</p> <p>Habitat: Undisturbed scrub jungle with open areas.</p> <p>Distribution: Found only in the northern part of Andhra Pradesh (earlier also in Maharashtra).</p> <p>Threats: Clearing of scrub jungle, creation of new pastures, growing of dryland crops, plantations of exotic trees, quarrying and the construction of the Telugu-Ganga Canal. Illegal trapping of birds is also a threat.</p> |
| Forest Owlet  | <p>Habitat: Dry deciduous forest.</p> <p>Distribution: South Madhya Pradesh, in north-west Maharashtra and north-central Maharashtra.</p> <p>Threats: Logging operations, burning and cutting of trees damage roosting and nesting trees of the Forest Owlet.</p> |
| White-Bellied Heron  | <p>Habitat: Rivers with sand or gravel bars or inland lakes.</p> <p>Distribution: found in five or six sites in Assam and Arunachal Pradesh, one or two sites in Bhutan, and a few in Myanmar.</p> <p>Threats: Loss and degradation of lowland forest and wetlands through direct exploitation and disturbance.</p> |
| Vultures  | <p>Out of nine species of vultures, population of three species (White-backed Vulture <i>Gyps bengalensis</i>, Slender-billed Vulture <i>Gyps tenuirostris</i> and Long-billed Vulture <i>Gyps indicus</i>) have declined by 99%.</p> <p>Vultures keep the environment clean, by scavenging on animal carcasses.</p> <p>Habitat: Forests, habitation, villages etc.</p> <p>Distribution: Across India.</p> <p>Threats: A major threat to vultures is the use of the painkiller diclofenac for veterinary purposes. On consumption of carcasses, diclofenac gets into the system of vultures which they are unable to metabolize. Accumulation of diclofenac results in gout-like symptoms such as neck-drooping ultimately leading to death</p> |

| | | |
|--|---|-----------------------|
| <p>Bengal Florican</p>  | <p>Bengal Florican is a rare bustard species that is very well known for its mating dance.</p> <p>Habitat: Grasslands sometimes interspersed with scrublands.</p> <p>Distribution: Native to only 3 countries in the world - Cambodia, India and Nepal. In India, it occurs in 3 States namely Uttar Pradesh, Assam and Arunachal Pradesh.</p> <p>Threats: Ongoing conversion of the bird's grassland habitat for various purposes including agriculture is mainly responsible for its population decline.</p> | <p>Student Notes:</p> |
| <p>Himalayan Quail</p>  | <p>Habitat: They are known to inhabit long grass and scrubs on steep hillsides, particularly south facing slopes between the altitudes of 1,650 and 2,400 metres.</p> <p>Distribution: The Himalayan quail is native to India, found only in the mountains of Uttarakhand in north-west Himalayas.</p> | |
| <p>Pink Headed Duck</p>  | <p>Habitat: Lowlands, ponds, swamps and marshes with dense vegetation.</p> <p>Distribution: Eastern India, Bangladesh and Myanmar.</p> | |
| <p>Sociable Lapwing</p>  | <p>This medium-sized lapwing has longish black legs and a short black bill. The head has a striking pattern, with a black crown and eyestripe, the latter being bordered above and below with white.</p> <p>Habitat: This species breeds on open grassland</p> <p>Distribution: in Russia and Kazakhstan. These birds migrate South to enter North-West India.</p> | |
| <p>Baer's Pochard</p>  | <p>Habitat: This species inhabits water bodies with rich aquatic vegetation. They occur in freshwater bodies, rivers, freshwater lakes, reservoirs and coastal habitats surrounded by thick vegetation.</p> <p>Distribution: Baer's pochard species breed in Russia and north-eastern China. They move southwards for wintering in eastern and southern mainland China, India, Bangladesh, Myanmar, Japan, Vietnam.</p> <p>Threats: Habitat degradation, hunting and drying up of breeding grounds</p> | |

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| | | Student Notes: |
| Spoon-billed Sandpiper | <p>Habitat: During the breeding season Spoon-billed Sandpipers live in coastal tundra. During migration and winter Spoon-billed Sandpipers occupy coastal marine sites, especially mudflats on the outer reaches of tidal estuaries.</p> <p>Distribution: It breeds in the Chukotsky Peninsula, and in the southern and northern regions of the Kamchatka Peninsula—and mainly winters in Bangladesh, Myanmar, and Thailand. It has also been recorded from India, Vietnam, southern China, Singapore, and the Philippines.</p> | |
| Siberian Crane | <p>Habitat: Shallow wetlands in Tundra and plains</p> <p>Distribution: They occur in three groups: the eastern group, which migrates from eastern Siberia to China, the central group, which migrates from western Siberia to India, and the western group, which migrate from western Russia to Iran.</p> <p>Keoladeo (Ghana) National Park (KNP) was the last consistently confirmed wintering area for the species in India.</p> | |

2. Mammals

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| Pygmy Hog | <p>The Pygmy hog is the world's smallest wild pig, with adults weighing only 8 kg. This species constructs a nest throughout the year. In 1996, a captive-breeding programme of the species was initiated in Assam, and some hogs have been reintroduced in Sonai Rupai area also in 2009.</p> <p>Habitat: Relatively undisturbed tall 'terai' grasslands. It is one of the most useful indicators of management status of grassland habitats. The grasslands where the pygmy hog resides are crucial for the survival of other endangered species such as Indian rhinoceros, swamp deer, wild buffalo, hispid hare), Bengal florican and swamp francolin.</p> <p>Distribution: Formerly, the species was more widely distributed along the southern Himalayan foothills but now is restricted to only a single remnant population in Manas Wildlife Sanctuary and its buffer reserves.</p> <p>Threats: The main threats are loss and degradation of grasslands, dry-season burning, livestock grazing and afforestation of grasslands. Hunting is also a threat to the remnant populations.</p> |
| Namdapha Flying Squirrel | <p>This is an arboreal species that is likely most active at dusk. The Namdapha Flying Squirrel is only known with certainty from a single individual collected in Namdapha National Park, the largest protected area in the Eastern Himalaya biodiversity hotspot, at altitudes of between 100 and 350 meters above sea level.</p> |

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| <p>Malabar Civet</p>  | <p>This small, dog like carnivore has been pushed to the brink of extinction by hunting and habitat loss.</p> <p>Once widespread in the Western Ghats, the Malabar civet was declared possibly extinct in 1978. Although it was rediscovered nine years later, it has never been photographed and there has been no published proof of its continued survival for over a decade. If the species survives at all, it is likely to be as a series of isolated relic populations, largely confined to thickets in cashew nut plantations.</p> | <p>Student Notes:</p> |
| <p>Other endangered mammals: Andaman White-toothed Shrew, Jenkin's Andaman Spiny Shrew, Nicobar White-tailed Shrew, Large Rock Rat or Elvira Rat.</p> | | |

3. Reptiles and Amphibians

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| <p>Gharial</p>  | <p>The Gharial is the most uniquely evolved crocodilian in the world, a specialized river-dwelling fisheater.</p> <p>Habitat: Clean rivers with sand banks.</p> <p>Distribution: Only viable population in the National Chambal Sanctuary, spread across three States of Uttar Pradesh, Rajasthan and Madhya Pradesh in India. Small non-breeding populations exist in Son, Gandak, Hoogly and Ghagra rivers. Now extinct in Myanmar, Pakistan, Bhutan and Bangladesh.</p> <p>Threats: The combined effects of dams, barrages, artificial embankments, change in river course, pollution, sand-mining, riparian agriculture and ingress of domestic and feral livestock caused irreversible loss of riverine habitat and consequently of the gharial.</p> |
| <p>Leatherback Turtles</p>  | <p>Leatherback turtles are the largest of living sea turtles weighing as much as 900 kg. Adult leatherback turtles are excellent swimmers – they swim on an average of 45-65 km a day, travel upto 15,000 km per year and can dive as deep as 1200 m. Jelly fish are their primary prey. The population spikes of leatherbacks coincide with abundance of jellyfish, making them important top-predators in marine environments.</p> <p>Habitat: Tropical and subtropical oceans</p> <p>Distribution: Found in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans.</p> <p>Threats: High sea fishing operations, harvesting of eggs, destruction of nests by wild species and domesticated species such as cats, dogs and pigs. Artificial lighting disorients hatchlings and adult and causes them to migrate inland rather than back to the sea. Threats to habitat include construction, mining and plantation of exotics.</p> |

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| | | Student Notes: |
| Four-toed river terrapin | <p>Four-toed river terrapin or River terrapin is a critically endangered turtle. The omnivorous diet of the river terrapin and other terrapin species, makes them an essential part of the effi cient clean-up systems of aquatic habitats.</p> <p>Habitat: Freshwater rivers and lakes.</p> <p>Distribution: Bangladesh, Cambodia, India, Indonesia, Malaysia</p> <p>Threats: Use of flesh for medicinal purposes, demand for eggs, which are considered a delicacy</p> | |
| Red-Crowned Roofed turtle | <p>The red-crowned roofed turtle or Bengal roof turtle is a species of freshwater turtle endemic to South Asia.</p> <p>Distribution: Historically, this turtle was found in central Nepal, northeastern India, Bangladesh and probably Burma.</p> <p>Threats: harvested for meat and shells, drowned in fishing nets, water pollution, hydro-electric schemes and habitat loss.</p> | |
| Other Critically Endangered Amphibians: | | |
| <p>Frogs: Anamalai Flying Frog, Gundia Indian Frog, Kerala Indian Frog , Charles Darwin's Frog, Kottigehar Bubble-nest Frog , Amboli Bush Frog, Chalazodes Bubble-Nest Frog, Small Bush Frog, Green-eyed Bush Frog, Griet Bush Frog, Kaikatt's Bush Frog, Mark's Bush Frog, Munnar Bush Frog, Large Ponmudi Bush Frog, Resplendent Shrub Frog, Sacred Grove Bush frog, Sushil's Bush Frog and Shillong Bubble-nest Frog.</p> <p>Toad: Tiger toad</p> | | |

4. Fish

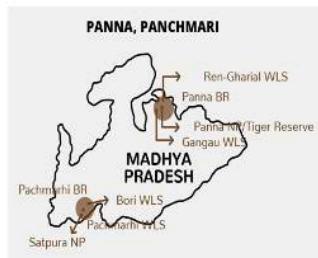
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| Largetooth Sawfish |  <p>Habitat and range: It can tolerate a range of salinities, or salt levels. Due to this flexibility, they've historically been found in tropical and subtropical waters around the world—anywhere the waters are warm.</p> <p>Threats: Their long rostrums, while an effective tool for hunting and defense, also make them vulnerable, as they're easily entangled in fishing gear. Accidentally getting caught in fishing nets targeting other fish is one of the biggest threats they face today.</p> |
| Wayanad Masheer |  <p>The Wayanad Mahseer is an endemic fish that occurs in the upland streams and rivers of the southern region of the Western Ghats.</p> |
| Pondicherry Shark |  <p>The Pondicherry Shark is a rare shark found on the continental and insular shelves of the eastern Indian Ocean and the western Pacific, from India to New Guinea. Little is known about their particular size or breeding habits.</p> |

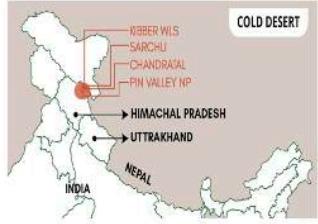
BIOSPHERE RESERVES IN INDIA



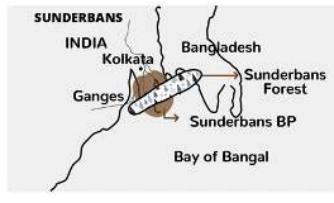
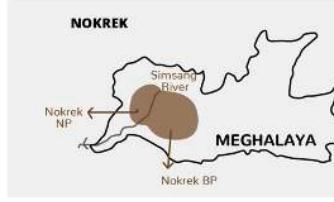
| S.N. | BIOSPHERE RESERVE | STATE | GEOGRAPHIC AL FEATURES | PROTECTED AREAS | FLORA AND FAUNA | Student Notes: |
|------|---|--------------------|---|--|--|----------------|
| 1. | DIHANG-DIBANG BIOSPHERE RESERVE <ul style="list-style-type: none"> ○ BP - Biosphere Reserve ○ WLS - Wildlife Sanctuary ○ NP - National Park  <p>DEHANG-DIBANG</p> | ARUNACHA L PRADESH | VEGETATION :- sub-tropical broad-leaved, sub-tropical pine, temperate broad-leaved, temperate conifer, sub-alpine woody shrub, alpine meadow bamboo brakes and grassland. | 1. Mouling National Park 2. Dibang Wildlife Sanctuary | Flora: Tree fern, Begonia, Lady's slipper orchid Fauna: Endemic Fauna: Red panda, Himalayan black bear, Green pit viper, Takin | |
| 2. | SESHACHALAM HILLS  <p>SESHACHALAM HILLS</p> | ANDHRA PRADESH | Climate: Tropical Monsoon Forest type: Both dry and Moist deciduous Type | 1. Sri Venkateswar a National Park 2. Sri Venkateshwa ra wildlife Sanctuary | Endemic Flora: Red Sanders and Slender Loris Fauna: Jungle cat, Great Mouse Deer, golden Geckos | |
| 3. | DIBRU-SAIKHOWA  <p>DIBRU - SAIKHOWA AND MANAS</p> | ASSAM | Climate: Tropical monsoon Forest Type: semi wet evergreen forests, tropical moist deciduous forest, bamboo, swamp forests, cane brakes and grasslands. | 1. Dibru-Saikhowa National Park | Endemic Flora: Rauvolfia (Sarpagandhi), Benteak, Livistona (orchid) Endemic Fauna: White winged wood duck, Hollock-gibbon, Wild buffalo | |

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| 4. | <p>MANAS</p> <p>DIBRU - SAIKHOWA AND MANAS</p>  | <p>ASSAM</p> <p>River-Manas-Beki</p> | <p>Climate: Tropical Monsoon</p> <p>The monsoon forests of Manas lie in the Brahmaputra Valley semi-evergreen forests ecoregion.</p> <p>Main Forest types: semi-evergreen forests mixed moist and dry deciduous forests, alluvial grasslands, creeper swamp forest, Eastern seasonal Swamp Forest, Cane and bamboo brakes</p> | <p>Manas Wildlife Sanctuary</p> <p>Manas National Park</p> <p>Manas Tiger Reserve</p> | <p>Endemic Flora: Catechu tree, Sissoo, White siris</p> <p>Endemic Fauna: Pygmy hog, Golden langur, Assam roofed turtle</p> | Student Notes: |
| 5. | <p>ACHANAKMAR -AMARKANTAK</p>  | <p>CHHATTISGARH-MADHYA PRADESH</p> | <p>Climate: Tropical Monsoon</p> <p>Forest Type: Tropical deciduous vegetation. Further classified into Northern Tropical Moist Deciduous and Southern Dry Mixed Deciduous forests</p> | | <p>Several thallophyte, bryophyte, pteridophyte, gymnosperm, and angiosperm species found.</p> | |

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| 6. | <p>PANNA</p>  | <p>MADHYA PRADESH</p> | <p>Climate: semi-Arid to Dry Sub-humid</p> <p>Flora: Vegetation types: Southern Tropical Dry Deciduous Dry Teak Forest, Northern Tropical Dry Deciduous Mixed Forest, Dry Deciduous Scrub Forest, <i>Boswellia</i> Forest, Dry Bamboo Brakes, <i>Anogeissus pendula</i> Forest.</p> | <p>1. Panna National Park/Panna Tiger Reserve</p> <p>2. Gangau Wildlife Sanctuary</p> <p>3. Ken-Gharial Wildlife sanctuary (dedicated to breeding programs and proper housing of Gharials)</p> | <p>Panna represents the northern boundary of the natural distribution of teak, and the eastern limits of teak-kardhai mixed forests.</p> <p>Fauna: Tiger, chinkara, tree shrew, long snouted crocodile, mugger</p> <p>Links the eastern and western wildlife populations of the Vindhyan ranges.</p> | Student Notes: |
| 7. | <p>PACHHMARI</p>  | <p>Madhya Pradesh</p> <p>River-Denwa</p> | <p>Climate: Tropical Monsoon climate</p> <p>The Panchmarhi plateau is cool in summer and has heavy rainfall in the rainy season, whereas low lands in Narmada basin are uncomfortably hot in summer with less rainfall</p> | <p>Bori Sanctuary, 2. Pachmarhi Sanctuary 3. Satpura National Park These altogether has also been notified as Satpura Tiger Reserve</p> | <p>Flora: Forest Types: moist deciduous, dry deciduous, central Indian sub tropical hill forest.</p> <p>Endemic Flora : Sal tree, <i>Selaginella</i> fern, <i>Palimorpha</i> bamboo</p> <p>Endemic Fauna: Barasingha, Wild buffalo, Red jungle fowl.</p> | |

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| <p>8. KUTCH</p>  | <p>GUJARAT</p> | <p>Climate: Arid, Desert like conditions Two major ecosystems: Great Rann of Kutch (GRK) and Little Rann of Kutch (LRK)</p> | <p>1. Kutch Desert Sanctuary 2. Wild Ass Sanctuary (for conservation of wild ass)</p> | <p>Flora: mixed scrub, thorn, savannah in GRK Mangroves in the eastern border of Banni grassland, inside the GRK a place locally known as Shrawan Kavadia Fauna: Indian wild ass, Greater and Lesser Flamingos</p> | <p>Student Notes:</p> |
| <p>9. COLD DESERT</p>  | <p>HIMACHAL PRADESH</p> | <p>Climate: Cold, harsh climate with low mean annual rainfall-creating desert like conditions</p> | <p>1. Pin Valley National Park 2. Kibber Wildlife Sanctuary 3. Chandratal Wildlife Santuary 4. Sarchu Wildlife Sanctuary</p> | <p>Flora: Herbs, shrub species Fauna: Tibetan gazzle, red fox, weasel, marmot, griffon, lammergeyer, golden eagle, snow cock, snow leopard, brown and black bear, ibex etc.</p> | |
| <p>10. AGATSYAMALAI</p>  | <p>Kerala, Tamil Nadu River-Tambraparani</p> | <p>Climate: Tropical Monsoon Flora: Forest Types: thorn, moist deciduous and semi-evergreens</p> | <p>1. Neyyar Wildlife Sanctuary 2. Peppara Wildlife sanctuary 3. Shendumey wildlife Sanctuary 4. Kalakad Mundanthurai Tiger Reserve.</p> | <p>Endemic Flora: Rudraksha tree, Black plums, Gaub tree, Wild dhaman Endemic Fauna: Lion-tailed macaque, Slender loris, Great pied hornbill</p> | |

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| 11. | KANCHANDEZONGA  | SIKKIM | Climate: Varies with altitude, aspect Forest Type: Sub-tropical broad leaved hill forest, Himalayan wet temperate forest, and temperate broad leaved forest, mixed coniferous forest, sub-alpine forests and dry alpine forest | Kanchenjunga National Park | Endemic Flora: Anemone, Uvaria, Sikkim Rhododendron, Sikkim Mahonia Endemic Fauna: Tibetan sheep, Musk deer, Monal pheasant, Snow partridge | Student Notes: |
| 12. | SIMLIPAL  | ODISHA River-Budhabalanga, Palpala Bhandan, Kharkai River and Deo | Climate: Tropical Monsoon Relatively higher annual precipitation of over 200 cm spread over about 135 days. Marked variation of temperature range between the central and southern regions. | 1.Simlipal Tiger Reserve, 2.Hadgarh Wildlife Sanctuary 3.Kuldiha Wildlife Sanctuary | Flora: Forest Type: Northern Tropical Semi Evergreen Forests, Northern Tropical Moist Deciduous Forests, Dry Deciduous Hill Forests, High Level Sal Forest, Grassland and Savannah Endemic Flora: Coix grass Endemic Fauna: Red breasted falconet, Slender billed scimitar babbler, Ruddy mongoose | |

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| | | | | | Student Notes: |
| 13. | SUNDARBANS  | WEST BENGAL River-Meghna | Climate: Tropical Monsoon Flora: Forest Types: Tidal Swamp Forests, Saline Water Type Mixed Forests, Brackish Water Type Mixed Forests, Palm Swamp Type | 1.Sundarban National Park /Sundarban tiger Reserve 2.Sajnekhali Wildlife Sanctuary 3.Lothian Wildlife Sanctuary 4.Haliday Wildlife Sanctuary | Endemic Flora: Sundari, Passur, Nypa Fauna: Endemic Fauna: Bengal tiger, Bengal monitor lizard, Salvator lizard Others: Gangetic dolphin, estuarine crocodile, river terrapin, olive ridley turtle, |
| 14. | GULF OF MANNAR  | Tamil Nadu | Ecosystem types: Tropical Dry Broad-leaved forest, seaweed communities , sea grass communities , coral reefs, salt marshes and mangrove forests. | Mannar Marine National Park | Endemic Flora: Endemic Flora : Morning glory, Jatropha, Halophila grass Endemic Fauna: Sea Cow, Sea Anemone, Sea fans. |
| 15. | NOKREK  | MEGHALAYA (parts of Garo Hills) River-Ganol, Dareng and Simsang | Climate: Tropical-High humidity, Monsoon Rains, High Temperature Forest Type: Evergreen and semi-evergreen deciduous forests | Nokrek National Park | Endemic Flora: Grand rasamala, White meranti, Lali, Chempaka, Wild lemon Endemic Fauna: Stump tailed macaque, Pig-tailed macaque, Giant flying squirrel |

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| | | | | | Student Notes: |
| 16. | GREAT NICOBAR  | ANDAMAN & NICOBAR ISLAND | <u>Climate:</u> Tropical and Sub-tropical Moist Broad-leaved Forest | | Endemic Flora: Screw pine, Nipa palm, Ceylon iron wood Fauna: Endemic Fauna: Crab-eating macaque, Nicobar megapode, Giant robber crab, Nicobar serpent eagle |
| 17. | NANDA DEVI  | UTTRAKHAND RIVER- Rishi Ganga | <u>Climate:</u> Dry with low yearly precipitation <u>Flora:</u> <u>Forest Type:</u> mixed temperate and subalpine | 1. Nanda Devi National park 2. Valley of Flowers National Park | Endemic Flora: Salep Orchid, Silver weed, Fairy candelabra, Fairy Primrose Fauna: Endemic fauna: Himalayan tahr, Brown bear, Koklas pheasant |
| 18. | NILGIRI  | Parts of Tamil Nadu, Kerala, Karnataka. RIVERS- Bhavani, Moyar, Kabini (tributaries of Cauvery), Chaliyar, Punampuzha | <u>Climate:</u> Annual Rainfall- 500mm- 7000mm <u>Temperature</u> - 0-41 C <u>Flora:</u> Moist Evergreen, Semi-Evergreen, Thorn, Savannah Woodland, Sholas and Grassland | 1. Mudumalai Wildlife Sanctuary (Also Tiger Reserve), 2. Wyanaad Wildlife Sanctuary 3. Bandipur National Park (Also Tiger Reserve), 4. Nagarhole National Park (Also Tiger Reserve), 5. Mukurthi National Park 6. Silent Valley | Endemic Flora: Vanda, Liparis, Bulbophyllum, Spiranthes , Thrixspermum Fauna: Endemic Fauna: Nilgiri tahr, Nilgiri langur, Lion – tailed macaque |

APPENDIX III - IMPORTANT NATIONAL PARKS

Student Notes:



| S.N. | State/U T | National Park | Major River | Flora/ Forest Type | Fauna | Student Notes: |
|------|---------------------------|-------------------------------------|-------------|--|--|----------------|
| 1 | | Campbell Bay NP | | Tropical evergreen forest, orchids, tree fern, mangroves | Crab-eating Macaque, Giant robber crabs, Saltwater crocodile, Giant leatherback turtle, Megapode, Andaman Wild Pig | |
| 2 | | Galathea Bay NP | | Tropical and subtropical moist broad leaf forests. | Giant leather back Turtle, Water monitor lizard, Reticulated python, Nicobar Tree Shrews, Nicobar Long-Tailed Macaque, | |
| 3 | Andaman & Nicobar Islands | Mahatama Gandhi Marine (Wandoor) NP | | Mangroves, Gurjan, Bamboo, Ferns | White-Bellied Sea Eagle, Water Monitor Lizard, Banded Sea Snake, Estuarine crocodiles | |
| 4 | | Middle Button Island NP | | Moist Deciduous Forest | Spotted deer, Fruit Bat, White-Bellied Sea Eagle, Sooty Tern, Monitor lizards, Dugongs, Andaman Serpent Eagle | |
| 5 | | Mount Harriett NP | | tropical evergreen, hilltop tropical evergreen | Andaman Wild Pig, Andaman Masked Palm Civet, Andaman Rat, , Andaman cuckoo dove, | |

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| | | | and littoral forests | | Student Notes: |
| 6 | North Button Island NP | | Moist Deciduous Forest | Corals, Spotted deer, Blue whale, Monitor lizard, Dolphins, Dugongs, Humpback Snappers, Giant Groupers | |
| 7 | Rani Jhansi Marine NP | | Lowland evergreen rain forest, semi-evergreen rain forest and mangrove forests. | Dugong, Fruit- eating bats, Daniel's Forest Lizard, Andaman Island Grass Skink, Andaman Water Monitor, Corals | |
| 8 | Saddle Peak NP | | Andaman Tropical Evergreen, Andaman Moist Deciduous, Andaman Semi-evergreen, Canebrake, Wet Bamboo and littoral. | Andaman wild pig, Andaman Horseshoe Bat, Andaman hill mynah, Imperial pigeon, Andaman Teal | |
| 9 | South Button Island NP | | | Dugongs, water lizards, sea turtles, dolphins and blue whales. <u>Endemic:</u> Subspecies of edible-nest swiftlet | |

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| | | | | | Student Notes: |
| 10 | | Papikonda NP | Godavari | Dry deciduous Teak forest with Bamboo, Terminalia, and other species conforming to the Eastern Ghat vegetation. | Tiger, Hyena, Four horned antelope, Spotted deer, Muggers |
| 11 | Andhra Pradesh | Rajiv Gandhi (Rameswaram) NP | Penna | | |
| 12 | | Sri Venkateswara NP | | Dry deciduous mixed forest, Patches of mixed deciduous forest Endemic: Red Sanders, Shorea talura, Sandalwood | Tiger, Golden Gecko, Slender Loris, Indian Giant Squirrel, Tree Shrew and Flying Lizard |
| 13 | Arunachal Pradesh | Mouling NP | Siyom 13 rivers finally join Siang River | Forms a transition zone between tropical forests at lower altitudes to most temperate forest | Red Pandas, Deers, Hoolock Gibbons and Tigers |
| 14 | | Namdapha NP | Noa Dihing | Evergreen Forests, | Tiger, leopard, clouded leopard, snow leopard, |

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| | | | | Moist deciduous forests, sub-tropical forests, Temperate Forests and Alpine Rare Blue vanda orchid found | golden cat, marble cat, , red panda, | Student Notes: |
| 15 | Assam | Dibru-Saikhowa NP | Dibru, Bramhaputra | <u>Forest</u> <u>Type:</u> moist deciduous forest, bamboo, swamp forests, cane brakes and grasslands. <u>Endemic Flora:</u> Rauvo Ifia (Sarpagandhi), Benteak, Livistona (orchid) | Endemic Fauna: White winged wood duck, Hollock-gibbon, Wild buffalo | |
| 16 | | Kaziranga NP | Bramhaputra, Mora Dhansiri, Diphlu | <u>Forest</u> <u>Type:</u> alluvial inundated grasslands, alluvial savannah woodlands, tropical moist mixed deciduous forests, and tropical | Tiger, One-horned Rhino | |

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| | | | semi-evergreen forests. | |
| 17 | Manas NP | Manas Beki | <p><u>Main Forest types:</u> semi-evergreen forests mixed moist and dry deciduous forests, alluvial grasslands, creeper swamp forest, Eastern seasonal Swamp Forest, Cane and bamboo brakes</p> <p><u>Endemic Flora:</u> Catechu tree, Sissoo, White siris</p> | <p><u>Endemic Fauna:</u> Pygmy hog, Golden lungur , Assam roofed turtle</p> |
| 18 | Nameri NP | Jia Bhoroli | Semi-evergreen, moist deciduous forests with cane and bamboo brakes and narrow strips of open grassland along rivers. | Tiger,Black Panther, , Himalayan Black Bear, Elephant |
| 19 | Rajiv Gandhi Orang NP | Brahmaputra | Eastern Himalayan Moist | Tiger, Pygmy hog, elephant, Bengal florican |

Student Notes:

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| | | | | Deciduous Forest, Eastern Seasonal Swamp Forest, Eastern Wet Alluvial Grassland, Savannah Grassland, Degraded Grassland | | Student Notes: |
| 20 | Bihar | Valmiki NP | Gandak, Burhi Gandak, Pandai | <p><u>Forest Types:</u> Moist mixed deciduous</p> <p>Open – land vegetation</p> <p>Sub-mountainous semi-evergreen formation</p> <p>Freshwater swamps</p> <p>Riparian fringes</p> <p>Alluvial grasslands and high hill savannah</p> <p>Wetlands</p> | Tiger, Rhino, black Bear, Nepal kaleej pheasant | |
| 21 | Chattisgarh | Guru Ghasidas (Sanjay) NP | Umaria, Kodmar | Moist deciduous forest consisting mainly of sal | Tiger, Leopard, Golden Hooded Oriole, Egyptian vulture | |

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| | | | | | Student Notes: |
| 22 | | Indravati (Kutru) NP | Indravati | Southern Dry Mixed Deciduous Forests and Southern Moist Mixed Deciduous Forests | Tiger, leopard, sloth bear, striped hyena |
| 23 | | Kanger Valley NP | Kanger | mixed moist deciduous type of forests with predominan ce of sal, teak and bamboo | Tiger, Leopard, mouse deer, Bastar hill Myena |
| 24 | Goa | Mollem NP | Mandovi | West Coast tropical evergreen forests, West Coast semi- evergreen forests and moist deciduous forests. | Black Panther, bonnet macaque, Slender loris |
| 25 | | Vansda NP | Ambika | Deciduous Forest, bamboo | Indian leopard, rhesus macaque, |
| 26 | Gujarat | Blackbuck (Velavadar) NP | Lies between Parvalia and Alang which drains into Gulf of Cambay | Grassland, shrubland | Blackbuck, wolf and lesser florican |
| 27 | | Gir NP | Hiran, Shetrungi, Datardi, Shingoda, Machhundri, | Dry Deciduous Scrub, Dry Savannah | Asiatic lion, Chital, chinkara, Indian Leopard |

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|----|------------------|-----------------------------|---|---|---|
| | | | Godavari and Raval. | Dominant Species: Teak | |
| 28 | | Marine (Gulf of Kachchh) NP | | | Corals, Blue Whales, greater flamingo, Whale sharks |
| 29 | | Kalesar NP | Yamuna River forms the Eastern boundary | Dense old forest dominated by Sal | Barking Deer, Ghoral, Leoprd |
| 30 | Haryana | Sultanpur NP | | Tropical and Dry Deciduous | Migratory Birds: Amur falcons, Egyptian vultures, plovers Resident Birds: Common hoopoe, paddyfield pipit, purple sunbird, |
| 31 | Himachal Pradesh | Great Himalayan NP | Tirthan, Sainj, Jiwa Nal, and Parvati | Temperate broad-leaved forests, Temperate conifer forests ,Upper temperate broad-leaved and mixed conifer forests, Sub-alpine (Birch-Rhododendron) forests, Alpine scrubs ,Alpine meadows ,Riverine forests | Himalayan Musk Deer, Snow Leopard, Himalayan Brown Bear, Himalayan tahr |

Student Notes:

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| | | | | (along the rivers), Temperate grassy slopes, Temperate secondary scrub near village pastures and forest edges. | | Student Notes: |
| 32 | Inderkilla NP | | | | | |
| 33 | Khirganga NP | | | | | |
| 34 | Pin Valley NP | Pin, Spiti | Dry Temperate, Alpine dominated by Juniper and Birch Trees | Tibetan Gazelle, Wooly Hare, Snow Leopard, Himalayan Ibex, Tibet Snow Finch, | | |
| 35 | Simbalbara NP | | sal forest, mixed forest, mixed forest grassy slopes, mixed forest riverine, pine mixed woodland and Mixed forest with khair plantations. | Himalayan Bear, Brown Bear, Snow Leopard | | |
| 36 | Jammu and Kashmir | City Forest (Salim Ali) NP | Mangrove shrubberies | Kashmiri stag, Chakkar, Snow Cock, Serow, hangul | | |

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| 37 | | Dachigam NP | Daghwan | Coniferous forest, grasslands, scrubs | Kashmiri Stag, leopards, Himalayan Gray Langurs, Monal |
| 38 | | Hemis NP | Markha, Sumdah, Rumbak, bounded by Indus in the north | pine forests, alpine shrublands and meadows, and alpine tundra. | Argali, Bharal, Shapu, Tibetan wolf, Snow Leopard |
| 39 | | Kishtwar NP | Kiar, Nath, Kibar, Marwa, Rinnay | Coniferous, Alpine, Meadows and Scrub forests. | Himalayan Snowcock, Brown Bear |
| 40 | Jharkhand | Betla NP | North Koyal | Sal and Bamboo forest | Sloth Bear, Panther |
| 41 | Karnataka | Anshi NP | Kali | North Western Ghats montane rain forests and North Western Ghats moist deciduous forests | Tiger, Black Panther |
| 42 | | Bandipur NP | Kabini, Moyar | Dry Deciduous Scrub, Tropical Dry Deciduous Forest, Tropical Moist Mixed | Tiger, Leopad |

Student Notes:

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| | | | Deciduous Forest | | |
| 43 | Bannerghatta NP | Suvarnamukhi | Moist Deciduous, Scrubs | Elephant, Leopard | |
| 44 | Kudremukh NP | Tunga, Bhadra, Netravati | Evergreen, Semi-evergreen, eucalyptus | Tiger, Leopard, Lion-tailed Macaque, Malabar trogon, Malabar whistling thrush | |
| 45 | Nagarahole (Rajiv Gandhi) NP | Lakshmmantirtha river, Sarati Hole, Nagar Hole, Balle Halla, Kabini River | North Western Ghats moist deciduous forests with (teak and rosewood), Central Deccan Plateau dry deciduous forests with Pala indigo and thorny wattle, Sub-montane valley swamp forests with several species of the Eugenia genus. | Tiger, Leoprad | |
| 46 | Kerala | Anamudi Shola NP | Chinnar, Pambar | West coast tropical evergreen, Southern Hilltop Tropical Vegetation | Elephant, Tiger, Panther, Parantica nilgiriensis (a RET listed species of butterfly) |

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| | | | | Shola Forest predominantly | |
| 47 | Eravikulam NP | Periyar, Chalakudiyar, Cauvery | Southern montane wet temperate forests, southern west coast evergreen forest, Mixed Deciduous Predominance of shoal forest, grasslands Endemic: The genus <i>impatiens</i> has 6 species endemic to grasslands | Nilgiri Tahr, Nilgiri marten Endemic: <i>Salea Anamalayana</i> , <i>Ahatulla disper</i> (reptiles) | |
| 48 | Mathikettan Shola NP | Panniyar | West coast tropical evergreen forests, west coast semi evergreen forests, moist deciduous forests, shola forests | | |

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| | | | and grasslands | | |
| 49 | Pambadum Shola NP | Pambar | Shola Forests, Grasslands | Elephant, Gaur, Leopard, Wild boar | |
| 50 | Periyar NP | Periyar, Pamba | West Coast Tropical Evergreen Forests, West Coast Semi Evergreen Forests, Moist Deciduous Forest, Southern Montane Wet Grassland, Eucalyptus Plantations | Tiger, Leoprad, Elephant, Nilgiri Tahr | |
| 51 | Silent Valley NP | Bharathapuz ha River, Kunthipuzha River | South Western Ghats mountain rain forests and tropical moist evergreen forest | Nilgiri wood-pigeon, Malabar parakeet, Malabar grey hornbill, Great Indian Hornbill, lion-tailed macaque, Nilgiri langur, Malabar giant squirrel, Nilgiri tahr | |
| 52 | Madhya Pradesh | Bandhavgarh NP | Charangang a | Moist Peninsular Low Level Sal, West Gangetic Moist Mixed Deciduous Forests | Tiger, leopard, wild dog |

Student Notes:

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| | | | | | Student Notes: |
| 53 | Fossil NP | Narmada | Dry Mixed Deciduous Forest | Tiger, Leopard, Wild Dog, Gaur, Chinkara | |
| 54 | Indira Priyadarshini Pench NP | Pench, Kanhan | Dry Teak Bearing Forest, Southern Dry Deciduous Mixed Forest | Tiger, leopard | |
| 55 | Kanha NP | Banjar, Halon | Southern Tropical Moist and Dry Mixed Deciduous Forest, Peninsular Sal Forests | Tiger, Leoprad, Barasingha | |
| 56 | Sakya Sagar and Madhav Sag ar Lakes created on Manier River | Madhav NP | Dry Mixed Deciduous Forest | Chinkara, Black Buck, Leopard, Migratory Birds: Pochard, Pintail, Geal | |
| 57 | Panna NP | Ken | Southern Tropical Dry Deciduous | Links the eastern and western wildlife | |

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| | | | Dry Teak Forest, Northern Tropical Dry Deciduous Mixed Forest, Dry Deciduous Scrub Forest, Boswellia Forest, Dry Bamboo Brakes, Anogeissus pendula Forest. | populations of the Vindhyan ranges. | Student Notes: |
| 58 | Sanjay NP | Umaria, Kodmar | Mixed Deciduous Forest mainly of Sal, Bori Teak Forests, bamboo, Tendua etc | Tiger, Leopard, Chital | |
| 59 | Satpura NP | Denwa | Moist deciduous forest consisting mainly of sal | Tiger, Blackbuck | |
| 60 | Van Vihar NP | | Sal, Bel, Amaltas, Babul, tendua etc | Captive and herbivores. All carnivorous animals are kept inside enclosed areas and herbivores are allowed to roam freely. | |
| 61 | Kuno National Park | | Part of Kathiawar-Gir dry deciduous forests ecoregion | | |

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| | | | | | Student Notes: |
| 62 | Maharashtra | Chandoli NP | Warna | Malabar Coast moist forests and North Western Ghats moist deciduous forests. | Tiger, Leopards, Blackbucks |
| 63 | | Gugamal NP | Dolar | Southern dry deciduous forest. | Tiger, Leopard, Ussuri Dhole |
| 64 | | Nawegaon NP | Major Source of water: Nawegaon lake | Southern Tropical Dry Deciduous Forests | Tiger, Panther, Sloth bears |
| 65 | | Pench (Jawaharlal Nehru) NP | Pench, kanhan | Dry Teak Bearing Forest, Southern Dry Deciduous Mixed Forest | Tiger, Leopard, Sambar |
| 66 | | Sanjay Gandhi (Borivilli) NP | two lakes, Vihar Lake and Tulsi Lake, | Southern mixed-deciduous forest | Chital, Barking Deer, Crocodiles (Tulsi lake) |
| 67 | | Tadoba NP | Tadoba lake, Kolsa lake and Andhari river | Southern Tropical Dry Deciduous Forest | Tiger, Leopard, sloth Bears |
| 68 | Manipur | Keibul-Lamjao NP | Loktak lake | Semi-Evergreen Forest | Famous for brow-antlered deer(Sangai) |
| 69 | Meghalaya | Balphakram NP | Origin of Mahadeo, Maheshkola, Goneswari, | Deciduous Forest | wild water buffalo, red panda, elephant, tiger, golden cat |

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| | | | Kanai and Chimite | Famous for Pitcher plant | |
| 70 | | Nokrek Ridge NP | Ganol, Dareng and Simsang | Evergreen and semi-evergreen deciduous forests | Slow Loris, tiger, leopard |
| 71 | | Murlen NP | | tropical, semi-evergreen and sub montane Forests | Tiger, Leopard, Himalayan Black Bear, Serrow, Hollock Gibbon |
| 72 | Mizoram | Phawngpui Blue Mountain NP | Kolodyne | Sub-tropical Broadleaf, Tropical Evergreen forests and Grasslands | Blyth's tragopan, Tiger, mountain bamboo partridge, oriental pied hornbill, purple cochoa, |
| 73 | Nagaland | Intanki NP | | Grasslands, Tropical Deciduous Forest, Evergreen Forests | Hoolock gibbon, Golden langur, Palm civets, Tiger |
| 74 | | Bhitarkanika NP | Estuarine region of Brahmani-Baitarani | Mangrove Forests | saltwater crocodile, white crocodile, Indian python, black ibis |
| 75 | Odhisa | Simlipal NP | Budhabalanga, Palpala Bhandan, Kharkai River and Deo | Northern Tropical Semi Evergreen Forests, Northern Tropical Moist | Tiger, Leopard, Elephant |

Student Notes:

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| | | | | Deciduous Forests, Dry Deciduous Hill Forests, High Level Sal Forest, Grassland and Savannah | | Student Notes: |
| 76 | | Mukundra Hills NP | Ramzan, Ahu, Kali and Chambal. | Tropical dry Deciduous Forest and Tropical thorn Forest | Tiger, Panther, Sloth bear | |
| 77 | | Desert NP | | sewan grass and aak shrub , thorns | Great Indian Bustard, Desert Fox, Blackbuck | |
| 78 | Rajasthan | Keoladeo Ghana NP | | tropical dry deciduous forests intermixed with dry grasslands | Migratory Waterfowl, Siberian Crane | |
| 79 | | Ranthambhore NP | Banas, Chambal | Northern Tropical Dry Deciduous Forest | Tiger, Leopard, Characal | |
| 80 | | Sariska NP | Chambal | Tropical Dry Deciduous Forest, Tropical thorn Forest | leopard, caracal, rusty spotted cat | |
| 81 | Sikkim | Khangchendzonga NP | Tessta | Sub-tropical broad leaved hill | Tibetan sheep, Musk deer, Monal pheasant, Snow partridge | |

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| | | | | | Student Notes: |
| | | | | forest, Himalayan wet temperate forest, and temperate broad leaved forest, mixed coniferous forest, sub- alpine a forests and dry alpine forest Endemic: Sikkim Rhododendr on, Sikkim Mahonia | |
| 82 | | Guindy NP | | tropical dry evergreen scrub and thorn forests | blackbuck, chital, pangolin |
| 83 | Tamil Nadu | Gulf of Mannar Marine NP | | Tropical Dry Broad-leaved forest, seaweed communitie s, sea grass communitie s, coral reefs, salt marshes and mangrove forests | Hawks bill turtle, Dugongs, Whales |
| 84 | | Indira Gandhi | Aliayar , Apambar , Chinnar, | wet evergreen forest and | Tiger, Elephant, Dhole |

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| | | (Annamalai) NP | Parambikulam | semi-evergreen forest, montane shola-grassland, moist deciduous, dry deciduous, thorn forests and marshes | | Student Notes: |
| 85 | | Mudumalai NP | Moyer | Tropical moist deciduous ,Tropical dry deciduous forest occurs in the middle, southern tropical dry thorn forests | Tiger, endangered Indian white-rumped vulture | |
| 86 | | Mukurthi NP | Billithadahalla, Pykara and Kundah rivers | montane grasslands and shrublands | Nilgiri Tahr, tiger | |
| 87 | | Kasu Brahmananda Reddy NP | | Tropical Dry Deciduous | pangolin, small Indian civet | |
| 88 | Telangana | Mahaveer Harina Vanasthalı NP | | Dry deciduous forest mixed with scrub jungle and grasslands | Blackbuck, Water Monitor | |
| 89 | | Mrugavani NP | | Tropical dry Deciduous | Panther, Cheetal, Sambar, | |

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| | | | | | Student Notes: |
| 90 | Tripura | Clouded Leopard NP | | Mixed Deciduous Forest | Clouded Leopard, barking deer |
| 91 | | Bison (Rajbari) NP | | | |
| 92 | Uttar Pradesh | Dudhwa NP | Suheli and Mohana | North Indian Moist Deciduous type with predominance of Sal | tigers, leopards, Asiatic black bears |
| 93 | | Corbett NP | Ramganga | Moist Deciduous Forest, Tropical Dry Deciduous Forest, Himalayan Subtropical Pine Forests | Tiger, leopard, elephant, sambar, |
| 94 | Uttarakhand | Gangotri NP | | Western Himalayan sub conifer forests, Western Himalayan alpine shrub and meadows | snow leopard, ibex, tahr, Himalayan barbet, |
| 95 | | Govind NP | Tons | western Himalayan broadleaf forests, western Himalayan subalpine conifer forests and western Himalayan alpine shrub | Snow Leopard, Himalayan tahr, Asian black bear |

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| | | | and meadows | |
| 96 | Nanda Devi NP | Rishiganga | mixed temperate and subalpine | snow leopard, Asiatic black bear, brown bear, Himalayan musk deer |
| 97 | Rajaji NP | Rawasan | Broadleaved deciduous forests, riverine vegetation, scrubland, grasslands and pine forests | Tiger, Himalayan Black Bear |
| 98 | Valley of Flowers NP | | Mixed Temperate and subalpine <u>Endemic:</u> Aconitum falconeri, A. balfouri, Himalayan maple the blue Himalayan poppy and Saussurea atkinsoni. | Snow Leopard, Musk Deer, Red Fox |
| 99 | West Bengal | Buxa NP | Jainti, Kaatulam Nala Northern Dry Deciduous Forest, Eastern Bhabar, Terai Sal, East Himalayan | Tiger, elephant, leopard cat, |

Student Notes:

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| | | | Moist Mixed Deciduous Forest, Sub-Montane Semi-Evergreen Forest, Northern Tropical Evergreen Forest | | Student Notes: |
| 100 | Gorumara NP | Murti River and Raidak River | Terai-Duar savanna and grasslands, Lower Gangetic plains moist deciduous forests | Indian Rhino, elephant | |
| 101 | Jaldapara NP | Torsa | savannah covered with tall elephant grasses. | Indian one-horned rhinoceros, Leopard, Elephants | |
| 102 | Neora Valley NP | Neora | Sino-Himalayan Temperate Forest, Sino-Himalayan Subtropical Forest, Indo-Chinese Tropical Moist Forest | Leopard, civet, black bear, sloth bear, | |
| 103 | Singalila NP | River Rammam and River Sirikholia | Eastern Himalayan subalpine conifer forests, Eastern Himalayan broadleaf forests, | red panda, leopard cat, barking deer, yellow-throated marten, Himalayan Newt | |

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| | | | Himalayan Sub-Tropical Pine Forest | |
| 104 | Sunderban NP | Meghna | Tidal Swamp Forests, Saline Water Type Mixed Forests, Brackish Water Type Mixed Forests, Palm Swamp Type | Tiger, estuarine crocodile |

Student Notes:



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