CENTRE FOR DISTANCE & ONLINE EDUCATION

UNIVERSITY OF JAMMU

JAMMU

SELF LEARNING MATERIAL

M.A. EDUCATION

SEMESTER-III

Subject : Environmental Education | **Unit : I – IV**

Course No. : 306 | **Lesson No. : 1 – 8**

Dr. Anuradha Goswami

Course Co-ordinator

http:/www.distanceeducationju.in

Printed and Published on behalf of the Centre for Distance & Online Education, University of Jammu, Jammu by the Director, CD & OE, University of Jammu, Jammu

Course Contributors :

- Dr. Deepika Slathia
  Associate Professor, Department of Environmental Sciences, University of Jammu, Jammu

- Dr. Rakesh K. Atri
  Senior Assistant Professor, Department of Environmental Sciences, University of Jammu, Jammu

- Dr. Ranjan Sharma
  Teaching Assistant, Department of Environmental Sciences, University of Jammu, Jammu

- Dr. Ravinder Kumar
  Teaching Assistant, Department of Environmental Sciences, University of Jammu, Jammu

Format Editing :

Dr. Anuradha Goswami
CD&OE, University of Jammu, Jammu

Editing and Proof Reading :

Dr. Manisha

Printed at : Quick Offset, Delhi

MASTER'S DEGREE PROGRAMME IN EDUCATION (M.A. EDUCATION)
(CD&OE) CHOICE-BASED CREDIT SYSTEM

SEMESTER III

Syllabus for the Examination to be held in December 2024, 2025 and 2026

Course No. PSEDTE306 **Title: Environmental Education**
Credits: 4

Maximum Marks:	**100**
Minor Test-I :	**10**
Minor Test-II :	**10**
Internal Assessment Assignment	**10**
Major Test :	**70**

Learning Outcomes:

1. Students will develop awareness about the relationship between between environment & humans.
2. Students will understand importance of environment for sustaining development.
3. Students will organize various activities at the secondary & hr. Secondary level.
4. Students will realize the need and analyze approaches for environmental management.
5. Students will appreciate the various bio-diversity present, need and ways to preserve them.
6. Students will gain knowledge of various environmental legislations.
7. Students will analyze and evaluate the various measures available to conserve environment.

Unit-I

Environmental education-meaning, objectives, scope and need of environmental education Environmental awareness through education-programme for secondary & hr. Secondary school children Formal & non-formal environmental education

Unit II

Man & environment relationship, man as a creator & destroyer Conservation of environment: an immediate need
Need of sensitizing and need of sustainable development
Challenges for sustainable development

Unit III

Need for environmental management
Aspects of environment management-ethical, economic, technological and social
Approaches for environmental management- economic policies, environmental indicators, seting of standards, information exchange and surveillance

Unit IV

Concept and types of biodiversity

Strategies for conservation of bio-diversity-institution and ex-situ environmental legislations in India:

a) The water act-1977
b) Forest conservation act-1980
c) The air act-1981
d) Environmental act-1986
e) National environmental educational Act-1990

Modes of Transaction: ***Lecture-cum-discussion method, field visits***

Note for paper setting:

There shall be two tests & one Assignment as part of Minor Evaluation & one major test at the end of semester in each semester. The students shall be continuously evaluated during the conduct of each course the basis of their performance as follows:

Thory	Syllabus to be covered in the examination	Time allotted for the examination	% weightage (marks)
Minor Test-I	Unit I & Unit II	Sixty Minutes	10 Marks
Minor Test-II	Unit III & Unit IV	Sixty Minutes	10 Marks
IAA			10 Mark (two questions of 5 marks each)
Major Test	Unit I to IV	Three Hours	70 Marks

Essential Reading

Aggrawal, J.C. (2007): Education for values, environment and human rights, Delhi: Shipra publications.

Kohli, V. and Kohli, V (200): Environmental Pollution and Management, Ambala: Vivek Publishers,

Nanda, V.K. (1997): Environmental Education, New Delhi: Anmol Publication. Reddy,

K.P. and Reddy, D.N. (2002): Environmental Education. Hyderabad: Neelkamal Publications Pvt. Ltd.

Sharma, V.S. (2006): Environmental Education, New Delhi: Anmol Publications Pvt. Ltd. Shrivastava, K.K. (2014) Environmental Education, New Delhi: Kanishka Publishers, Distributors.

Suggested Readings:

Sing, P.P. & Sharma, Sandhir, (2004) Teaching of Environment, New Delhi: Deep & Deep Publications Pvt. Ltd.

Sungosh, S.M. (2006): An introduction to Environmental Education, Shillong: Akashi Book Depot. Trivedy, R.N. (1990): Dimensions of safe environment, New Delhi: Anmol Publishers Pvt. Ltd.

Note for Paper Setters (Major Test):

The question paper will contain long and short answer-type questions. There will be eight long answer-type questions (two questions from each unit with internal choice) and the candidates will be required to answer one question from each unit. Each long answer type question will carry 15 marks. Question No. 1 will be compulsory and shall have 04 short answer type questions (100 words per question). Short answer type questions will be from all the units. Each short answer type question will carry 2.5 marks.

TABLE OF CONTENTS

LESSON 1

ENVIRONMENTAL EDUCATION- MEANING, OBJECTIVES, SCOPE AND NEED OF ENVIRONMENTAL EDUCATION

Structure

1.1 INTRODUCTION

The earth's declining environment has made us more aware of the causes of environmental pollution and how to effectively manage them to create a sustainable ecosystem. One of the major concerns of any nation is to attain sustainable education, particularly environmental education. Since we are all powered by renewable resources, the idea of environmental education is based on the idea that we must educate ourselves to repair the environment that is deteriorating. Since the future of the society depends on the youth in particular, they are the most important resource. In order to foster interest in the environment and encourage efforts to preserve, conserve, and enhance it, this lesson aims to raise students' awareness and comprehension of environmental concepts and environmental education.

Through environmental education, students can build a framework for their understanding of the world and look for information that will help them grow and use throughout their lives. By giving them the opportunity to take part in a sustainable future, environmental education also empowers students. Thus, environmental education lays the groundwork for lifelong learning. Students will gain a thorough understanding of the meaning, importance, role, and scope of environmental education in this lesson. You will also learn why environmental education is essential in the current context and how it will develop in the future.

1.2 LEARNING OBJECTIVES AND LEARNING OUTCOMES

After going through this lesson, you shall be able to:

explain the concept of environment and it's components, describe and explain environmental education, explain the importance and need of environmental education in present day situation, discuss the nature, types, scope and importance of environmental education, and inspire people to believe in biodiversity conservation and explain the connection between the environment and population.

1.3 CONCEPT OF ENVIRONMENT AND ENVIRONMENTAL EDUCATION

It is important to comprehend the environment before talking about the idea of environmental education. When it comes to the environment, we are concerned for the survival of all people on Earth as well as future generations. The environment as a whole signifies surroundings, in which we are living. The environment encompasses everything that for our survival, we are either directly or indirectly dependant on living things, such as vegetation, animals, or non-living components such as soil, water or air. In conclusion, the environment consists of a variety of forces like physical, intellectual, economic, political, cultural, social, moral and emotional. The environment is the culmination of all outside influential forces, and circumstances that impact nature, behaviour, life, growth and development of living things.

Everything that surrounds and effects living organisms is called as 'Environment'. The study of environment is a comprehensive and flexible subject. It is studied in terms of various branches of science and social

sciences. Consequently, its nature has become multidisciplinary. Initially, the study of environment was confined only to natural sciences. A depletion of natural resources led to the environmental imbalance. Therefore, a need was felt to broaden the area of Environmental studies. Now-a-days environment is studied in terms of social science as well as natural sciences.

1.3.1. Definitions of Environment

'Environment' is derived from the French word "Environner" meaning to encircle or surround. All the biological and non-biological entities surrounding us are included in the environment.

According to Advance Learner's Dictionary environment means "the natural conditions, circumstances etc. affecting a person's life."

According to E. J. Ross, "Environment is an external force affecting us."

According to Dr. D. H. Davis, "Environment in relation to man, means all physical aspects surrounding him which always affect him.

Environmental Protection Act (1986) defined "Environment as the sum total of water, air and land, their interrelationship among themselves and with the human beings, other living beings and property."

1.3.2. Components of Environment

I. **Atmosphere:** The atmosphere, often known as the "sphere of air," is a thin layer of gas that envelops the hydrosphere and lithosphere. Nitrogen (about 78%), oxygen (about 21%), and carbon dioxide (around 0.03%) make up the majority of the atmosphere. In addition to these gases, there are trace amounts of argon, neon, helium, methane, ammonia, and ozone.

   a. The **troposphere** (0–12 km) is the lowest layer of the atmosphere, where people and other living things exist. It is one of the five layers that make up the sphere of air, which is known as atmospheric stratification. It is a layer of change since it is where every day weather-related changes take place. Since the majority of clouds form here, 99 percent of the water vapour is found in this layer. In this layer, the temperature drops as altitude increases.

   b. The **stratosphere**, which is the second layer of the atmosphere, is 12–50 km. Tropopause is the term used to describe the boundary between the troposphere and stratosphere. This layer also contains the ozone layer (15–35 km), which scatters and absorbs UV rays from the sun.

   c. The **mesosphere** (50–85 km) is the layer that sits above the stratosphere. The stratopause is the line separating the stratosphere from the mesosphere. In this stratum, the majority of meteors burn up. Throughout this stratum, the temperature drops with height, and it may reach -90ºC near the top.

d. **Thermosphere** (85–700 km) is referred to as the "heat sphere" because the temperature there consistently rises to well above 1000°C. The temperature rises as a result of the sun's energy entering this layer through certain molecules. The term "mesopause" refers to the line separating the thermosphere and mesosphere. The ionosphere, a section of this layer that spans 85–400 km, includes ionized particles that are what cause radio waves to travel.

e. The outermost layer of the atmosphere, known as the **exosphere** (700–10,000 km), is primarily made up of atomic oxygen, carbon dioxide, helium, and hydrogen. This layer has extremely low temperatures that are almost constant throughout.

II. **Hydrosphere:** The total amount of water that covers the lithosphere is known as the hydrosphere i.e., the sphere of water. 71% of the earth is covered with it. The water can be found in lakes, rivers, seas, and oceans. Life is water. Therefore, it is hard to think of all living things existing without water. Rainfall on the lithosphere is caused by the hydrosphere. The temperature distribution is impacted by these water bodies. The hydrosphere is regarded as a natural resource's future treasure. The hydrosphere is primarily responsible for regulating Earth's environment. Just 2.5% of the water on Earth is freshwater, whereas the majority, 97.5% is saline. Only 0.3% of this freshwater is located in lakes, rivers, streams, and reservoirs; the remaining 68.9% is found in the form of snow or ice (Arctic and Antarctic) and glaciers; and the remaining 30.8% is groundwater.

III. **Lithosphere:** It is the area where structures similar to rocks can be found called as sphere of land. It is mostly made up of the crust and the upper mantle, which is attached to the crust. It is also known as the 50–100 km thick earth's crust. The lithosphere is made up of plains, plateaus, and mountains. This layer is home to all flora and fauna as well as man's natural habitat. The most active area of environmental interactions and consequences is the lithosphere. Minerals are abundant in this layer. The oceanic and continental lithospheres are the two divisions of this stratum.

IV. **Biosphere:** All living things coexist in this sphere and engage in biological activities that take place at the interface of the hydrosphere, lithosphere, and atmosphere. The biosphere is located 500 meters below the ocean's surface and 20km from top to bottom in the atmosphere. The Biosphere crisis is currently the biggest issue facing the entire world. Man is the primary component of Biosphere.

1.3.3. Meaning and Definitions of Environmental Education

Although there are millions of species on Earth, man is one of them, and he is also exploiting nature to the point where no one is safe to the damage they create. The goal of environmental education is to make people conscious of the damage they are doing to Mother Earth. In essence, environmental education is a program that raises awareness and requires everyone to participate. The study of how people interact with the environment is known as environmental education. It combines several methods from the social

sciences, biological sciences, physical sciences, and humanities and uses them to study environmental issues. One of the most important processes for changing people's knowledge, values, behaviours, and lifestyles—all necessary to attain sustainability and stability both within and between the different nations is environmental study. Every problem that impacts an organism is included in environmental education as well. In general, it is an interdisciplinary approach that fosters an understanding of the integrity of our natural world and the effects that humans have on it. The applied approach of environmental education looks for workable solutions to ensure the sustainability of human civilization.

William Stapp, a professor at the University of Michigan's School of Natural Resources and Environment, originally described environmental education in 1969 as the process of creating citizens who are informed about the biophysical environment and the issues it faces, aware of how to contribute to their resolution, and driven to do so. The goal of environmental education, according to Stapp, was to develop individuals who understood the environment, were conscious about environmental concerns, and were capable of solving them and actively involved in their resolution. Root cause analyses should be used to address environmental issues, and environmental educators should modify current educational goals and promote eco-friendly practices.

Environmental education is "a process of recognizing values and clarifying concepts in order to develop skills and additional tools necessary to understand and appreciate the interrelationships among man, his culture, and his biophysical surroundings," according to the Ministry of Environment and Forests, Government of India (2006). The process of raising awareness and understanding of the environment and how it relates to humans and their actions is known as environmental education. The development of responsible acts required for the conservation, preservation, and enhancement of the environment and its constituent parts is another goal.

According to a report from the 1968 Conference of African Educators in Nairobi, Studying the environment and its dynamics, environmental degradation in all of its manifestations, the causes of environmental degradation, and how it affects human existence is known as environment education. Education "about," "from," and "for" the environment is referred to as environment education. "Environmental education is to create an awareness and understanding of the evolving social and physical environment as a whole, its natural, manmade, cultural, and spiritual resources together with the rational use and conservation of these resources for development.

According to IUCN Commission of Education (1970), Environmental education is the process of identifying ideas and explaining concepts in order to build the abilities and attitudes required to comprehend and respect the interdependence of man, his culture as well as his biophysical environment."

Check your Progress No. 1

Answer the following questions:

a. The word Environment is derived from French word.....which means to surround.

b. What are the different components of Environment

i. Atmosphere ii. Hydrosphere

ii. Lithosphere iv. All of the above

c. Define Environmental Education.

……

……

……

……

……

……

d. Who described Environmental Education in 1969?

……

……

……

……

……

……

e. How many layers are there in the atmosphere?

i. Three ii. Four

iii. Five iv. Six

1.4. OBJECTIVES, SCOPE AND NEED OF ENVIRONMENTAL EDUCATION

1.4.1. Objectives of Environmental Education

Raising awareness of the environment and the issues it faces is the main goal of environmental education. Knowledge, abilities, drive, attitude, and a dedication to working both individually and collaboratively to find solutions to contemporary issues are all part of the study. The objectives of environmental education can be broadly classified into three categories:

a. **Cognitive Objectives:** It includes,

- **Awareness:** One of the primary goals that every field of study can offer is awareness. Awareness of the environment, environmental concerns, and solutions to those problems are created through environmental education. Furthermore, the reasons behind the different functions of the environment are properly understood.
- **Knowledge:** A person can learn more about the present state of the environment through environmental education. Comprehensive and appropriate education regarding the environment and its components is provided to them.

b. **Affective Objectives:** It includes,

- **Responsibility:** We can only take appropriate action to stop environmental disruptions when we recognize the causes of them. People are aware of the activities thatnegatively impact the environment, regardless of their proportions, and they adopt the appropriate safety measures to deal with the challenges. It also aids in making responsible decisions and behaviours in the future.
- **Participation:** We often develop greater interest in a subject as we learn more about it. Since everyone cares about the environment, we must protect it and keep it safe. As people learn about the damage that they can do to their life, environmental education inspires them to take part in protecting and caring for the environment.

c. **Behavioural Objectives:** It includes,

- **Sustainable Practices:** With increased awareness of the harm that man's actions are causing to the environment, environmental education aims to create a new behaviour pattern and attitude towards the environment. This results in less harm as the sustainable pattern is aimed at being environmentally friendly.
- **Understanding the Complexity of Environment:** Humans inhabited a complicated environment with a wide range of activities taking place there. The goal of environmental education is accomplished by helping people understand the complexity of working with the environment and the processes that take place there. People are more inclined to preserve and defend the environment when they are aware of this.

1.4.2. Scope of Environmental Education

Programs for environmental education and awareness as well as environmental extension services include every aspect of environmental science. This covers the ways in which man has damaged and contaminated the environment, but more importantly, it covers the ways in which man may defend himself against the problems he has caused by mistreating, abusing, and exploiting an excessive amount of natural resources.

It is essential that we understand the root causes of environmental degradation. Therefore environmental education should not only focus on its consequences. These should also include an analysis of the social and economic factors that lead to environmental degradation.

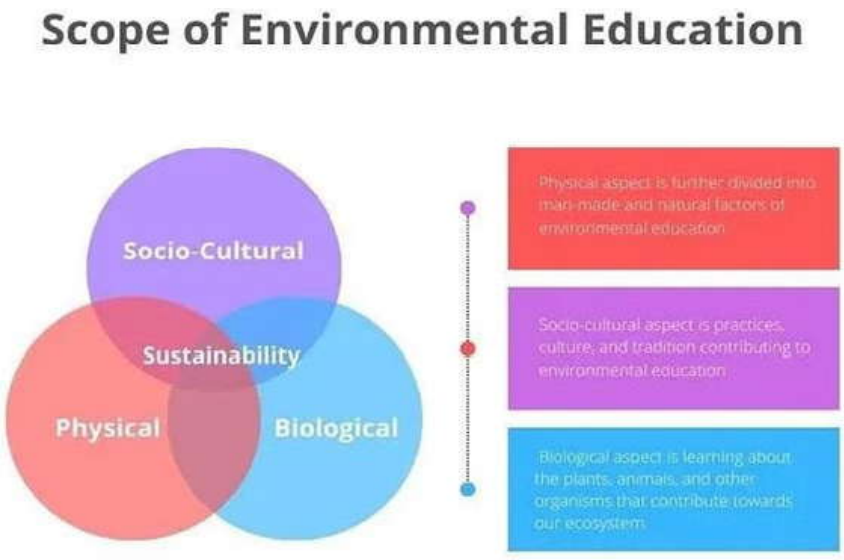
Environmental education includes experiences from our surroundings. This includes the aesthetic value of the environment and the need to preserve it as such. An important part of environmental education is learning about the composition, function, and utility of our surroundings. This is an essential component of environmental education since we cannot create the environment until we understand it. In order to maximize the advantages for present and future generations, environmental education teaches us how to preserve the environment. Conservation is covered in this part of environmental education. Its scope is wide since environmental education is one of the most important academic disciplines. People will need to understand their relationship to the environment.

The following points can be used to explain the scope of environmental education:

a. **Biological Aspect:** The biological components of environmental education are the most crucial. Humans are the best example. Animals, birds, insects, microbes, and plants are further instances of biological elements.

b. **Physical Aspect:** There are two categories for the physical component of environmental education: natural and man-made. Air, water, land, climate, and so on are examples of physical aspects. Roads, highways, airports, railroads, buildings, bridges, dams, reservoirs, and so on are examples of man-made features.

c. **Socio-Cultural Aspect:** These are the customs, cultures, and behaviours that people create in order to survive in a community. It may consist of legislation, regulations, religious convictions, etc. Humans have produced things through their labours.



1.4.3. Need of Environmental Education

We must conserve the environment because, as a result of industrialization and population growth, natural resources have been used up quickly and human activity is causing our ecosystem to deteriorate more and more. In order for environmental protection to be more cost-effective and feasible than the harm that results from taking action, it is not only the responsibility of the government but also of the people to actively participate in environmental protection. The importance of implementing environmental education at all educational levels has been emphasized in the National Policy on Education, 1986. "There is an urgent need to raise awareness of the environment among all ages and all segments of society," it says.

A sustainable future for our planet depends heavily on environmental education. It gives people the information and abilities they need to make wise choices and act responsibly toward the environment. The following points describe the significance of environmental education:

Creates Awareness: People become more conscious of environmental problems including pollution, resource depletion, and climate change as a result of environmental education. It also emphasizes how humans and the environment are interdependent and how human activity affects the environment.

Promotes Responsible Behaviour: By motivating people to adopt sustainable habits, save resources, and lessen their carbon footprint, environmental education encourages people to behave responsibly toward the environment.

Fosters Critical Thinking: By motivating people to assess and examine environmental problems as well as to formulate their own ideas and solutions, environmental education promotes critical thinking.

Builds Community: By uniting people to work toward the shared objective of preserving and protecting the environment, environmental education fosters a sense of responsibility among the community.

Check your Progress No. 2

Answer the following questions:

a. Awareness are considered under which objective of the Environmental Education:

   i. Cognitive ii. Affective

   iii. Behavioural iv. All of the above

b. Responsibility is applied .....under objective of the Environmental Education.

c. Physical aspects of Environment includes ……

d. Name the different aspects of Environmental Education.

……

……

……

……

……

e. Sustainability is achieved by ……..

1.5. LET US SUM UP

Environmental education, addresses all issues that have an impact on people and other living things. Multidisciplinary and interdisciplinary approaches to teaching environmental education are used to counteract human impacts on the integrity of the natural world and to inculcate in people or society at large an appreciation for it. Environmental education is a study of the factors affecting ecosystems, population pressures, deteriorating cities, mental and physical health, and leaving and working conditions. The process of identifying values and elaborating ideas about the environment and its issues in order to cultivate the knowledge, abilities, and attitudes required to effectively understand the environment is known as environmental education. By raising people's awareness and encouraging them to adopt principles into their daily lives, it helps students to understand the idea of environmental conservation. The key to achieve these aims and objectives is environmental education involves decision-making practice and seeks to provide citizens with the skills necessary to conduct scientific research and identify workable solutions to contemporary environmental issues.

Environmental education is important and involves everyone, from young children to adults, in order to improve both the individual and societal environment. E.E. plays a crucial role in maintaining human health and living standards, protecting and conserving nature, and igniting environmental consciousness for the good of everyone.

1.6. KEYWORDS/ GLOSSARY

Environment- The sum total of all the living and non-living elements and their effects on human life.

Atmosphere - It is *a blanket of gases that surrounds Earth*

Troposphere - *The lowest densest part of the earth's atmosphere* in which most weather changes occur and temperature generally decreases rapidly with altitude

Lithosphere - The lithosphere is *the rigid, outermost shell on Earth*.

Biosphere - It is *a narrow zone on the earth's surface where* soil, water, and air combine to sustain life.

Participation - *An act or instance of participating.*

Awareness - *The state or condition of being aware; having knowledge; consciousness.*

1.7. SELF ASSESSMENT QUESTIONS

a. What do you understand by Environment?

b. Describe the scope and importance of the Environment.

c. Explain briefly the different components of the Environment.

d. Define Environmental Education and give its objectives in detail.

e. Write a short note on Awareness and Participation in Environmental Education.

f. Write a note on importance of Environmental Education.

g. "Environmental Education is the need of the hour". Discuss.

h. Discuss the scope of Environmental Education.

1.8. SUGGESTED READINGS

1. Bharucha, E. (2015). Textbook of Environmental Studies for Undergraduate Courses, 2nd ed. New Delhi: University Grants Commission.
2. C. E. E. (1994). Essential Learning in Environmental Education. Ahmadabad: C.E.E. Publication.
3. Nanda, V.K. (2010). Environmental Education. New Delhi: Anmol Publications Pvt. Ltd.
4. N.C.E.R.T. (1981). Environmental Education of the School Level: A Lead Paper. New Delhi: NCERT Publication.
5. Singh, P.S. (2017). Textbook of Environmental Education. New Delhi: Pacific Books International.
6. Tbilisi UNESCO-UNEP. (1977). First Intergovernmental Conference of Environmental Education, Final Report, USSR

LESSON : 2

ENVIRONMENTAL AWARENESS THROUGH EDUCATION

Structure

2.1. INTRODUCTION

The environment and humans are interconnected. The state of the environment is getting worse each day as a result of many developmental processes. There is irreversible harm to the natural resources. If a society's natural resources become unusable, it will not be able to endure. Only by raising people's awareness and motivating those to strive toward environmental conservation and preservation can make a big difference. This is possible only when environmental education is incorporated into the curriculum at different formal education levels and combined with non-formal environmental education aimed at adults, housewives, school dropouts, others, etc. This lesson will be crucial in advancing knowledge of environmental education's goals and objectives, particularly in formal education at the secondary and higher secondary school levels. After completing the course, the students will be prepared to serve as ambassadors for environmental education, instructing pupils at several levels, including elementary and secondary level, via both official and informal channels.

2.2. LEARNING OBJECTIVES AND LEARNING OUTCOMES

Following this course, you will be able to:

categorize the various forms and levels of environmental education,

explain how we can learn from the environment,

describe in detail the rules and goals of environmental education,

provide more details about the goals and emphasis of environmental education in secondary and higher secondary schools,

list the different elements that need to be prioritized while creating an environmental education program,

list some crucial pointes for curriculum use in the classroom. formal and informal system of environmental education

2.3. ENVIRONMENTAL AWARENESS THROUGH EDUCATION

The environment, a medium of learning, also provides numerous opportunities beyond those of traditional classrooms. Through real-world experiences, learners are encouraged to become curious in order to develop their minds about many different subjects. One exampleof nature-based learning involves deepening knowledge in a subject like biology, ecology, or environmental science, during which time the student might observe plant and animal life, the ecosystems that they live within, and the climate patterns. Hands-on experiences give learners a connection to the content and can go as deep as tangible or relatable exploration of the concepts. This also develops outdoor play and exploration to contribute to both physical and cognitive

development. Besides natural settings, urban settings also constitute rich learning grounds. Cities provide learners with the chance to study human geography, economics, sociology, and history by analyzing infrastructure, architecture, and cultural diversity. Students can simply understand how urbanization affects an individual, transportation systems, and social organization in the environment in which they live. This setting often provides practical experience lacking in theoretical lessons, thereby letting the students understand modern living as well as its relation with nature.

In addition, through the use of an environment as a tool of learning, it allows a critical thinking and problem-solving mechanism. Encouraging the students to observe, question, and analyse their surroundings makes them to approach the different issues from various angles. They can try out solutions, observe the outcomes, and adapt to challenges in real time. Such learning leads to active engagement and ownership of knowledge because they can apply what they have learned to solve real-world problems. Ultimately, the environment will turn out to be more than just a backdrop for learning. The environment will actually become a tool in shaping curious, informed, and responsible people.

In a nutshell, Environmental awareness refers to the human understanding of the natural environment and the challenges it faces resulting from human activity. That is, acquiring knowledge relating to issues such as climate change, deforestation, pollution, or loss of biodiversity, and then aware of how these issues will affect ecosystems and human health. Education is key in shaping environmental awareness since it enhances the knowledge, skills, and attitude of individuals to make the right informed decisions and undertake sustainable actions.

2.3.1. Importance of Environmental Education

a. **Decision Making Ability:** Through environmental education, the individuals gain a realization about how their activities affect the environment. They are then in a better position to implement changes like reducing their wasteful consumption, saving water, and adopting renewable sources of energy.

b. **Promotes Sustainability:** Education encourages sustainable practices, responsible consumption and waste reduction along with conserving resources. When educated about sustainability, the person can make environmentally friendly decisions in life, such as recycling, cutting down on plastics, and using energy-efficient technologies.

c. **Sense of responsibility:** When people know about the environment, most of them develop a responsibility for its preservation. Some may participate in environmental campaigns or community clean-up drives, they may plant trees, or support policies that will have a positive impact on their environment.

d. **Environmental Leaders:** Environmental education can provide a basis for tomorrow's environmental leaders, scientists, policymakers, and activists. For example, incorporating topics from environmental studies into school curricula would allow the incoming generation to learn skills that prepare them

for the next environment challenges.

e. **International Dimensions:** Environmental issues are neither local nor national but truly a global concern. Environmental education helps create awareness regarding various international environmental issues such as climatic change, biodiversity losses, or ocean pollution. It evokes in the minds of individuals international perspectives and cooperation for effective results.

2.3.2. Benefits of Environmental Education

a. Advocacy and Awareness: People who are knowledgeable about environmental issues are more inclined to support laws and procedures that safeguard the environment. A critical mass of knowledgeable, change-driven people can be produced with the aid of environmental education.

b. Civic Engagement: Growing awareness of environmental issues frequently results in a greater commitment to regional or worldwide environmental causes. People with higher levels of education are more likely to support green enterprises, volunteer for environmental causes, and vote for political leaders who care about the environment.

c. Empowerment: People who receive environmental education are more equipped to manage their environmental impact. It encourages a sense of agency in which individuals believe they can change the world via both individual and group efforts.

d. Long-Term Environmental Benefits: Broad public awareness and support are essential for environmental conservation initiatives to succeed in the long run. A generation that is educated is better equipped to confront and mitigate tomorrow's environmental issues.

2.3.3. Challenges in Environmental Education

Although most people agree that environmental awareness is important, providing effective environmental education presents a number of difficulties:

a. Equity and Access: Access to formal education and environmental resources may be restricted in many areas, particularly in developing nations. Regardless of socioeconomic background or geographic location, efforts must be made to guarantee that environmental education is available to everyone.

b. Cultural and Socioeconomic Barriers: Political, economic, or cultural considerations may have an impact on people's views regarding environmental issues. In order to raise environmental consciousness in ways that speak to many populations, education must be cognizant of these obstacles.

c. Curriculum Restrictions: Environmental education may not be given priority in certain educational systems or may be in competition with other courses. More funding for these initiatives is required, as is a more robust integration of environmental education into local and national curriculum.

d. **Behavioural Change:** Sometimes bringing about long-lasting behavioural change requires more than just educating people. It calls for constant involvement, encouragement, and neighbourhood-based programs that give people the means and drive to behave sustainably.

Check your Progress No. 1

Answer the following questions:

a. What is environmental education, and why is it important?

……

……

……

……

……

……

……

b. How does environmental education contribute to sustainable development?

……

……

……

……

……

……

……

c. What impact can environmental education have on local communities?

……

……

……

……

……

d. Define Sustainable development.

……

……

……

……

……

……

……

e. Climate change has no impact on biodiversity or ecosystems. (True/ False)

f. Environmental education is important only for students in schools and has little value for adults. (True/ False)

2.4. ENVIRONMENTAL EDUCATION PROGRAMME FOR SECONDARY AND HIGHER SECONDARY SCHOOL CHILDREN

2.4.1. Environmental education program for secondary school children

Secondary schools incorporate environmental concepts into subjects such as physics, chemistry, biology, and geography. Teachers use local examples to promote environmental understanding among students.

The goal of secondary school environmental education is to provide students the information, abilities, and mind-sets they need to understand and address environmental problems. At this level, the goals of environmental education can be roughly divided into the following categories:

a. Developing Environmental Awareness

Objective: Helping pupils understand the environment, its elements (land, water, air, etc.), and their interactions with one another.

Goal: Motivate students to understand and value the role that nature plays in their everyday lives.

b. Fostering Knowledge of Environmental Concerns

Objective: To increase public understanding of environmental issues on a local and worldwide scale, including resource depletion, pollution, deforestation, climate change, and biodiversity loss.

Goal: Promote critical thinking regarding the origins and effects of these problems.

c. Establishing an Ethical Code for the Environment

Objective: To develop a sense of accountability and environmental care.

Goal: Students ought to become champions for environmental preservation and conservation and cultivate a dedication to sustainable living.

d. Promoting Ecological Methods

Objective: To instruct young children in sustainable activities, including recycling, reducing down on waste, using green technologies, and conserving energy and water.

Goal: Motivate students to make wise choices around waste and consumption in their day-to- day lives.

e. Developing Critical Thinking and Problem-Solving Abilities

Objective: To improve student's capacity to assess environmental problems and suggest solutions.

Goal: Equip students with the knowledge and abilities necessary to apply creative solutions and critically assess environmental policies, practices, and technologies.

f. Improving Scientific Literacy

Objective: To advance a scientific comprehension of environmental processes, ecological systems, and human consequences.

Goal: Give students the scientific information they need to comprehend environmental issues and help find solutions.

g. Encouraging Multidisciplinary Education

Objective: To incorporate environmental issues into science, geography, economics, and social studies, among other courses.

Goal: Motivate students to understand how environmental concerns relate to other academic fields.

h. Promoting Active Participation

Objective: Involve students in community-based initiatives and environmental activities.

Goal: To promote active participation in environmental conservation initiatives like awareness campaigns, clean-up drives, and tree planting.

i. Fostering Global Citizenship

Objective: To raise student's awareness of global environmental challenges and their part in sustainability.

Goal: Equip students to be conscious of how their local acts can impact the environment globally and to be environmentally responsible citizens.

j. Encouraging Ethical Decision-Making

Objective: To assist students in thinking about the moral implications of environmental choices, including the effects on ecosystems, marginalized people, and future generations.

Goal: Motivate students to consider the long-term effects of their decisions.

2.4.2. Environmental Education Program for Higher Secondary School Children

Students in higher secondary schools can learn about sustainability, ecological systems, and the environment through an Environmental Education (EE) program. It aims to

raise awareness of environmental issues and promote proactive measures to save the earth. The curriculum, which focuses on developing knowledge, values, and abilities to address environmental concerns, can be run as a stand-alone module or incorporated into standard school curricula.

Environmental education is to be taught as integrated science in which environmental education concepts are included. The main Objectives of Environmental Education Program for Higher Secondary School Children's are given below:

Strengthen student's awareness of urgent environmental problems such asenvironmental pollution, biodiversity loss, climate change, and unsustainable utilization of resources.

Teach students to consider the long-term effects of our activities as well as the relationships between humans and the environment.

Motivate students to embrace sustainable activities and lifestyles on a personal and community level.

Inspire students to take the lead in projects that advance sustainability and to participate in environmental protection.

I. Key Components of the Program

To demonstrate the idea of environmental education and discuss its significance in light of current international concerns by describing the concept of the environment, ecosystems, and the interdependence between nature and humans.

Explaining various Environmental challenges such as global warming, greenhouse gases and their effect on the local and global climate.

Discuss various types of environmental pollution (air, water, soil, and noise), their sources and deteriorating effects on health and ecosystems.

Causes and effects of habitat degradation, endangered species, and deforestation. Impacts of population growth on resources and unsustainable resource extraction.

Introduction of the Sustainable Development Goals (SDGs) given by United Nations and teaching the relationship between environmental preservation and economic expansion.

Assessing green technologies such as waste reduction, sustainable agriculture and renewable energy sources.

To discuss the ethical implications of environmental degradation and our duty to preserve the natural world.

Diverse ecosystems (forests, oceans, and wetlands) and their functions in sustaining life on Earth are taught to students.

The significance of preserving biodiversity for both human existence and ecological balance.

II. Practical Engagements of the Program

a. **Field Trips & Visits:** Outings to recycling locations, parks, wildlife sanctuaries, water treatment facilities or renewable energy sources.

b. **Eco Projects:** Practical tasks like planting trees, establishing waste separation systems, or developing environmental awareness campaigns.

c. **Green School Practices:** Promoting the adoption of eco-friendly procedures in schools, such as cutting back on plastic use, saving electricity, and establishing green areas.

d. **Waste Management:** Teaching solid and e-waste management techniques as well as waste reduction, reuse, and recycling techniques.

e. **Water Conservation:** Methods for conserving water in everyday activities, such as minimizing water waste, reusing grey-water, and rainwater harvesting.

f. **Energy Conservation:** Promoting energy-saving practices at home and at school and educating students about renewable energy sources (hydroelectric, wind, and solar).

g. **Youth Activism:** Examining the ways in which youth-led initiatives have achieved worldwide popularity and had a remarkable influence such as Fridays for Future.

h. **Leadership Skills:** Educating students how to plan awareness campaigns, push for legislative changes, and interact with communities in order to equip them to become environmental leaders.

i. **Case Studies:** Examining effective environmental initiatives and movements that demonstrate the impact of collaborative effort.

j. **Green Audits:** Students perform out audits to evaluate the sustainability policies of their school including management of waste, biodiversity of campus, electricity and water consumption, and others.

k. **Monitoring Progress:** Evaluating the effectiveness of environmental initiatives at schools or in the community (e.g., waste reduction, energy savings, or expansion of green spaces).

l. **Reflection:** Think about all the information you have learned from conversations, group projects, discussions and other activities.

m. **Action Plans:** Students should be encouraged to develop individual or group action plans to lessen their ecological footprint and raise awareness in their neighbourhoods.

III. Teaching Methods of the Program

a. **Interactive Learning:** Explain challenging environmental issues with multimedia (documentaries, info-graphics, and videos).

b. **Group Discussions & Debates:** Debates on sensitive environmental issues, such as the usage of plastic or genetically modified organisms, might encourage critical thinking.

c. **Workshops and Guest Speakers:** Reach out to organizations, campaigners, and environmental specialists to address students about various environmental issues and their practical solutions.

d. **Project-Based Learning:** Introduce group assignments to students in which they must identify environmental problems in their community and develop creative solutions.

e. **Community Involvement:** Get students involved in voluntary projects like planting trees or organizing neighbourhood clean-up efforts in collaboration with the local communities.

IV. Benefits of Environmental Education for Higher Secondary School Students

Empowerment: Students understand that by making wise decisions and working together, they might contribute to environmental change.

Critical Thinking: Students are encouraged to analyse problems critically, consider their underlying causes, and consider potential remedies.

Hands-on Experience: Learning is enhanced by hands-on activities like establishing sustainable school gardens or carrying out waste audits.

Holistic Understanding: Students acquire a thorough awareness of social issues, sustainable development pertaining to environmental science.

Leadership Development: Students develop leadership skills and a sense of duty to their communities and the environment as an outcome.

2.5. CLASSIFICATION OF ENVIRONMENTAL EDUCATION

Environmental education can be broadly divided into two types:

a. Formal environmental education

b. Informal environmental education

2.5.1 Formal environmental education

Classroom instruction and a well-organized curriculum are hallmarks of formal environmental education, which is typically defined as the education we receive in schools and institutions. The instructor teaches both theoretical and practical real-world challenges and situations. The term "formal environmental education" describes organized educational programs designed to raise students' understanding and consciousness of environmental issues. It usually occurs in schools, colleges, or universities and adheres to a predetermined curriculum intended to teach students about sustainability, the environment, and the connections between natural systems and human activity. Topics including ecology, biodiversity, resource management, climate change, and environmental policy are frequently covered in this kind of teaching. Giving students the information, abilities, and attitudes they need to make wise decisions and help address environmental issues is the aim of formal environmental education. It is essential for raising a generation of ecologically conscious individuals who can lead initiatives for environmental preservation and sustainable development.

2.5.2. Informal environmental education

Learning about sustainability and environmental challenges outside of conventional classroom settings is referred to as informal environmental education. It happens in a number of places, including media, nature reserves, museums, community initiatives, and everyday interactions. Since this kind of education is usually voluntary, self-directed, and unrestricted by a set curriculum, people of all ages can study environmental issues at their own pace. Informal environmental education frequently takes the shape of nature walks, movies, eco- friendly workshops, and environmental campaigns. Its main objective is to link people with nature and cultivate a sense of responsibility in order to increase awareness, stimulate curiosity, and encourage action toward environmental protection. People can stay informed and involved with urgent environmental concerns through informal environmental education, which supports formal education and offers a chance for lifelong learning.

Check your Progress No. 1

Answer the following questions:

a. Formal environmental education is provided in classrooms with developed curriculum. (True/False)

b. Write a note on Formal Environmental Education.

……

……

……

……

……

……

……

c. What are the different goals of Environmental education programme for secondary school children?

……

……

……

……

……

……

……

d. Unplanned population growth is the prime reason for environmental change. (True/ False)

e. Discuss some practical methods for teaching Environmental education.

……

……

……

……

……

……

……

2.6. LET US SUM UP

The education we receive in schools, colleges, and universities through structured curricula and classroom instruction is known as formal environmental education. An essential component of elementary, secondary, and university education is formal environmental education. Students are taught to preserve and protect their environment, human health, human nutrition, rural development, community improvement, food contamination prevention, love for plants and animals, environmental problem-solving techniques, and environmental awareness.

Teachers who instruct environmental education at the school level must be ready to serve as facilitators of environmental education. This requires well defined policies and goals for environmental education at the school level. It is a known fact that educators have the power to effect change by influencing students' attitudes, knowledge, abilities, and awareness. They can also produce a workforce of knowledgeable, skilled, and driven learners. Through both official and informal educational channels, they can equip students with the skills, mindset, and values necessary to preserve the environment. Teachers themselves must receive the necessary training, skills, and values to effect such a change by highlighting and identifying some focus areas, such as population growth, natural resources, land and land use, air, water, and land pollution, human health and nutrition, and the preservation of plants and wildlife.

A clear curriculum that focuses on important topics is necessary for formal environmental education at the elementary and secondary levels. Teachers that teach environmental education should use innovative teaching strategies such group projects, plays, problem- solving exercises, observations and investigations conducted outside of the classroom, student participation, and games. In order to develop the next generation of environmental stewards, higher secondary school students must participate in an environmental education program. It gives students the values, information, and abilities they need to handle tomorrow's environmental problems. Students become not only knowledgeable citizens but also active participants in the global drive towards sustainability by cultivating environmental awareness, critical thinking, and action.

2.7. KEYWORDS/ GLOSSARY

Education. The discipline that is concerned with methods of teaching and *learning* in schools or school-like environments.

Teaching. The process of imparting knowledge, skills, and values to others.

Formal education. It is a structured and systematic form of learning.

Informal education. The process of acquiring knowledge, skills and attitudes outside of formal, structured education or training programmes.

Empowerment. The degree of autonomy and self-determination in people and communities.

Conservation. The careful maintenance and upkeep of a natural resource to prevent it from disappearing.

Preservation. It is the act of keeping something in its original state or in good condition.

Curriculum. A curriculum is a well-structured plan that defines what students should learn and how they will achieve educational goals.

Awareness - The state or condition of being informed or cognizant of something

2.8. SELF ASSESSMENT QUESTIONS

a. Define formal education. How environment can be a medium of learning?

b. Write a note on broad guidelines and objectives for environmental education.

c. Write a note on environmental education and its objectives at secondary school stage.

d. Write a note on environmental education and its objectives at higher secondary school stage.

e. Describe briefly the development of curriculum for environmental education at school level.

2.9. SUGGESTED READINGS

1. Aggarwal, S.K. (1997). Environmental Issues Themes. New Delhi: APH Publishing Corporation.
2. C.E.E (1994). Essential Learning in Environmental Education. Ahmadabad: C.E.E. Publication.
3. Nanda.V. K. (2005), Environmental Education. New Delhi: Anmol Publications Pvt. Ltd.
4. N.C.E.R.T. (1981). Environmental Education of the School Level: A Lead Paper. New Delhi: NCERT Publication.
5. Singh, P.S. (2017). Textbook of Environmental Education. New Delhi: Pacific Books International.

LESSON : 3

MAN AND ENVIRONMENT RELATIONSHIP

Structure

3.1 INTRODUCTION

The environment serves as a crucial resource for humans, providing essential elements such as nourishment, water, fuel, pharmaceuticals, and construction materials. In the early stages of human history, environmental factors like temperature, precipitation, topography, and soil fertility played a significant role in determining population distribution and density, much like for other species. However, humans' unique ability to adapt and modify their surroundings to meet their needs has facilitated their rapid growth and survival on Earth. This environmental alteration, while beneficial for human progress, has resulted in detrimental effects on ecological processes, leading to pollution and environmental degradation. Today, we face numerous environmental challenges, including global warming, climate change, ozone layer depletion, acid rain, and various forms of pollution. These anthropogenic environmental changes have, in turn, significantly impacted human activities, affecting both health outcomes and socioeconomic development.

Man requires favourable physical environment viz., optimum climatic conditions, accessible clean water, fertile soil, etc. which enable them to live and thrive. However, unfavourable environment conditions like very hot climate, limited water supply and infertile land, make it difficult for human to survive. In addition to this environmental event like earthquakes, landslides, floods and drought results in damage to property, infrastructure and agriculture. These events may also induce displacement of people and cause injury, loss of life and destruction of livelihoods. These disasters can create unhygienic conditions resulting in contamination of water resources which can cause spreading of water borne diseases. Thus, man and environmental has a complex and dynamic relationship, significantly impacting each other. To understand man and environment relationship, the following philosophies and approaches have been put forward by various workers:

1. **Determinism**: This is philosophical approach which indicated that human actions are predetermined by environmental factors. Thus, suggesting that the physical environment controls human behaviour and societal development. For example, it is argued that the climate of ancient Egypt, being conducive to agriculture due to the Nile River, led to the growth of a prosperous civilization.

2. **Environmental determinism**: A subset of determinism, it emphasizes that the natural environment, particularly climate, dictates human actions and cultural development. An example is the idea that the harsh climates of the Arctic lead to a culture of cooperation among the Inuit people, as survival requires working together in extreme conditions.

3. **Shift to possibilism**: Post-World War II, the deterministic view was challenged, leading to possibilism, which argues that while the environment offers opportunities, human agency and technological advancements allow humans to choose and modify their surroundings. For instance, the invention of irrigation technology allows for agriculture in arid regions, such as the deserts of California.

4. **Neo-determinism**: Introduced by Griffith Taylor, this approach balances determinism and possibilism, suggesting that while humans can influence their environment, they must operate within natural limits. An example is the idea that agricultural practices in a region (such as terrace farming in mountainous areas) must adapt to the geographical constraints imposed by the environment, but also that human innovation can lead to sustainable practices.

5. **Cultural ecology**: This approach focuses on the adaptive responses of cultures to their environments, emphasizing the dynamic interaction between cultural and environmental factors. An example is the way the Maasai people of East Africa manage their livestock and land in response to the semi-arid climate in which they live, practicing transhumance to find better grazing areas.

6. **Structuralists deterministic approach**: This perspective examines how political and economic structures influence human adaptation to the environment, particularly in developing countries. For instance, marginalized communities in urban areas may be forced to live in flood-prone areas due to socioeconomic factors, making them more vulnerable to disasters.

7. **Radicalism**: Emerging in the 1960s, this approach critiques traditional geography and emphasizes the need for revolutionary changes in theory and practice, focusing on social issues like poverty and civil rights. An example could be the advocacy for the rights of indigenous peoples to maintain their traditional lands, which has gained attention in the context of environmental conservation and social equity.

3.2 Quantitative approach: Post-World War II, this approach introduced statistical techniques to geography, aiming for precision and accuracy in understanding human-environment interactions. An example is the use of demographic data and statistical modelling to analyse urban growth patterns in cities to predict future population distribution.

1. **Positivism**: Founded by Auguste Comte, this philosophy advocates for studying social phenomena using scientific methodologies, emphasizing verifiable and logical proof. An example includes using surveys and experiments to gather data on human behaviour in urban environments, aiming to create generalizable theories about city living.
2. **Behaviouralism**: This approach critiques the economic rationality models of positivism, focusing on how individuals respond to environmental stimuli in varied ways. An example could be research on how urban green spaces affect mental health, observing how different demographics utilize parks in cities.
3. **Humanism**: Emerging in the 1960s, this approach reacts against positivism, emphasizing human awareness, agency, and creativity in understanding the man- environment relationship. An example is the study of how individuals and communities perceive and interact with their local environments, such as how cultural festivals can shape community identity and attachment to place.

3.3 LEARNING OBJECTIVES AND LEARNING OUTCOMES

- To understand how environment influences man.
- To understand how man affects their environment.
- To understand how human impact on environment can be minimized.
- Students will be able to recognize the association between environment and humans
- Students will be able to differentiate the positive and negative impacts of human-environment association.

3.4 MAN AND ENVIRONMENT RELATIONSHIP

As discussed earlier, man and environment have complex and dynamic relationship. However, throughout history, the manner in which humans interact with their environment has undergone significant changes, reflecting developments in social organizations, technology and human requirements. The major stages of

this dynamic relationship between humans and environment are as under:

I. **Hunter-gatherer communities:** In the earliest stages of human existence, individuals subsisted as hunter-gatherers and relied directly on nature for sustenance. These groups had a minimal ecological footprint, primarily engaging in hunting animals and gathering fruits, nuts, and other natural resources. Their existence was intimately connected to nature, with their survival dependent on the abundance of natural resources.

II. **Agricultural revolution:** Around 10 thousand years ago human came into agricultural practices which was a huge turning point in the human relation with environment. This allowed for the creation of permanent habitation, animal husbandry and crop production. Thus, forests were cleared, landscapes were sculpted for agriculture and the first civilizations arose in Mesopotamia, Egypt, and the Indus Valley. Though this switched facilitated the flourishing of human civilizations, it exacerbated the footprint on abiotic biodiversity.

III. **Industrial revolution:** Then, during the 18th and 19th centuries, the industrial revolution started to change the human-environment relationship once again. Fossil fuels like coal and oil as energy resource and new technologies gave an unparalleled potential to human's use of natural resources. Industrial boom led to spurting of the urban development, rapid deforestation, pollution and transition from subsistence farming to a widespread mechanism of industrial agriculture. Such industrialization related activities also resulted in environmental phenomena like greenhouse gases and other pollutants besides causing various types of air and water pollution and contributing to global climate change.

IV. **Information revolution:** The present human-environment interaction is more intense and complicated now than at any time in the past. The increase in global populations, economic development and technological innovation has magnified human reliance on natural resource, but at the same time altered the natural world in a momentous manner. Some of the modern aspects of this human-environment relationship are given below:

a) **Urbanization and infrastructure development:** More than half of world population is currently living in urban areas and cities and infrastructure developed. The process of mobilization of resources it makes use with requires space that leads to the transformation of land use and cover from natural landscapes to constructed ones. The buildup of transportation networks including road, highway & airport construction are the other major factor of habitat fragmentation and ecosystem impact.

b) **Resource extraction and consumption:** Human societies today are very resource hungry. To satisfy ever increasing industrial, technological and energy needs, the extraction of minerals, fossil fuels and other natural resources has rapidly expanded. As a result, there are problems like deforestation, devastation of habitat and environmental pollution. Mining operations are well-

known for soil degradation and water contamination, and fossil fuel extraction and combustion have long been the largest source of greenhouse gases.

c) **Industrial agriculture:** Expansion of industrial scale agriculture is driven by demand for food for a growing global population, but the costs to the environment are perhaps equally significant. Although it has boosted production of food, it has also caused deforestation, erosion of soil and water reserves. Soils and aquifers are being poisoned by chemical fertilizers and pesticides, which is anti-ecological and have negative impact on biodiversity and human health.

Impacts of human activities on environment

The humans are dependent on their surroundings and the bond between them are complex and interlinked. People depend on ecosystems for crucial ecosystem services including clean air, water, food, and raw materials. Not only this, ecosystems fulfill a host of services that are crucial for the survival and well-being of humankind. Forests control climate, preserve biodiversity and sustain soil and water. Wetlands clean water, store stormwater, and are homes for animals. Oceans smooth out global temperature and supply food and livelihoods from fishing and tourism. However, the anthropogenic activities have altered the ecosystems and the environment on such a scale that some long-term changes in our planet are likely to be irreversible. The major ecological and environmental impacts of human-environment relationship are as under:

I. **Deforestation and Habitat Loss:** Deforestation and habitat loss pose significant threats to global biodiversity and ecosystem functioning. The clearing of forests for agriculture, logging, and urban expansion has led to widespread destruction of natural habitats, particularly in tropical regions. This loss of forest cover disrupts ecological processes, reduces carbon sequestration capacity, and threatens countless plant and animal species. Habitat fragmentation further isolates populations, impeding gene flow and increasing extinction risks. The cascading effects of deforestation extend beyond biodiversity loss, impacting climate regulation, water cycles, and soil stability.

II. **Environmental Pollution:** Environmental Pollution is one of the most prominent problems caused by industrial and agricultural activities. For example, vehicle emissions and industrial processes produce air pollution, which is seen as smog and causes acid rain, which can result in human health problems in cities around the globe. Agricultural runoff, chemical spills, and plastic waste pollute rivers, lakes, and oceans, impacting aquatic life and ecosystems. The second example is of soil pollution, basically resulting due to the use of pesticides and industrial waste which degrades the quality of land and may affect agricultural produce.

III. **Global warming:** Global warming refers to the long-term increase in Earth's average surface temperature due to human activities, primarily the emission of greenhouse gases like carbon dioxide and methane.

These gases trap heat in the atmosphere, leading to a rise in global temperatures, which in turn accelerates melting ice caps, rising sea levels, and extreme weather patterns. Industrialization, deforestation, and fossil fuel combustion are key contributors to this phenomenon. The impacts of global warming threaten ecosystems, biodiversity, and human livelihoods, emphasizing the urgency of global mitigation efforts through renewable energy adoption, reforestation, and international climate agreements such as the Paris Accord.

IV. **Climate change:** The most significant consequence of human activity on the environment is climate change, which is significantly associated with global warming. Global Warming may result from industrial activities like combustion of fossil fuels which emits 5Ø6Ü5ØBÜ$_2$, making the atmosphere more saturated with this greenhouse gas and warm it up. This will result rise in sea levels and other extreme weather events, which will drive shifts in ecosystems and species distributions. However, human societies are also at risk with these changes as they affect agriculture, water resources and infrastructure.

V. **Ozone layer depletion:** Ozone layer depletion refers to the thinning of the ozone layer in the Earth's stratosphere, primarily caused by human-made chemicals such as chlorofluorocarbons (CFCs), halons, and other ozone-depleting substances (ODS). These chemicals release chlorine and bromine upon exposure to ultraviolet (UV) radiation, which break down ozone molecules, reducing the layer's ability to block harmful UV-B radiation. The resulting increase in UV exposure poses risks to human health, including skin cancer and cataracts, and harms ecosystems, particularly marine life. International measures like the Montreal Protocol have been successful in curbing ODS emissions, showing progress toward ozone layer recovery.

VI. **Acid rain:** Acid rain is precipitation with elevated levels of sulfuric and nitric acids, formed when sulphur dioxide (SO,) and nitrogen oxides (NO") react with water, oxygen, and other atmospheric chemicals. These pollutants primarily originate from fossil fuel combustion in power plants, vehicles, and industrial processes. Acid rain has detrimental effects on ecosystems, causing soil acidification, damage to aquatic habitats, and harm to plant life by leaching essential nutrients. It also accelerates the deterioration of buildings and monuments, particularly those made of limestone and marble. Efforts to reduce acid rain include implementing clean energy technologies and international regulations like the Clean Air Act.

Check Your Progress No. 1

a. What are the major environmental impacts of agricultural revolution?

…….....

……

……

……

……

……

b. How industrialization affected the environment?

……

……

……

……

……

……

……

3.5 MAN AS A CREATOR AND DESTROYER.

Man through his innovations and technologies, have beautified the landscape, made life better, and lifted his experience as civilizations. But this resulted in environmental destruction, thus human beings can be regarded as both creator and destroyer. From here, man and environment coexistence will only benefit humans in the long run if they become a breed that cares for life on earth. This equilibrium can best be achieved through sustainable development and conservation, along with the transition to renewable energy and green technologies. The man as a builder of the world and, at the same time, as a destroyer of everything are the key statements in the concept of anthropology of environment and society. This idea shows how people have creatively, innovatively and productively changed the environment and world around us, while also showcasing the negative impacts of these changes.

A. Man the creator: how human creation is beneficial

Man has shown remarkable ability to build, to shape the world, to organize societies, economies, cultures and the world around him through intelligence and technology. The role of humans as creators can be discussed as under:

I. **Creation of agriculture:** Among greatest single act of creation is coming up with agriculture. Through the domestication of plants and animals, early societies of the human species settled into small village communities that gave birth to civilizations like Mesopotamia, the Nile valley, and the Indus valley. The abundance of food provided by agriculture could sustain a growing population and permitted the emergence of specialization and indoctrination of labour as well as the advancement of art, culture, and governance.

II. **Urbanization and infrastructure:** The process of creating cities & forming infrastructure displays unique human ingenuity in creating complex, structured societies. Cities grew to be centres for trade, culture, and politics; so, roads, buildings, and other public amenities began to be developed. From aqueducts, roads, and temples, ancient civilizations including the Romans built infrastructure that fulfilled practical needs, while also reaching milestones in human artistry and engineering.

III. **Technological advancements:** Humans have played a very creator-like role in the technological innovation, but there are so many ways that humans have used creation. Just think about how machines and steam engines provided a boost to societal productivity and that was later enhanced by the arrival of electricity. The computer and the internet, and subsequently renewable energy technologies are just a few of the technological advancements that have accelerated in the 20th, and more notably the 21st Century. These innovations not only made good life standards, long-term expectancy of a human and connected the whole world like never before.

IV. **Cultural and artistic expression:** The human creations are not only physical and technological, but have shaped the world through cultural and artistic achievements. The construction of architectural marvels like the Pyramids of Egypt and the Parthenon in Greece to the creation of masterpieces in literature, music and visual arts. Thus, human creativity has enriched societies and preserved knowledge, traditions and histories.

V. **Scientific advancements and healthcare:** Progress in the fields of science and medicine has profoundly impacted human societies. Breakthroughs in biology, chemistry, physics and various other scientific disciplines have enhanced our comprehension of the natural environment and spurred innovations in healthcare, agriculture, and industry. The development of vaccines, antibiotics, and contemporary medical technologies has significantly improved health outcomes and lowered mortality rates, thereby increasing life expectancy and improving overall quality of life.

B. Man as a destroyer: the negative consequences of human actions

While human beings have created civilizations and advanced technology, these actions have often come at a cost to the environment and society. The destructive impact of human activity is evident in several areas:

I. **Deforestation and habitat destruction**: The expansion of agriculture, urbanization, and industrial activities has led to the widespread clearing of forests and natural habitats. Deforestation not only reduces biodiversity by destroying the habitats of countless species but also disrupts ecosystems that play crucial roles in regulating the climate, maintaining soil health, and supporting water cycles. For example, deforestation for agriculture and logging has led to the loss of vast areas of forest in the Amazon rainforest, often called the "lungs of the Earth".

II. **Environmental pollution**: Human activity has introduced significant levels of pollution into the environment. Industrial processes, vehicle emissions, and agricultural runoff release pollutants such as greenhouse gases, heavy metals, plastics, and chemicals into the air, water, and soil. Air pollution, particularly from fossil fuel combustion, contributes to respiratory and cardiovascular diseases, as well as to climate change. Water pollution from plastics and chemicals harms marine life and contaminates drinking water sources, while soil pollution affects agriculture and food safety.

III. **Climate change:** One of the most far-reaching consequences of human activity is climate change. The burning of fossil fuels, deforestation, and industrial emissions have significantly increased the concentration of greenhouse gases in the atmosphere, leading to global warming. Climate change results in rising sea levels, extreme weather events, melting ice caps, and changes in ecosystems, all of which pose threats to both natural environments and human societies. Human-induced climate change has disrupted agricultural patterns, threatened coastal cities, and led to the loss ofbiodiversity.

IV. **Resource depletion:** The rapid consumption of natural resources has led to the depletion of essential materials such as fresh water, minerals, fossil fuels, and forests. Overfishing, deforestation, and unsustainable mining practices have all contributed to resource depletion, affecting ecosystems and threatening future supplies. The overuse of water resources in agriculture and industry, for instance, has led to water scarcity in many parts of the world, impacting food security and livelihoods.

V. **Loss of biodiversity:** Human expansion and activity have led to the extinction of numerous species and the degradation of ecosystems. Habitat destruction, pollution, overexploitation of wildlife, and climate change are primary drivers of biodiversity loss. Species extinction disrupts ecosystems, reduces genetic diversity, and weakens the resilience of natural systems. This loss of biodiversity not only impacts wildlife but also threatens human societies that rely on healthy ecosystems for food, medicine, and ecosystem services.

Check Your Progress No. 2

a. What are the prime creations of the human beings?

…….....

…….....

……

……

……

b. How human activities result in loss of biodiversity?

……

……

……

……

……

……

3.6 CONSERVATION OF ENVIRONMENT: AN IMMEDIATE NEED

The conservation of the environment is an urgent global imperative given the accelerating threats posed by human activities such as deforestation, pollution, climate change, and biodiversity loss. Protecting and preserving natural resources and ecosystems is crucial not only for maintaining ecological balance but also for ensuring human well-being and survival. The urgency for environmental conservation is driven by the increasing realization that without immediate and concerted efforts, the damage caused to the planet may become irreversible, affecting current and future generations. Below is a detailed account of the need for environmental conservation, the challenges faced, and the strategies being implemented.

I. The importance of environmental conservation

The conservation of the environment is critical for maintaining the health of ecosystems, which provide essential goods and services that support life on Earth. The major essential goods and services provided by the environment to man are discussed below:

a. **Ecosystem services:** Ecosystems such as forests, wetlands, oceans, and grasslands provide essential services that sustain human life. These include air and water purification, climate regulation, soil fertility, pollination of crops, and the provision of raw materials and food. Conserving these ecosystems is vital for ensuring that they continue to function effectively and provide the resources needed for human survival.

b. **Biodiversity and species protection:** Biodiversity, which encompasses the variety of all life forms on Earth, is crucial for maintaining ecological balance and resilience. Species diversity allows ecosystems to adapt to changing conditions and provides genetic resources for agriculture, medicine, and other human needs. Conservation efforts help protect endangered species and their habitats, ensuring that biodiversity remains intact for ecological stability and human benefit.

c. **Climate regulation:** Forests, oceans, and other ecosystems play a key role in regulating the Earth's climate by absorbing carbon dioxide and releasing oxygen. Forests, for instance, act as carbon sinks, mitigating the impact of greenhouse gas emissions Conserving these natural areas is essential for combating climate change and reducing the global temperature rise, which poses risks such as extreme weather events, sea-level rise, and disruption of ecosystems.

II. The immediate need for environmental conservation

Human activities have led to significant environmental degradation, which is now manifesting in urgent global challenges. Without immediate action, these issues may have catastrophic consequences for the planet and human societies. Following is some of the major environmental issues that need immediate mitigatory interventions:

a. **Climate change and global warming:** Human-induced climate change, primarily caused by the burning of fossil fuels and deforestation, has led to rising global temperatures. This warming trend is responsible for extreme weather events such as hurricanes, droughts, floods, and heatwaves, which disrupt human communities, agriculture, and natural ecosystems. Immediate conservation efforts, such as reforestation and reducing carbon emissions, are necessary to mitigate these effects and stabilize the climate.

b. **Deforestation and habitat loss:** Deforestation, driven by agriculture, logging, and urban expansion, is one of the most pressing environmental issues. Forests are being cleared at an alarming rate, resulting in habitat loss for countless species, increased carbon emissions, and reduced biodiversity. Protecting and restoring forest areas is essential to prevent further damage and maintain ecological balance.

c. **Environmental pollution:** Pollution from industrial activities, agriculture, and urbanization has led to the contamination of air, water, and soil. Air pollution, primarily from vehicles and industrial emissions, contributes to respiratory and cardiovascular diseases, while water pollution from plastic waste, chemicals, and agricultural runoff harms marine life and ecosystems. Soil contamination affects agriculture and food security. Addressing these issues requires immediate action to reduce pollution and implement sustainable practices.

d. **Loss of biodiversity:** Habitat destruction, pollution, climate change, and overexploitation of resources are causing unprecedented rates of species extinction. The loss of biodiversity threatens the stability

of ecosystems, making them less resilient to environmental changes and thus, reduce their ability to provide essential services. Immediate conservation measures, such as establishing protected areas and combating poaching, are critical for preserving biodiversity.

III. Challenges in environmental conservation

Conservation efforts face numerous challenges that complicate the implementation of effective strategies and policies. Major challenges in achieving environmental conservation are discussed below:

a. **Economic pressures and development needs:** Many countries, especially developing nations, prioritize economic growth and poverty alleviation over environmental protection. The need for agricultural land, energy, and raw materials often leads to deforestation, mining, and other environmentally harmful activities. Balancing economic development with environmental sustainability is a significant challenge that requires comprehensive policies and international cooperation.

b. **Lack of awareness and education:** In many parts of the world, there is a lack of awareness about the importance of environmental conservation and the long-term impacts of environmental degradation. Public education and awareness campaigns are crucial for encouraging sustainable practices and mobilizing communities to participate in conservation efforts.

c. **Political and institutional barriers:** Environmental conservation often requires strong political will and effective governance. In some cases, corruption, lack of enforcement, and weak environmental regulations hinder conservation efforts. Establishing transparent, accountable, and capable institutions is essential for implementing and enforcing environmental policies.

d. **Climate change complications:** As climate change continues to impact the environment, it complicates conservation efforts by altering ecosystems and weather patterns. For example, rising temperatures and changing precipitation patterns affect the distribution of species and the health of ecosystems, making it more challenging to implement traditional conservation methods. Adapting conservation strategies to cope with climate change is an ongoing challenge.

IV. Strategies for environmental conservation

To address the urgent need for environmental conservation, various strategies and approaches are being implemented at local, national, and international levels. These strategies aim to protect ecosystems, reduce environmental degradation, and promote sustainable development. Some of the strategies for environmental conservation are discussed as under:

a. **Protected areas and wildlife reserves:** Establishing protected areas such as national parks, wildlife reserves, and marine sanctuaries is a key conservation strategy. These areas help safeguard critical habitats, protect endangered species, and maintain biodiversity. They also provide opportunities for

ecotourism, which can support conservation efforts and provide economic benefits to local communities.

b. **Sustainable resource management:** Implementing sustainable practices in agriculture, forestry, and fishing is essential for reducing environmental degradation. Sustainable agriculture focuses on minimizing chemical use, conserving water, and promoting crop diversity. Sustainable forestry practices, such as selective logging and reforestation, help maintain forest ecosystems while providing resources. Sustainable fishing regulations prevent overfishing and protect marine ecosystems.

c. **Renewable energy transition:** Transitioning from fossil fuels to renewable energy sources like solar, wind, and hydroelectric power is crucial for reducing greenhouse gas emissions and mitigating climate change. Investing in renewable energy not only reduces pollution but also promotes energy security and creates green jobs, contributing to economic growth in a sustainable manner.

d. **Reforestation and restoration projects:** Reforestation and ecosystem restoration projects are vital for repairing damaged environments and restoring biodiversity. Planting trees and rehabilitating degraded land help sequester carbon, protect soil, and create habitats for wildlife. Projects like the Great Green Wall in Africa aim to restore degraded landscapes, combat desertification, and improve local livelihoods.

e. **International agreements and cooperation:** Addressing global environmental challenges requires international cooperation and commitments. Agreements such as the Paris Agreement on climate change and the Convention on Biological Diversity aim to reduce emissions, protect ecosystems, and promote sustainable development. Countries collaborate to set targets, share resources, and monitor progress, ensuring that collective action is taken to conserve the environment.

V. The role of individuals and communities

While governments and organizations play a significant role in conservation, individual and community action is also essential. Raising awareness, advocating for environmental policies, and adopting sustainable lifestyles are ways that individuals can contribute to conservation efforts. The individuals and communities can contribute towards environmental conservation by undertaking the following measures:

a. **Sustainable consumption:** Reducing waste, using energy-efficient appliances, minimizing plastic use, and supporting eco-friendly products are ways individuals can reduce their environmental footprint. Sustainable consumption helps reduce demand for environmentally harmful products and promotes the growth of green industries.

b. **Community involvement in conservation:** Local communities often play a critical role in managing and protecting natural resources. Community-based conservation programs empower local people to take an active role in conserving forests, wildlife, and water resources. By involving communities, conservation initiatives can become more effective, culturally relevant, and sustainable.

c. **Advocacy and education:** Individuals and organizations can advocate for stronger environmental policies and raise awareness about the importance of conservation. Environmental education programs in schools and communities help build awareness from an early age, creating a culture of conservation and stewardship.

Check Your Progress No. 3

i. What are various essential goods and services that are provided by environment to man?

……

……

……

……

……

……

……

ii. What are major challenges in achieving environmental conservation?

……

……

……

……

……

……

3.7 NEED FOR SENSITIZING LEARNERS TOWARDS CONCERN OF ENVIRONMENTAL CONSERVATION.

The need for sensitizing learners towards the concerns of environmental conservation is crucial in today's world, where environmental degradation, climate change, and biodiversity loss threaten the planet's health and human well-being. Education plays a fundamental role in shaping attitudes, behaviors, and actions, making it essential to integrate environmental conservation into learning. By doing so, we prepare a generation that is informed, responsible, and proactive in addressing ecological issues. Below is a detailed account of the importance, methods, and outcomes of sensitizing learners about environmental conservation.

I. Importance of sensitizing learners towards environmental conservation

Educating learners about the environment and conservation is essential for building a foundation of ecological literacy, fostering responsible behavior, and encouraging positive actions that contribute to sustainability.

a. **Building environmental awareness and knowledge:** Many students lack fundamental knowledge about environmental issues such as climate change, pollution, and resource depletion. Educating learners about these topics increases their awareness of the problems facing the planet and the scientific, social, and economic factors involved. When students are knowledgeable, they are more likely to recognize the significance of these issues and understand their role in protecting the environment.

b. **Developing ecological and critical thinking skills:** Environmental education helps learners develop skills in ecological and systems thinking, allowing them to understand the complex relationships between natural and human systems. By examining the causes and consequences of environmental problems, learners develop critical thinking skills that enable them to analyze situations, assess risks, and consider sustainable alternatives. Such skills are essential for effective decision- making and problem-solving in a world facing ecological challenges.

c. **Developing a sense of stewardship and accountability:** Educating students about environmental preservation cultivates a sense of duty to the earth. It emphasizes that humans are both a part of and depend on nature, and therefore have a duty to protect and preserve it. When students are taught to care for the environment, they are more likely to engage in actions that promote conservation, such as reducing waste, conserving water, and supporting biodiversity initiatives.

d. **Empowering learners as change agents:** Young people are not only the future leaders and decision-makers but also have the potential to influence current attitudes and behaviors. By equipping learners with the knowledge, skills, and motivation to act, they become advocates for environmental conservation in their communities. They can engage in local and global initiatives, participate in environmental advocacy, and inspire others to adopt sustainable practices.

II. Methods for sensitizing learners about environmental conservation

Integrating environmental conservation into education requires a multifaceted approach that combines classroom instruction, experiential learning, and community engagement.

a. **Integrating environmental topics into the curriculum:** Environmental conservation should be embedded across various subjects in the curriculum, such as science, geography, social studies, and even literature. Interdisciplinary approaches help students see the interconnectedness of environmental issues with social, economic, and political factors. For example, science lessons can explore ecosystems and climate change, while social studies can examine the impact of deforestation on indigenous communities.

b. **Experiential and outdoor learning:** Learning outside the classroom, through activities like nature walks, field trips to forests, wetlands, or conservation centers, and participation in biodiversity surveys, provides hands-on experiences that connect learners with nature. Such experiences foster a deeper appreciation of the environment and make abstract concepts like biodiversity, ecosystems, and sustainability more tangible and relatable.

c. **Project-based learning and community involvement:** Projects that focus on solving real-world environmental problems encourage students to apply their knowledge and skills. Examples include organizing recycling campaigns, planting trees, designing sustainable school gardens, or creating water conservation plans for their schools. Involving students in community-based projects helps them understand the impact they can have and provides practical experience in environmental stewardship.

d. **Use of technology and media:** Technology and media can be powerful tools for environmental education. Interactive apps, documentaries, virtual reality experiences, and online simulations allow students to explore environmental issues from multiple perspectives and understand their global impact. Digital tools also help learners connect with global conservation initiatives and join online platforms that advocate for sustainable actions.

e. **Role of educators and schools:** Educators play a critical role in inspiring and guiding students towards environmental conservation. Teacher training programs must include environmental education components to prepare educators to effectively teach these topics. Schools, as institutions, can lead by example by implementing green practices such as waste management programs, energy-saving measures, and sustainable building practices. These practices demonstrate to students how conservation principles can be applied in everyday settings.

III. Outcomes of sensitizing learners about environmental conservation

Properly implemented environmental education not only benefits learners individually but also have broader social and ecological impacts. The major outcomes of sensitizing learners about environmental conservation are as under:

a. **Development of environmentally conscious citizens:** Sensitized learners grow into environmentally conscious adults who understand the importance of sustainable living and conservation efforts. They are more likely to adopt and advocate for sustainable practices in their personal and professional lives, contributing to a culture that prioritizes environmental responsibility.

b. **Promotion of sustainable lifestyles and behavioral changes:** When learners understand the impact of their actions on the environment, they are more likely to make sustainable choices such as reducing waste, conserving energy, and minimizing their carbon footprint. Education promotes habits like recycling, reducing plastic use, conserving water, and supporting eco-friendly products, creating lasting behavioral changes that benefit the environment.

c. **Engagement in environmental action and advocacy:** Educated and sensitized individuals are more likely to become involved in environmental initiatives, from participating in local clean-up efforts and tree planting events to advocating for policy changes that support sustainability. Young people who have been educated about environmental issues often become leaders in conservation movements, advocating for policy changes, renewable energy adoption, and the protection of natural habitats.

d. **Long-term societal and ecological benefits:** By fostering a generation that values and understands the importance of conservation, societies can move toward more sustainable models of development. When environmentally educated individuals occupy key roles in society—whether as policymakers, scientists, business leaders, or community organizers—they are better equipped to implement and support policies that protect natural resources, reduce emissions, and promote sustainable economic growth.

IV. Challenges in sensitizing learners about environmental conservation

Despite its importance, sensitizing learners about environmental conservation faces several challenges that must be addressed to make such education effective and widespread. Following are the major challenges in sensitizing learners about environmental conservation:

a. **Lack of resources and funding:** In many regions, schools lack the resources to implement comprehensive environmental education programs. Funding for field trips, nature centers, and hands-on learning experiences is often limited, especially in underserved or rural areas. Governments and organizations need to invest in educational resources and infrastructure that facilitate effective environmental learning.

b. **Curriculum overload and prioritization:** In many educational systems, environmental conservation topics may not receive the attention they deserve due to an already crowded curriculum. Balancing traditional academic subjects with the need for environmental education requires curriculum planners to prioritize sustainability as a core component of learning.

c. **Cultural and socioeconomic barriers:** In some societies, cultural norms, beliefs, or socioeconomic conditions may hinder the promotion of environmental education. In regions where poverty is prevalent, immediate economic survival often takes precedence over conservation efforts. Sensitizing learners in these contexts requires a culturally relevant approach that aligns environmental conservation with improving livelihoods and community development.

V. Strategies for overcoming challenges in environmental education

To effectively sensitize learners about environmental conservation, various strategies can be employed to address the challenges outlined above.

a. **Government and policy support:** Governments should prioritize environmental education as part

of national education policies, ensuring that schools have the necessary resources and support to implement effective programs. This includes funding for teacher training, curriculum development, and the creation of outdoor learning spaces.

b. **Partnerships with NGOs and environmental organizations:** Collaboration with environmental NGOs and organizations can provide schools with additional resources, expertise, and programs that enhance environmental education. Many NGOs offer environmental awareness campaigns, workshops, and community projects that can be integrated into school activities.

c. **Incorporating local knowledge and context:** Environmental education should be context-specific, incorporating local knowledge and addressing issues relevant to learners' communities. By linking global environmental concerns to local experiences, such as water scarcity, waste management, or forest conservation, educators can make the learning experience more meaningful and impactful.

d. **Innovative teaching methods:** Utilizing technology, storytelling, and art in environmental education can engage learners in creative ways that go beyond traditional classroom settings. Schools can use digital platforms for virtual field trips, simulations, and global connections that enrich the learning experience and make environmental topics more engaging.

Check Your Progress No. 4

i. Why sensitizing learners towards environmental conservation is important?

……

……

……

……

……

……

……

ii. What are various challenges in sensitizing learners about environmental conservation?

……

……

……

……

……

……

3.8 ILLUSTRATIONS/ EXAMPLES

In modern times, we employ advanced tools like powerful chainsaws for tree felling and synthetic chemical fertilizers and pesticides in agriculture. These technological advancements have significantly accelerated human impact on the environment. The interactions between human activities and the environment are multifaceted and diverse, but can be categorized into two primary types:

1. Exploitation of natural resources, including land, food, water, soil, minerals, flora and fauna
2. Generation of waste from various sectors such as agriculture, industry and mining, as well as biological waste from human bodies.

3.9 LET'S SUM UP

- The term "environment" encompasses our physical surroundings and the attributes of our living space, as well as the broader natural world including land, sea, and air. Human interaction with the environment has been ongoing since the earliest days of our species. For example, the long-standing practice of deforestation for agricultural purposes, which has significantly altered our surroundings. The Industrial Revolution, beginning in 18th century Britain and subsequently spreading globally, marked a turning point in our environmental relationship. Before this era, human activities had limited environmental impact due to the use of less powerful technologies.
- Humans exhibit a complex duality as both creators and destroyers, which is evident in their environmental and societal impact. While people have shown remarkable ability to build civilizations, advance technology, and achieve cultural milestones that have positively transformed the world, these creative endeavours often come with destructive consequences. These include deforestation, pollution, climate change, and loss of biodiversity. Striking a sustainable balance between these opposing forces is crucial to ensure continued human innovation and development without compromising planetary health and the well-being of future generations.
- Environmental conservation is an urgent global priority that requires immediate attention and action. The critical issues of climate change, deforestation, pollution, and biodiversity loss necessitate swift and coordinated efforts to mitigate and reverse environmental damage. Key strategies for achieving conservation objectives include establishing protected areas, promoting sustainable practices, shifting to renewable energy sources, and fostering international collaboration. By uniting the efforts of governments, organizations, communities, and individuals, we can create a sustainable future that safeguards both the planet and humanity.

❖ Raising awareness among students about environmental conservation is a pressing and vital task in building a sustainable future. Education has the capacity to mold attitudes, behaviours, and actions, making it essential to incorporate environmental topics into curricula and involve students in hands-on conservation activities. Although challenges exist, strategies such as government backing, partnerships, and innovative teaching approaches can help overcome obstacles and nurture a generation of environmentally conscious citizens. By investing in environmental education, societies can ensure that future generations are equipped to tackle ecological challenges and make positive contributions to the planet's health.

3.10 KEYWORDS/ GLOSSARY

Anthropogenic - Human-caused changes or impacts on the environment, such as pollution or deforestation.

Adaptation - Adjustments in human behaviour, systems, or practices to mitigate the effects of environmental changes.

Biodiversity - The variety of plant, animal, and microbial life in a particular environment or on Earth as a whole.

Climate Change - Long-term changes in temperature, precipitation, and weather patterns caused by natural and anthropogenic factors.

Conservation - The sustainable use and management of natural resources to prevent depletion or degradation.

Deforestation - The large-scale removal of forests, often to make way for agriculture, urbanization, or other human activities.

Desertification - The process by which fertile land becomes desert due to drought, deforestation, or inappropriate agriculture.

Disaster - A sudden, catastrophic event causing significant disruption, destruction, and harm to people, property, and the environment. Disasters can be natural (e.g., earthquakes, floods, hurricanes) or human-induced (e.g., industrial accidents, oil spills, nuclear incidents).

Ecosystem Services - Benefits provided by natural ecosystems, such as clean water, air purification, and pollination.

Global Warming - The gradual increase in Earth's average surface temperature due to the buildup of greenhouse gases.

Greenhouse Effect - The trapping of heat in Earth's atmosphere by greenhouse gases, leading to

warming.

Habitat Loss - The destruction or alteration of the natural environment, often due to human activities

Land Degradation - The decline in the quality and productivity of the land due to factors like erosion, overuse, and pollution.

Natural Resources - Materials or substances occurring in nature, such as water, minerals, forests, and fossil fuels, that humans use for survival and economic activity.

Pollution - The introduction of harmful substances or energy into the environment, adversely affecting ecosystems and human health.

Preservation - Protecting natural environments from human interference to maintain their pristine state.

Renewable Resources - Resources that can replenish naturally over time, such as solar energy, wind, and water.

Resilience - The capacity of an ecosystem or community to recover from disturbances or adapt to change.

Sustainability - Meeting current human needs without compromising the ability of future generations to meet theirs.

Stewardship - The ethical responsibility to manage and care for the environment.

Urbanization - The expansion of cities and towns, often leading to habitat destruction and increased resource consumption.

Unsustainable Practices - Activities that deplete resources faster than they can regenerate or cause long-term environmental harm.

Waste Management - The collection, transportation, and disposal or recycling of waste materials in an environmentally friendly way.

Water Scarcity - A lack of sufficient available water resources to meet the demands of a region.

3.11 SELF-ASSESSMENT QUESTIONS

a. Explain the relationship between humans and the environment.

b. Analyse the impacts of urbanization on the environment.

c. Evaluate the role of technology in shaping the man-environment relationship.

d. Discuss the concept of sustainable development in the context of man-environment relationship.

e. Explore the role of communities in environmental conservation.

f. Examine the effects of climate change on human societies and the environment.

g. Assess the importance of environmental education in promoting sustainability.

h. Discuss the ethical dimensions of the man-environment relationship.

i. Explain the concept of ecological footprint and its relevance to sustainable living.

j. Evaluate the role of international agreements in addressing environmental challenges

3.12 SUGGESTED READINGS

1. Adhikari, S., 2015: *Fundamentals of Geographical Thought*, Orient BlackSwan.
2. Gadgil, M., & Guha, R. (1995). *Ecology and Equity: The Use and Abuse of Nature in Contemporary India.* Penguin Books.
3. Goudie, A. S., 2013. The Human Impact on the Natural Environment: Past, Present, and Future, 1st ed, New York Academy of Sciences Series. John Wiley & Sons, Incorporated, Newark.
4. Hussain, M., 2002: *Human Geography.* Third Edition, Rawat Publications, New Delhi, India.
5. Hussain, M., 2015: *Evolution of Geographical Thought.* Sixth Edition, Rawat Publications, New Delhi, India.
6. Koszegi, M., Bootlik, Z., Telbisz, T. and Mari, L., (2015): *Human environment relation- ship in modern and post-modern geography.* Hungarian Geographical Bulletin, 64(2), 87-99.
7. Mishra, V. K. (2011). *Man and Environment Interaction.* Pointer Publishers.
8. Rangarajan, M. (Ed.). (2007). *Environmental Issues in India: A Reader.* Pearson Education India.
9. Singh, S. (2009). *Environmental Geography.* Prayag Pustak Bhawan.
10. Venu, R. (2012). *Man and Environment: A Study of their Interactions.* Atlantic Publishers.

LESSON : 4

NEED OF SENSITIZING AND NEED OF SUSTAINABLE DEVELOPMENT

Structure

4.1 INTRODUCTION

In recent centuries, the concept of "development" has become increasingly equated with economic expansion, often gauged by metrics like gross domestic product or individual income. This limited view has led to a race among nations to reach and sustain developmental goals, which frequently clash with efforts to protect the environment and promote sustainability. To address this tension between human advancement and ecological preservation, global organizations such as the United Nations have launched initiatives advocating for sustainable development, aiming to restore harmony between humanity and nature.

Sustainability

The term "sustainable" refers to something that can be upheld or continued at a specific level, suggesting it is both tolerable and long-lasting. Thus, sustainability can be understood as the processes that maintain something consistently. In modern usage, sustainability typically denotes the methods and actions through which humans conserve natural resources, preserving ecological balance to prevent a deterioration in the

quality of life for contemporary societies. This broader application of "sustainability" encompasses advancements in various domains, including conserving natural resources, enhancing production methods (with a focus on energy efficiency and reducing polluting byproducts), tackling linear consumption patterns, guiding investment approaches, altering citizen lifestyles and consumer habits, fostering technological progress, and implementing changes in business and institutional practices.

Sustainable development

The most widely accepted definition of sustainable development comes from the Brundtland Report: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This concept emphasizes improving current living standards while preserving natural resources for future generations. The term was first introduced at the 1972 United Nations Conference on Human Environment in Stockholm. The World Commission on Environment and Development's 1987 publication "Our Common Future" is regarded as the most influential work on sustainable development. At the 1992 Earth

Summit in Rio de Janeiro, 170 countries signed crucial documents committing to environmental protection. Sustainable development is often characterized as the intersection of economic and ecological interests, striving for economic growth without disrupting ecological equilibrium. Achieving this goal requires significant policy shifts, decisive actions, and modified practices. The Earth Summit established sustainable development as the primary objective for all nations' development efforts. Governments also pledged to create and implement national sustainable development strategies, envisioned as highly participatory instruments designed to "ensure socially responsible economic development while safeguarding the resource base and environment for future generations." The United Nations Millennium Declaration recently reaffirmed these Rio commitments.

4.2 LEARNING OBJECTIVES AND LEARNING OUTCOMES

- To understand sustainable development
- To understand the genesis of the concept
- To understand the various challenges in achieving the sustainable development.
- Students will be able to recognize the importance of sustainable development
- Students will understand the importance of sustainable development goals for sustainable future.

4.3 CONCEPT OF SUSTAINABLE DEVELOPMENT

The global environmental, social and economic concerns gained more prominence in the 20th century, which resulted in the development of concept of sustainable development. This concept originated due to gradual recognition of the need to balance human progress with the preservation of the planet and its resources.

The development of the concept of sustainable development involves a series of events as discussed below:

I. Early foundations (Pre-20th century)

The importance of managing natural resources has been rooted in the ancient civilizations, such as the Greeks, Romans, and early Asian societies. The early examples of sustainable resource use include the agricultural practices like crop rotation, irrigation, and forest management. Later, the thinkers like Thomas Malthus and John Stuart Mill expressed concerns about the limits of population growth and resource exploitation, in the 18th and 19th centuries. The outstripping of the food production capacity as the consequences of unchecked human population growth was warned by Malthus, while Mill suggested balanced resource use so that society could aim for a "stationary state" economy.

II. Industrial revolution and early environmental concerns (19th century)

The significant environmental damage, including pollution, deforestation and loss of biodiversity has been caused by the industrial revolution which involves human activities like rapid urbanization, technological advances and economic growth. Thus, this period is characterized by the increased tension between economic development and environmental health. Some of the earliest environmental movements emerged in response to these socio-economic and environmental conflicts. Moreover, the conservation of natural landscapes, leading to the establishment of national parks and protected areas, was advocated by Henry David Thoreau and John Muir, particularly in the United States.

III. Rise of modern environmentalism (1960s–1970s)

The growing awareness about the environmental impacts of industrialization led to the development of modern concept of sustainable development and environmentalism in the 1960s and 1970s. During this period a shift from purely conservationist approaches to major ecological concerns was observed. Silent Spring (1962) one of the key publications by Rachel Carson significantly improved awareness regarding the harmful effects of pesticides on ecosystems, which lead to a broader understanding of how human activity can affect the environment. Global recognition to environmental concerns was marked by the United Nations Conference on the Human Environment (Stockholm Conference) in 1972. The Stockholm Declaration emphasized that development should be aligned with environmental conservation and resulted in the establishment of the United Nations Environment Programme (UNEP).

IV. Introduction of sustainable development (1980s)

The World Conservation Strategy published in 1980, by the International Union for Conservation of Nature (IUCN), introduced the term "sustainable development". It focused on the need to integrate environmental conservation with development to ensure that future generations could meet their needs. The Brundtland Report, Our Common Future by the World Commission on Environment and Development (WCED) in 1987, is one of the most influential documents in the history of sustainable

development. The report, chaired by Gro Harlem Brundtland, defined sustainable development as "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This definition emphasized the importance of balancing economic growth, social equity, and environmental protection.

V. Institutionalization and global agreements (1990s)

The sustainable development as a global priority was further institutionalized by the United Nations Conference on Environment and Development (UNCED) 1992, held in Rio de Janeiro, also known as the Earth Summit. The recommendations of the summit resulted in key documents like Agenda 21, the Convention on Biological Diversity and the Rio Declaration on Environment Development. The agenda 21, emphasized the need for cooperation among nations, the involvement of non-governmental organizations (NGOs) and the integration of environmental and developmental goals. Therefore, provided a comprehensive action plan for governments, international organizations, and communities to promote sustainable development globally. Moreover, the concept of sustainable development was included in various international agreements like the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention to Combat Desertification, indicating the need to address global environmental issues through collaborative efforts.

VI. Expansion of the concept (2000s–Present)

Inclusion of Sustainable development became fundamental to international policy- making in the early 21st century. To address global challenges like poverty, hunger and disease while incorporating sustainable practices, the Millennium Development Goals (MDGs) were established in 2000. MDGs laid the framework for the integration of environmental concerns with development goals, although they did not explicitly focus on sustainability. Moreover, the United Nations launched the Sustainable Development Goals (SDGs) in 2015, which include a set of 17 goals designed to achieve a more inclusive and sustainable future by 2030. The SDGs represent a more comprehensive global framework for sustainable development, emphasizing on the interdependence of economic, social and environmental dimensions. The SDGs expanded the concept of sustainable development to include issues like climate action (SDG 13), clean energy (SDG 7), responsible consumption and production (SDG 12), and life on land and underwater (SDGs 14 and 15).

VII. Contemporary context and challenges

At present, the sustainable development is at the forefront of global efforts to address issues like climate change, biodiversity loss, and social inequality. The Paris Agreement (2015), a legally binding international treaty under the UNFCCC, aims to limit global warming to below 2 degrees Celsius compared to pre-industrial levels. It emphasizes the need for sustainable development pathways to mitigate climate impacts and adapt to changes. However, achieving sustainable development requires

overcoming obstacles such as poverty, inequality, political conflicts, and economic dependencies on unsustainable practices. It also involves fostering technological innovation, international cooperation, and a commitment to equity and social justice.

COMPONENTS OF SUSTAINABLE DEVELOPMENT

Sustainable development is holistic in approach since it meets the need for the development of both the society and economy while, on the other hand, preserving the environment. Its long- term benefit will be that the desires of the present generation will be satisfied without jeopardizing the generations to come. This is because of the growing awareness that resource exploitation and uncontrolled economic growth lead to social inequality, environmental degradation, and a general decline in human well-being. Sustainable development comprises of three main pillars viz., economic, social and environmental, which are described in detail below.

a) **Economic sustainability:** Economic sustainability promotes inclusive and equitable growth and development that is resilient. Sustaining economic progress is achieved by ensuring productivity, employment, and innovation while making resources available for fostering an economy that is beneficial to all people in all walks of life. Sustainable economics focuses on increasing opportunities, reducing poverty and inequality, supporting fair trade, and investing in environmentally friendly technologies that decrease ecological footprints. For example, Economic sustainability incudes

   i. Creation for new markets and opportunities for sale growth

   ii. Cost reduction through efficiency and improvements and reduced energy and raw material inputs

   iii. Creation of additional value

b) **Social sustainability:** Social sustainability refers to inclusive societies in which all citizens have basic needs and access to healthcare, education, clean water, shelter, and economic participation. It encourages equity, justice, and respect for human rights. It seeks to help underprivileged communities by shrinking inequalities and creating environments where social well-being becomes as fundamental as economic growth.

   For instance, some of the aspects of social sustainability are

   i. Worker's health and safety

   ii. Impact on local communities, quality of life

   iii. Benefits to disadvantaged groups

c) **Environmental sustainability:** It is the protection and preservation of natural ecosystems, biodiversity, and natural resources in a manner that they can be available for future generations.

It involves the balance of extracting and using resources with mitigating pollution, waste, and ecosystem management. This also ties into global issues of environmental concern, including climate change, deforestation, and loss of biodiversity, which are critical for ecological balance. For example, Environmental sustainability constitutes:

i. Reduce waste, effluent generation, emission into environment
ii. Reduce impact on human health
iii. Use of renewable raw material
iv. Elimination of toxic substances

NEED FOR SUSTAINABLE DEVELOPMENT

The need for sustainable development is driven by a lot of global challenges that seem to be threatening ecological processes, social stability, and economic progress. The latter show the consequences of practices that are unsustainable and place emphasis on the need to evolve to a more sustainable approach of development.

I. **Climate change and environmental degradation:** One of the world's most urgent problems today is climate change, primarily driven by fossil fuel use, deforestation, and industrial activities. Global warming has led to extreme weather conditions, melting ice caps, rising sea levels and changes in ecosystems and agriculture. Environmental degradation including deforestation, soil erosion, air and water pollution, and loss of biodiversity - aggravates this problem. Sustainable development will do the trick for combating such effects, be it in terms of renewable energy, sustainable agriculture, conservation of forests, and other greenhouse gas emissions.

II. **Resource exploitation:** The population and consumption around the globe are increasing, and with them, so is the overexploitation of the natural resources at the disposal of man in the form of water, fossil fuels, minerals, and forests. Overuse of these resources is detrimental to the environment and also poses a threat to future economic security and development. Resource conservation and efficient use to ensure that there is still enough for later generations become a focus point of sustainable development through activities such as recycling, energy conservation, conservation agriculture, and the use of alternative materials.

III. **Poverty and social inequality:** While the world has achieved global economic growth, it remains abjectly poor with gross inadequacies in access to education, health, safe water, and electricity. Social inequalities continue unabated, and the socially deprived suffer disproportionately from environmental and economic issues. Sustainable development aims at developing social welfare programs, policies that promote disadvantaged group aspirations, and policy recommendations for inclusive economic growth. Sustainable development results in giving greater prominence to social equity with the aim of providing an equal opportunity for everyone to improve their quality of life.

IV. **Loss of biodiversity:** Un-sustainable activities involving deforestation, overfishing, habitat degradation, and pollution, are causing an alarming loss of biodiversity. It threatens the very survival of the ecosystems that provide essential services such as pollination, water purification, and climate regulation. Sustainable development involves the preservation of biodiversity through conservation programs, protected areas, sustainable land management, and attempts to reduce the human footprint on ecosystems.

V. **Urbanization and population growth:** The acceleration in people's rate of urbanizing and population puts massive pressure on infrastructure, natural resources, and the ecosystems. Cities are now the home to more than half of the world's population and account for vast pollution, waste generation, and energy consumption. Supportive sustainable development develops sustainability within cities by using infrastructure and public transport that generate green infrastructure, renewable energies, and land use for which proper planning ensures harmonious growth of cities while protecting the environment.

Check Your Progress No. 1

1. What do you mean by sustainable development?

   ……

   ……

   ……

   ……

   ……

   ……

2. Why sustainable development is necessary?

   ……

   ……

   ……

   ……

   ……

   ……

4.4 EFFORTS TOWARDS SUSTAINABLE DEVELOPMENT

To attain sustainable development, numerous initiatives are being undertaken at both individual and international levels. The United Nations has been instrumental in formulating and implementing these goals. On a personal

level, various innovations and strategies can contribute to sustainable development. The following actions can be adopted to foster sustainable development individually:

1. **Minimize waste:** Utilize reusable bags, bottles, and containers in place of single-use plastics. Compost organic waste and yard debris to lessen contributions to landfills. Choosing digital receipts and paperless billing. Repair and repurpose items rather than discarding them.
2. **Conserve energy:** Switch off lights, appliances, and devices when they are not in use. Employ energy-efficient light bulbs (such as LEDs) and appliances with high energy ratings. Insulate your residence to decrease heating and cooling demands. Transition to renewable energy sources, like solar panels, if feasible.
3. **Preserve water:** Install low-flow faucets, showerheads, and dual-flush toilets. Collect rainwater for gardening and outdoor applications. Water plants during the cooler parts of the day to minimize evaporation. Avoid letting taps run unnecessarily, such as while brushing teeth.
4. **Make environmentally conscious choices:** Support brands and companies that adhere to sustainable practices and ethical labor policies. Opt for locally sourced and seasonal foods to lower carbon emissions from transportation. Steer clear of fast fashion; invest in durable, high-quality clothing or shop second-hand. Reduce meat consumption and incorporate more plant-based meals into your diet.
5. **Embrace sustainable transportation:** Walk, cycle, or utilize public transport instead of driving alone. Carpool or use rideshare services to decrease fuel consumption. Consider switching to electric or hybrid vehicles when possible.
6. **Cultivate and safeguard greenery:** Plant trees or shrubs to absorb CO2 and enhance local air quality. Establish a home garden to cultivate your own fruits, vegetables, and herbs. Engage in community cleanup and reforestation projects.

EFFORTS AT GLOBAL LEVEL:

A. The Millennium Development Goals (MDGs): Established by the United Nations in 2000, these eight global objectives were intended to be accomplished by 2015, targeting significant global issues, particularly in developing nations. The goals included:

1. **Eradication of extreme poverty and hunger:** Aim to reduce the percentage of individuals living on less than $1.25 a day by half and ensure full and productive employment for all.
1. **Universal primary education:** Guarantee that every child completes primary education.
2. **Promotion of gender equality and empowerment of women:** Eliminate gender disparities in education across all levels.

3. **Reduction of child mortality:** Achieve a two-thirds reduction in the under-five mortality rate.
4. **Improvement of maternal health:** Attain a three-quarters reduction in the maternal mortality ratio and ensure universal access to reproductive health services.
5. **Combating HIV/AIDS, malaria, and other diseases:** Stop and reverse the progression of these diseases.
6. **Ensuring environmental sustainability:** Incorporate sustainability into policy frameworks, reduce biodiversity loss, and enhance access to clean water and sanitation.
7. **Development of a global partnership for development:** Tackle issues related to debt, trade, and access to technology in developing countries.

B. The Sustainable Development Goals (SDGs): The SDGs consist of 17 interrelated global objectives established by the United Nations in 2015 as part of the 2030 Agenda for Sustainable Development. These goals are designed to tackle the most urgent challenges facing the world, striving to achieve a balance between economic advancement, social inclusion, and environmental sustainability. Below is a summary of the various SDGs:

1. **No poverty:** Aim to eliminate extreme poverty for all individuals (defined as living on less than $1.25 per day). Work towards reducing poverty in all its forms through social protection measures, access to resources, and strategies that build resilience.
2. **Zero hunger:** Strive to eradicate hunger and guarantee access to safe, nutritious, and sufficient food for everyone. Encourage sustainable agricultural practices, enhance food systems, and boost the productivity of small-scale farmers.
3. **Good health and well-being:** Focus on decreasing maternal and child mortality rates. Address communicable diseases such as HIV/AIDS, malaria, and tuberculosis. Ensure universal health coverage, access to essential medications, and promote mental health and well-being.
4. **Quality education:** Guarantee inclusive and equitable access to quality education for all individuals. Foster lifelong learning opportunities with an emphasis on literacy, numeracy, and technical skills development.
5. **Gender equality:** Work to eliminate discrimination and violence against women and girls.Advocate for equal opportunities in leadership roles, education, and employment. Tackle issues such as child marriage and female genital mutilation.
6. **Clean water and sanitation:** Ensure that everyone has access to safe drinking water and adequate sanitation facilities. Enhance water quality, minimize pollution, and encourage efficient water usage.

7. **Affordable and clean energy:** Guarantee universal access to affordable, reliable, and modern energy services. Increase the proportion of renewable energy sources and promote energy efficiency.
8. **Decent work and economic growth:** Foster sustainable and inclusive economic growth while ensuring full employment. Safeguard labor rights and work towards the elimination of child and forced labor.
9. **Industry, innovation, and infrastructure:** Develop resilient infrastructure and promote sustainable industrial practices.
10. **Addressing inequalities:** Mitigate income disparities both within and between nations. Foster social, economic, and political inclusion for all individuals.
11. **Sustainable urban development:** Guarantee access to affordable housing and implement sustainable urban planning practices. Enhance public transportation, green areas, and resilience against disasters.
12. **Responsible production and consumption:** Promote sustainable consumption habits and minimize waste. Encourage resource efficiency and work towards reducing global food waste.
13. **Climate action:** Implement immediate measures to address climate change and its effects. Enhance climate resilience and incorporate climate strategies into policy frameworks.
14. **Marine conservation:** Safeguard and sustainably manage oceans, seas, and marine resources. Prevent marine pollution, overfishing, and protect marine biodiversity.
15. **Terrestrial ecosystem preservation:** Safeguard, restore, and encourage the sustainable use of land ecosystems. Combat deforestation, desertification, and the loss of biodiversity.
16. **Promoting peace, justice, and robust institutions:** Foster peaceful and inclusive societies. Decrease violence and corruption while strengthening institutional frameworks. Ensure access to justice and uphold human rights.
17. **Collaborative partnerships for sustainable development:** Enhance global partnerships aimed at sustainable development. Mobilize resources, facilitate knowledge exchange, and promote technological collaboration.

Each Sustainable Development Goal (SDG) is associated with specific measurable targets (a total of 169) and indicators to track progress, encouraging cooperation among governments, businesses, and civil society.

Check Your Progress No. 2

3. What steps can be taken at individual level to achieve sustainable development?

……

……

……

……

……

4. What are sustainable development goals (SDG's)?

……

……

……

……

……

……

4.5 CHALLENGES TOWARD SUSTAINABLE DEVELOPMENT

Sustainable development is a need for ensuring a fair and robust future but has many challenges that dissuade its effective implementation. These challenges are multidimensional and fall under the economic, social, environmental, and institutional domains. Understanding these challenges is crucial in developing strategies to overcome them and effectively promote sustainable practices. The primary challenges to achieve sustainable development discussed as follow:

1. **Economic constraints**
2. **Social challenges**
3. **Environmental challenges**
4. **Institutional and governance challenges**
5. **Technological and innovation challenges**
6. **Cultural and behavioral Issues**

1. Economic constraints

Economic factors often prevent actual steps toward sustainable development, mainly in developing countries

where the outright growth need and reducing poverty have often taken precedence over sustainability objectives.

a. **Focus on short-term economic gains:** Certain governmental agencies and businesses may put short-term economic interests ahead of the long-term need for sustainability. The resource extraction and industrial development may gain advantage over conservation and environmental restoration. The objective of immediate economic gain often does not allow for sustainability, leading to resource exploitation, deforestation and pollution.

b. **Unavailability of spare finances:** Most countries, especially the Global South, do not have finances to invest in sustainability, green energy and conservational projects because they are financially poor. Capital and technology are lacking in these countries that limit them to live sustainably. Countries with well-developed infrastructure do not have funds or political will to fund large-scale environmental activities.

   Global economic inequality: Inequity around wealth and resources among countries present difficult challenges to address problems for sustainable development on an international level. The powerful rich nations may be affluent to afford green technologies or even policies, while those resource-poor countries are bothered about basic needs.All such inequalities may lead unevenness in environmental benefits and environmental burden, where developing country becomes the most vulnerable contributor with less contribution to greenhouse effect and environmental degradation resulting in climate change.

c. **Expensive green technologies:** It is a bit expensive to start green technology including renewable energy sources, green infrastructure, and a process of eco-friendly manufacture. Due to the lack of finance, many companies, and governments fear the change, opting for the less expensive options but also those that do not sustain.

2. Social challenges

Major challenges to sustainable development are social challenges such as culture, awareness, and inequality.

a. **Lack of public awareness and environmental education:**A major impediment to successful sustainable development is a lack of general public awareness and knowledge concerning environmental issues. People may not understand what sustainable practices are or how actions in daily life affect the environment, not realizing this properly in the event of inadequate education. Such a lack of knowledge makes it quite difficult to mobilize communities and achieve widespread behavioural change leading to sustainability.

b. **Tendency to resist change:** The cultural and societal norms may act as resistance against efforts to promote sustainable development. For example, resistance is usually shown towards change especially where the cultural and traditional habits of consuming things come in direct conflict with a new

sustainable way. Such factors as using renewable sources of energy and organic agricultural activities may face much resistance when it goes against conventional habits or ways. Changing these situations requires long-term education and advocacy plus engaging with people.

c. **Social inequality and marginalization:** Poverty, inequality, and social exclusion make it very difficult to achieve sustainable development. The most vulnerable groups often suffer more from environmental degradation and climate change but have very little capacity to adapt. They also lack resources for sustainable livelihoods necessary to implement inclusive and equitable development initiatives that do not leave anyone behind.

3. Environmental challenges

Environmental limitations and ecological constraints are the core challenges to sustainable development.

a. **Climate change and extreme weather events:** Climate change is probably the biggest threat to sustainable development because it is derived from greenhouse gas emissions and other unsustainable practices. This keeps on exacerbating pre-existing environmental problems like deforestation, desertification, and biodiversity loss. Increasing disruptions among communities, destruction of infrastructures, and declining agricultural productivity result from extreme weather events, such as hurricanes, floods, droughts, and wildfires, in making it challenging for societies to build sustainable and resilient systems.

b. **Overexploitation of resources:** Ecosystem Degradation: When natural resources, water, forests, minerals, or fossil fuel are exploited and overconsumed, an ecosystem starts degrading in the course of time because of it. Ecosystem services such as carbon sequestration, water filtration, and pollination can be harmed by this process. Once natural resources become scarce, competition will increase and reduce cooperative effort toward sustainability.

c. **Pollution and waste management:** The growing industrial activities, agricultural wastes, and urbanization processes are major obstacles in achieving the goal of sustainable development due to air, water, and soil pollution. Improper waste management procedures have become a problem for rapid growing cities as these practices pollute the environment and raise health issues. Increasing plastic and electronic wastes without appropriate recycling facilities add more difficulties in reducing environmental impact. Proper investment in pollution control mechanisms, sustainable technologies, and waste management systems are the solutions to these problems.

4. Institutional and governance challenges

Governance, policies, and institutional frameworks are important aspects for promoting sustainable development but always limited in their capability to support progress.

a. **Weak governance and political will:** In many countries, weak governance and corruption undermine efforts to implement sustainable policies effectively. Lack of transparency, accountability, and enforcement capacity can result in poorly managed environmental programs and misallocation of resources. Political leaders may also prioritize short-term gains and economic growth over sustainable practices, especially if they face pressure from industries or special interest groups.

b. **Incoherent and Unconnected Policies:** Sustainable development needs collaboration in a vast extent like agriculture, energy, transport, urban planning, amongst others, but often brings in with it the curse of disconnection in policies and incomprehensible policies, leaving environmental laws to conflict sharply with economical policies. Therefore, growth policy to the industrious may lead to contradictory carbon emission curbing, or resource usage protection, and therefore poor coordination as well as cohesiveness in policies is a dent to sustainability issues.

c. **Ability for implementation and enforcement:** It is not sufficient to adopt sustainable policies, and often there is a weakness of governments and institutions in effective implementation and enforcement. Technical skills, monitoring systems, and funding arrangements can all compromise effective implementation and enforcement of environmental legislation and programs. This feature is obviously on full display in developing countries where capacity in the institution may not be forthcoming.

d. **International coordination and cooperation:**Sustainable development is a global processand requires international cooperation. Nevertheless, consensus among nations is challenging to attain due to the varied priorities, levels of development, and resource availability. The negotiations for climate change agreements, such as the Paris Agreement, involve intricate negotiations where countries must weigh national interests against global commitments. Varying perceptions about who is responsible and how much financial support is needed by developing nations make international efforts difficult.

5. Technological and innovation challenges

Technology plays a critical role in advancing sustainable development, but it also presents challenges, especially when access and innovation are unevenly distributed.

a) **Limited access to sustainable technologies:**Developing nations face significant challengesin accessing sustainable technologies, primarily due to the prohibitive costs associated with these systems and the insufficient infrastructure and technological capabilities present in these regions. Renewable energy technologies, water purification systems, and sustainable agricultural practices remain largely out of reach for economically disadvantaged countries without support from international organizations or investments from the private sector.

b) **Dependence on unsustainable technology:** Many sectors are deeply entrenched in unsustainable technologies because of the earlier long-term investment and infrastructure. The shift to greener

alternatives requires retrofitting or replacement of old systems, which is expensive and time-consuming. For example, dependence on fossil fuels for energy and transportation is a huge barrier to achieving carbon neutrality and further reducing greenhouse gas emissions.

c) **Slow pace of innovation and implementation:** Although green technologies are developing, the speed of innovation and implementation could be too slow to reach the seriousness required to counter the environmental challenges. The time needed to develop and scale up carbon capture, sustainable agriculture practices, and eco-friendly construction methods cannot be matched by any serious effort. Also, regulatory barriers, market barriers, and industry resistance to the traditional methods will affect its adoption.

6. Cultural and Behavioral Issues

Sustainable development requires changing behaviors, consumption patterns, and cultural norms that may be deep-rooted and difficult to change.

a) **Over-consumption and unsustainable lifestyles:** In developed countries, overconsumption and a desire for material assets contribute to environmental degradation as well as resource depletion. Many of the world's population embraces high consumption lifestyles that involve exaggerated use of energy, water, and consumer goods-all of which undermine the message of minimalist living, recycling, and resource conservation.

b) **Cultural resistance to sustainable practices:** Cultural values and traditional practices can go against the goals of sustainability. For example, in areas where firewood from forests has been a way of life, the introduction of alternatives, such as clean energy solutions or sustainable agriculture, may be resisted if not considered part of the local traditions or the perceived benefits of the scheme.

c) **Non-involvement of personal action and participation:** If some governments or organizations are performing well regarding sustainable development, the same is expected from individuals. In addition, it is very difficult to motivate individuals to make sustainable decisions, that is, minimize plastic usage, reduce water usage, or use ecological products. It may be due to lack of personal empowerment or convenience and economic issues may out pass such environmental aspects.

Check Your Progress No. 3

5. What are various social challenges in achieving sustainable development?

……

……

……

……

……

……

6. What are technological and innovation challenges towards sustainable development?

……

……

……

……

……

……

……

4.6 ILLUSTRATIONS/ EXAMPLES

Linear & circular economy

Given the limited nature of Earth's resources, it is essential for individuals, governments, and businesses to collaborate in using them more efficiently. This has led to the emergence of the circular economy, a novel approach that contrasts with the traditional linear economic model.

The linear economy refers to the conventional system where raw materials are extracted, transformed into products for consumer use, and then discarded as waste, without considering environmental impacts or consequences. This model prioritizes financial gains over environmental sustainability, promoting disposable products.

In contrast, the circular economy aims to minimize environmental impact by reducing ecological footprints. It adheres to three fundamental principles: reduce, reuse, and recycle. This model integrates sustainability into design, production, and consumption processes. Manufacturing must minimize energy usage, employ renewable sources, and utilize non- polluting raw materials. Products should be designed for longevity, repairability, and recyclability, rather than having a limited lifespan.

The primary distinction lies in the focus: while the linear economy emphasizes profitability regardless of product lifecycle, the circular economy prioritizes sustainability throughout the entire process.

4.7 LET US SUM UP

- Sustainable development is a crucial concept in addressing contemporary global issues. It aims to balance economic growth, social equity, and environmental conservation, fostering a resilient society. This approach provides a means to create a future where humanity can flourish within the planet's ecological boundaries. However, realizing sustainable development demands collaborative efforts from various sectors, including governments, businesses, civil society, and individuals, as well as global cooperation and enduring commitment.
- The intricacy and interconnectedness of these factors pose significant challenges to sustainable development, necessitating comprehensive strategies and worldwide collaboration to overcome them. These challenges encompass reducing economic disparities, enhancing governance, raising public awareness, advancing green technologies, and promoting cooperation among diverse stakeholders to establish an environment that makes sustainable practices viable, appealing, and advantageous for all involved parties. By comprehending and tackling these obstacles, societies can progress towards the vision of sustainable development, ultimately achieving a balanced and resilient future for everyone.

4.8 KEYWORDS/ GLOSSARY

Adaptation - Actions taken to adjust to current or expected climate change impacts to reduce harm or exploit beneficial opportunities.

Agenda 21 - A comprehensive action plan adopted at the 1992 Earth Summit for sustainable development globally.

Blue Economy - A concept emphasizing the sustainable use of ocean resources for economic growth, improved livelihoods, and ocean ecosystem health.

Carbon Footprint - The total greenhouse gas emissions caused by an individual, organization, event, or product.

Carbon Neutrality - A state in which an entity balances its carbon dioxide emissions with equivalent removal or offsetting measures.

Carbon Offset - Actions or investments to compensate for carbon emissions, such as tree planting or renewable energy projects.

Circular Economy - An economic system aimed at minimizing waste and making the most of resources by reusing, recycling, and remanufacturing.

Clean Energy - Energy derived from renewable, zero-emission sources, such as solar, wind, and hydropower.

Climate Change Mitigation - Efforts to reduce or prevent the emission of greenhouse gases.

Community Engagement - The process of working collaboratively with community members to address issues affecting their well-being.

Corporate Social Responsibility (CSR) - Businesses' commitment to contribute to sustainable economic development and environmental preservation.

Cradle-to-Cradle Design - A sustainable product design approach that ensures materials can be fully recycled or safely decomposed after use.

Decarbonization - The process of reducing carbon dioxide emissions in energy generation, industry, and transportation.

Ecological Footprint - A measure of human demand on Earth's ecosystems, showing the amount of natural capital used compared to Earth's capacity to regenerate.

Ecosystem Services - The benefits people obtain from ecosystems, such as clean water, air, and food production.

Environmental Impact Assessment (EIA) - A process for evaluating the likely environmental impacts of a proposed project or development.

Fair Trade - Trade practices ensuring fair wages and working conditions for producers in developing countries.

Green Economy - An economy that aims for sustainable development without degrading theenvironment.

Human Capital - The skills, knowledge, and experience possessed by individuals, viewed as a resource.

Inclusive Growth - Economic growth that creates opportunities for all segments of society.

Integrated Water Resource Management (IWRM) - A process promoting coordinated development and management of water, land, and related resources for sustainability.

Life Cycle Assessment (LCA) - A method to assess the environmental impacts associated with all stages of a product's life.

Net Zero - Achieving a balance between the amount of greenhouse gases emitted into and removed from the atmosphere.

Social Equity - Ensuring fair access to resources and opportunities for all, particularly marginalized groups.

Sustainable Agriculture - Farming practices that maintain soil health, minimize water use, and reduce

pollution to support long-term food security.

Sustainable Cities - Urban areas designed with consideration for environmental impact, sustainable resource use, and quality of life.

Sustainable Consumption - Using products and resources in ways that minimize environmental impact and promote social well-being.

Sustainable Development - Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable Development Goals (SDGs) - A collection of 17 global goals set by the United Nations to achieve a sustainable future for all by 2030.

Sustainable Procurement - The process of purchasing goods and services with consideration for environmental and social factors.

Triple Bottom Line - The framework considering three dimensions of sustainability: environmental, social, and economic.

Waste-to-Energy - The process of generating energy in the form of electricity or heat from the treatment of waste.

Zero Waste - A philosophy encouraging the redesign of resource life cycles so that all products are reused, reducing landfill and incineration.

4.9 SELF-ASSESSMENT QUESTIONS

a. Define sustainable development and explain its core principles.

b. Analyse the role of the sustainable development goals (SDGs) in achieving a sustainable future.

c. Discuss the challenges of achieving sustainable development in developing countries

d. Explain the concept of sustainable consumption and its importance in sustainable development.

e. Assess the importance of biodiversity conservation in sustainable development.

f. Examine the role of technology and innovation in achieving sustainable development.

g. Discuss the role of education in promoting sustainable development.

h. Analyse the role of corporate social responsibility (CSR) in sustainable development.

i. Propose strategies for strengthening international cooperation in achieving sustainable development

4.10. SUGGESTED READINGS

1. Agarwal, S., Narain, S., & Sen, S. 1999. *The State of India's Environment: The Citizen's Fifth Report*. Centre for Science and Environment.
2. Bhalla, G. S. (Ed.). 2012. *Environmental Concerns and Sustainable Development: Some Perspectives from India*. Institute for Human Development.
3. Geethakrishnan, K. P., 1990. "Sustainable Development in Operation", in Malcolm S. Adiseshaiah (ed.), Sustainable Development: Its Content, Scope and Process. New Delhi: Lancer International.
4. Guha, R. (2000). *Environmentalism: A Global History.* Oxford University Press.
5. IUCN, UNEP & WWE, 1991**.** Caring for the Earth: A Strategy for Sustainable Living. Switzerland.
6. Kothari, R., 1988. Rethinking Development: In Search of HumaneAlternative. Delhi: Ajanta Publications.
7. NITI Aayog. 2019. *India and Sustainable Development Goals: The Way Forward*. NITI Aayog.
8. United Nations Environment Programme (UNEP). 2011. *Towards Green Growth: India's Transition to a Green Economy*. United Nations Publications.

LESSON : 5

ENVIRONMENTAL MANAGEMENT

STRUCTURE

5.1. INTRODUCTION

Environmental management is a critical field which involves the practice of organizing human activities to limit their impact on the Earths' environment. The practice of environmental management includes ''actual decisions and action concerning policy and practice regarding how resources and the environment are appraised, protected, allocated, developed, used, rehabilitated, remediated, and restored'' (Panzarella et al., 2023). As the human societies have progressed with large scale industrialization and urbanization, the impact on the environment becomes increasingly pronounced, thus demanding systematic approaches to limit the adverse effects and promote sustainable development. The environmental management doesn't intend to

hamper development but attempts to seeks a balance between environmental conservation and development, thus ensuring that current as well as future generation have access to clean and abundant natural resources. In context of increased environmental awareness and developmental needs, the significance of environmental management has grown dramatically in recent decades. Environmental management has evolved into a multidisciplinary domain that integrates scientific research, regulatory frameworks, and management practices to address a wide array of environmental challenges. One of the main focuses of environmental management is to t address the issue of sustainable use of environmental resources and ensuring the sustainable developmental model, emphasizing the importance of balancing economic, social, and environmental objectives. Effective environmental management promotes resource efficiency, reduces pollution, and fosters practices that contribute to long-term ecological balance.

In environmental management, anthropocentrism and ecocentrism represent two contrasting perspectives on the relationship between humans and the environment. Anthropocentrism prioritizes human needs and interests over those of the natural environment. Anthropocentric views see nature primarily as a resource for human use and focus on economic and practical benefits. While this perspective can drive technological innovation and economic development, it often leads to unsustainable practices if environmental impacts are not adequately considered. Ecocentrism places intrinsic value on all living organisms and ecosystems. It emphasizes the interconnectedness of all elements within an ecosystem and advocates for protecting nature for its own sake, rather than solely for human benefit. Ecocentric approaches promote sustainable and respectful interactions with the environment, prioritising ecological health and biodiversity.

5.2 LEARNING OBJECTIVES

After going through this chapter, learners should be able to:

a) Understand the foundational principles of environmental management

b) Understand the relevance of sustainability, conservation, and pollution control.

c) Evaluate and understand the role of environmental policies and regulations.

5.3 SIGNIFICANCE OF ENVIRONMENTAL MANAGEMENT

The significance of environmental management lies in its ability to mitigate environmental impacts, promote sustainability, and ensure the effective use of natural resources. The scope of environmental management is broad and requires the intervention and engagement of a range of stakeholders to address complex and interconnected environmental issues. The scope encompasses areas such as regulatory compliance, resource management, pollution control, and conservation. Besides, involves a range of stakeholders, including government agencies, businesses, non- governmental organizations, and local communities. The significance of environmental management can be understood through several key dimensions:

i. **Mitigating Environmental Impact**: Industrialization, urbanization, and agricultural expansion have led to significant environmental challenges, including pollution, deforestation, and climate change. Environmental management practices aim to minimize these impacts by implementing strategies that reduce emissions, manage waste, and protect natural habitats. By addressing these issues, environmental management helps prevent or mitigate the adverse effects of human activities on the environment.

ii. **Promoting Sustainability**: Sustainability is at the core of environmental management. It involves meeting the needs of the present without compromising the ability of future generations to meet their own needs. Environmental management promotes sustainable practices by encouraging efficient use of resources, reducing waste, and supporting renewable energy sources. This approach helps ensure that natural resources are preserved, and environmental quality is maintained for future generations.

iii. **Regulatory Compliance and Risk Management**: Environmental management ensures that organizations and activities comply with environmental regulations and standards. This compliance is crucial for avoiding legal liabilities and penalties. Additionally, effective environmental management practices help organizations identify and manage environmental risks, reducing the likelihood of environmental incidents and associated costs.

iv. **Enhancing Public Health and Well-being**: By addressing issues such as air and water pollution, environmental management directly impacts public health. Cleaner air, safer drinking water, and reduced exposure to hazardous substances contribute to improved health outcomes for communities. Moreover, environmental management fosters healthier ecosystems,which are essential for maintaining biodiversity and supporting human well-being.

v. **Supporting Economic Development**: Sustainable environmental management can also drive economic benefits. By promoting resource efficiency and green technologies, organizations can reduce operational costs and create new market opportunities. Additionally, investing in environmental management can enhance a company's reputation, attract environmentally conscious consumers, and lead to competitive advantages in the market.

5.4 KEY ASPECTS OF ENVIRONMENTAL MANAGEMENT

Environmental management is a multifaceted discipline encompassing various key aspects essential for effectively addressing environmental challenges and promoting sustainability. The principal elements of environmental management includes ethical, economic, social and technological aspects and considerations, anthropocentrism versus ecocentrism, the interplay between economics and ecology, and sustainability. Each aspect plays a crucial role in shaping environmental policies and practices, ensuring that human activities align with ecological balance and long-term well-being.

5.4.1. Ethical Aspects of Environmental Management

Humans have a moral and ethical obligation to protect the environment for present and future generations as the natural resources are limited and must be consumed judiciously. The ethical aspects of environmental management addresses questions of responsibility, justice, and sustainability. Key ethical aspects include:

i. **Stewardship:** The principle of stewardship implies that it is our duty to protect and manage natural resources responsibly to ensure their sustainbility. It emphasizes that present generations have a moral obligation to protect and preserve the environment for future generations through adoption of nature friendly practices and regulating their consumption patterns.

ii. **Environmental Justice:** Environmental degradation may have more pronounced impacts especially on the marginalized communities due to their limited capacity to adopt to the changes brought in by the changing climate or health implications of environmental pollution. Environmental justice seeks to address these inequalities through active engagement of the affected communities, awareness, their capacity building through training, legal help, easy loans, other financial incentives, etc.

iii. **Rights of Nature:** This concept refers to the rights of nature. It advocates the recognition of the of the rights of natural entities such as rivers, forests, and wildlife. This perspective challenges anthropocentrism and shifts the focus from viewing nature solely as a resource for humans.

Therefore, the ethical aspect of the environmental management ensures intergenerational and intra-generation justice besides ensuring that the rights of the nature are also protected.

5.4.2. Economic Aspects of Environmental Management

Environmental management is inherently linked to the economic aspects. Earlier many argued that adoption of the sustainable practices have high financial implications. However, now there is increasing evidence that adoption of clener technologies in long-term have economic advantages and significantly cutoff the the environmental externalities. For example, deforestation can severely decrease the soil quality through soil erosion and loss of nutrients. Similarly, if the ecosystem is damaged, industries relying on such an ecosystem for raw material shall have to bear the losses. Pollution from industries can affect the health of the residents which imposes significant cost of treatment for the government and insurance companies. The adoption of greener technologies and shift towards renewable energy sources not only reduces the reliance on fossil fuels but also generates local employment opportunities, besides reducing associated health risks.

Environmental policies, such as carbon pricing and pollution taxes, play a pivotal role in aligning economic incentives with sustainable outcomes. For instance, placing a price on carbon emissions encourages businesses to adopt cleaner technologies like shifting automobile industries towards electric vehicles. However, on

many occasions such policies often receive resistance from the manufacturer due to the heavy cost involved in the research and development of newer products. Besides, developing nations often lack resources to invest in greener technologies and infrastructure. In this context, international cooperation in the form of technology transfer, tax rebates, and climate financing enables the developing nations to balance development and sustainability.

5.4.3. Technological Aspects of Environmental Management

Technological interventions are essential tools for effective environmental management, enabling the monitoring, mitigation, and prevention of environmental challenges. Advancements such as LED lighting, solar and wind energy, green hydrogen, energy storage solutions, bioremediation, and vermicomposting play a crucial role in tackling issues like environmental pollution, climate change, resource conservation, and sustainability. As these technologies become increasingly affordable, even remote communities are adopting them to improve their quality of life.

Another critical area for technological application is resource mapping, which ensures natural resources are accurately identified and quantified to aid policymakers. Low-cost technologies, including satellite imaging, remote sensing, and Geographic Information Systems (GIS), are invaluable for tracking deforestation, forest fires, wastelands, air quality, and climate trends. In agriculture, remote sensing techniques optimize water and fertilizer use, reducing environmental impact while boosting productivity. Similarly, innovations like waste-to-energy systems, advanced recycling methods, sustainable resource extraction, low-cost sensors, biodegradable plastics, and affordable water filtration technologies address key environmental challenges, such as water scarcity and waste management, contributing to a more sustainable future.

5.4.4. Social Aspects of Environmental Management

Social dynamics, including community interactions, behavior, cultural values, and ethical principles, play a vital role in environmental management. Addressing environmental challenges requires raising awareness, encouraging participation, and fostering collaboration among diverse social groups. At its core, environmental education is essential for shaping attitudes and behaviors. Public sensitization through awareness campaigns and media initiatives helps individuals understand the importance of energy conservation, biodiversity preservation, wildlife protection, and responsible waste management. Vulnerable populations, such as low-income groups, marginalized communities, and indigenous populations, often bear a disproportionate burden of environmental degradation. For example, pollutants from urban areas significantly impact poorer neighborhoods, particularly along the urban-rural divide, due to inadequate healthcare systems and weak regulatory frameworks. To prevent exacerbating existing inequalities, effective environmental management must prioritize inclusivity and equity by actively engaging communities.

Grassroots movements and local conservation efforts often empower communities to participate in decision-

making processes. For instance, community-led water conservation projects, such as creating artificial glaciers in Ladakh, showcase the integration of traditional knowledge with modern approaches. Indigenous groups, like the Bishnoi community in Rajasthan, have a longstanding tradition of living in harmony with nature and protecting natural resources. Recognizing and incorporating traditional knowledge systems into contemporary environmental policies can enhance their impact. Urbanization and globalization have brought significant lifestyle changes that adversely affect the environment, especially in urban areas. The growing demand for electricity, driven by widespread air-conditioning use in India, along with a surge in waste production due to a "use-and-throw" culture, has intensified greenhouse gas emissions, contributing to climate warming. Promoting sustainable infrastructure—such as solar panels, energy-efficient appliances, public transportation, eco-friendly housing, and waste recycling—can improve environmental health and enhance the quality of life.

Check your progress No. 1

a. Define environmental management.

……

……

……

……

……

……

……

b. Explain the ethical aspects of environmental management.

……

……

……

……

……

……

……

c. Discuss the role of stakeholders in environmental management.

……

……

……

……

……

……

……

5.4 THE ROLE OF STAKEHOLDERS IN ENVIRONMENTAL MANAGEMENT

Since environmental management is a multi-faceted discipline which requires input from a broad spectrum of actors, each bringing unique perspectives, resources, and expertise. Therefore, a range of stakeholders include individuals, groups, academia, financial institutes, NGOs, businesses, government organizations etc. that have stake in the environmental outcomes shall be involved for ensuring that policies, practices, and projects designed to protect and improve the environment are equitable, sustainable, and effective.

I. Government and Policy Makers

Governments play a central role in environmental management by formulating policies and enacting regulations. They are key stakeholders in conserving natural resources, preserving biodiversity, reducing waste, and controlling pollution. Through regulatory bodies like pollution control boards, governments direct industries and urban bodies to limit air emissions and manage the disposal of solid waste and water pollutants. Governments also uphold international commitments under agreements such as the Montreal Protocol, Paris Agreement, and Basel Convention, which aim to control pollutants, reduce greenhouse gas emissions, and regulate the transboundary movement of hazardous substances. To meet these commitments, laws like the Air Act, Water Act, and Environmental Protection Act have been enacted, alongside the establishment of the National Green Tribunal and regional courts to ensure the swift resolution of environmental disputes. Additionally, governments support conservation efforts by launching various schemes and providing funding opportunities for academia and researchers. Regulatory agencies play a critical role in enforcing environmental standards, holding violators accountable, and promoting sustainable resource management practices.

II. Businesses and Corporations

Businesses are significant contributors to environmental issues, particularly those in industries such as oil extraction, coal mining, power generation, resource extraction, and transportation, which are

among the largest sources of environmental degradation and pollution. However, their potential to mitigate these challenges is equally significant, especially companies in sectors like renewable energy, waste recycling, energy-efficient appliance manufacturing, and small-scale handicrafts. By adopting sustainable practices, businesses can transition from being contributors to environmental problems to becoming key players in driving solutions. Industries such as manufacturing, energy, agriculture, and transportation impact the environment through resource extraction, pollution, and waste generation. At the same time, businesses investing in clean technologies and innovations can reduce their environmental footprint while enhancing economic performance. By reducing carbon emissions, minimizing waste, and transitioning to green energy sources, companies can lead the way toward sustainability. Corporate Social Responsibility (CSR) initiatives and Environmental, Social, and Governance (ESG) frameworks further encourage businesses to address environmental concerns, fostering resilience and long-term sustainable growth.

III. Non-Governmental Organizations (NGOs) and Advocacy Groups

NGOs and advocacy groups play a pivotal role in driving social change, delivering humanitarian aid, fostering community development, and advocating for people's rights and well-being. They have the power to mobilize public opinion and hold governments and corporations accountable for their environmental responsibilities. Additionally, NGOs act as a vital link between various stakeholders, championing critical causes such as climate action, biodiversity conservation, and pollution control. Organizations like Greenpeace and the World Wildlife Fund (WWF) often spearhead grassroots campaigns, conduct research, gather data on endangered species, and implement conservation programs. Working closely with marginalized communities, NGOs significantly influence policy-making and corporate practices, amplifying their impact on environmental and social issues.

IV. Local Communities and Indigenous People

Local communities, particularly indigenous groups, are among the most affected by environmental degradation. Ensuring their participation, as well as that of marginalized groups, is essential for effective environmental management. These communities often depend heavily on natural resources and ecosystem services for their livelihoods, making any disruption in these services potentially devastating. Additionally, their cultural identities are deeply connected to nature, positioning them as key stakeholders in ecosystem preservation.

Indigenous knowledge systems, enriched with sustainable practices such as forest conservation through sacred groves and crop rotation, provide valuable insights into environmental conservation. Collaborating with local communities ensures that management plans address their needs, minimize conflicts, and promote equitable resource distribution. Empowering these groups through participatory decision-making enhances environmental governance at the grassroots level and strengthens long-term

sustainability efforts. Individuals play a crucial role as stakeholders in environmental management through their choices and behaviours. Besides, the citizens can drive change by adopting sustainable practices such as reducing waste, conserving water and energy, and supporting eco-friendly businesses.

V. Scientists, Researchers, and Academic Institutions

Scientists, researchers, and academic institutions play a vital role in protecting the environment by expanding our understanding, creating innovative solutions, and shaping policies. They provide crucial data on issues like climate change, pollution, and ecosystem damage while developing technologies to address these problems. Universities and research institutions also educate future environmental experts and share knowledge through studies, conferences, and community outreach. By collaborating with governments, businesses, and communities, scientists ensure that decisions are based on solid evidence and drive technological progress. They create models to predict environmental changes, assess risks, and improve our understanding of nature and its connection to human activities. Additionally, they design practical, low-cost solutions tailored to local needs, such as water purification systems or methods to restore soil health. Researchers provide the evidence needed for effective environmental policies and international agreements. Their work is essential for tackling environmental challenges, promoting global sustainability, empowering local and indigenous communities, and ensuring the efficient management of natural resources.

Check your progress No. 2

a. What are the economic aspects of environmental management?

……

……

……

……

……

……

……

b. How does technology play a role in addressing environmental challenges?

……

……

……

……

……

……

c. Why are local communities and indigenous people critical to environmental conservation?

……

……

……

……

……

……

……

d. What role do individuals play in promoting environmental sustainability?

……

……

……

……

……

……

……

5.6. Let us Sum Up

The goal of environmental management is to promote sustainable practices that balance development with ecological preservation. It is a multidisciplinary field that brings together scientific, ethical, economic, technological, and social perspectives to tackle critical environmental challenges. An effective environmental management plan requires the involvement of diverse stakeholders, including governments, businesses, NGOs, local communities, scientists, and individuals. Each of these stakeholders plays a crucial role in implementing policies, driving innovation, and increasing awareness, ensuring the plan's success and long-term impact.

5.7. KEYWORDS

Sustainability: Meeting present needs without compromising future generations' ability to meet theirs.

Environmental Justice: Ensuring fair distribution of environmental benefits and burdens, protecting vulnerable populations.

Stakeholders: Individuals or groups with an interest in or impact on environmental management outcomes.

Resource Efficiency: Using resources responsibly to minimize waste and environmental impact.

Technological Innovation: Developing tools and technologies to monitor, mitigate, and solve environmental challenges.

5.8. SELF-ASSESSMENT QUESTIONS

a. How do social factors such as community engagement and public participation influence environmental management decisions?

b. What are the primary objectives of environmental management, and how do they aim to balance development with ecological preservation?

c. How does environmental management integrate scientific, ethical, economic, technological, and social perspectives to address environmental challenges?

d. How does the principle of stewardship influence our responsibility to protect and manage natural resources for future generations?

e. How do environmental policies like carbon pricing and pollution taxes align economic incentives with sustainable outcomes?

f. Why is environmental education crucial in shaping attitudes and behaviours toward sustainability?

g. How does urbanisation impact environmental challenges, and how can sustainable infrastructure mitigate these effects?

5.9. SUGGESTED READINGS

1. Panzarella, F., Turcanu, C., Abelshausen, B., & Cappuyns, V. (2023). Community capitals and (social) sustainability: Use and misuse of asset-based approaches in environmental management. *Journal of Environmental Management*, *329*, 117122.

2. Carson, R. (1962). *Silent Spring*. Houghton Mifflin.

3. Cunningham, W. P., & Cunningham, M. A. (2017). *Environmental Science: A Global Concern* (13th

ed.). McGraw-Hill Education.

4. Barrow, C. J. (2006). *Environmental Management for Sustainable Development* (2nd ed.). Routledge.
5. Gupta, A. K. (2011). *Environmental Management: Concepts and Practices*. Prentice Hall India.
6. Kolstad, C. D. (2011). *Environmental Economics* (2nd ed.). Oxford University Press.

LESSON : 6

APPROACHES FOR ENVIRONMENTAL MANAGEMENT

STRUCTURE

6.1. INTRODUTION

Environmental management is a multi-faceted approach, which systematically addresses environmental issues to achieve broader objectives of sustainable development. Being a multi- faced approach, environmental management adopts scientific tools for effective implementation, decision-making, and evaluation of strategies and policies designed for protecting, conserving, and sustainably utilizing natural resources while minimizing

the impacts of anthropogenic activities. To ensure the well of the present generation and the future generation, governments around the world have enacted numerous environmental laws and framed policies. To regulate the environmental pollutant, protect and conserve biodiversity in the terrestrial and aquatic ecosystems, legal framework aims to set environmental quality standards. For instance, in India, National Ambient Air Quality Stands (NAAQS) has been established under the Air Act to regulate the air pollutants. Like standards for water and soil quality have also been framed. The Central Pollution Control Board (CPCB) along with Statee Pollution Control Boards (SPCB) are the nodal institutions for the strict compliance of these environmental quality standards. Effective enforcement is ensured through permits, fines, and sanctions. Like wise to ensure the least impact of developmental projects on the environmental quality, Environmental Impact Assessment (EIA) of these projects are carried out following systematic guidelines. Besides, financial incentives which include green bonds, sustainable investment funds, tax relief, and loans are provided for the initiatives that have positive environmental impacts. The aim of the EIAs is to facilitate the identification of the negative impacts associated with the execution of a developmental project followed by mitigatory efforts such that projects are designed and implemented in an environmentally responsible manner.

International agreements, such as the Montreal Protocol on phasing out of Ozone Depleting Substances (ODS), Paris Agreement on climate change, have a very crucial role in creating consensus in guiding efforts for environmental protection. Additionally, development of green technologies such as renewable energy, innovation in energy efficiency, waste management, development of alternative cleaner fuels, water treatment etc. are also promoted both by governmental as well as non-governmental sector. Such technological advancement have been forefront of the global efforts towards environmental sustainability. The advancements in technology have also enabled more accurate and comprehensive environmental monitoring for tracking changes in land use, air and water quality, and biodiversity management which facilitate informed decision-making and adaptive management practices. The active involvement of the community in management of natural resources ensures that management strategies are culturally relevant, socially acceptable, and economically viable. Nowadays many businesses have adopted Environmental Management Systems (EMS) as an integral part of their operations to systematically manage their negative environmental impacts. ISO 14001 is a widely recognized international standard for EMS which helps in the identification, monitoring, and reducing environmental risks.

6.2. LEARNING OBJECTIVES

After going through this chapter, learners should be able to understand:

- The significance of environmental policies towards sustainable development.
- The role of environmental indicators in assessing and monitoring ecosystem health.
- Importance of environmental standards in monitoring environmental quality and pollution control.
- Importance of information exchange and surveillance in effective environmental management.

6.3. APPROACHES FOR ENVIRONMENTAL MANAGEMENT

6.3.1. Economic Policies

Economic policies are among the one of the fundamental schemes of things for managing environmental challenges. Economic policies must be aligned with the broader environmental goal to promote sustainable practices. For instance, climate resilience must be integrated with the existing agricultural policies, so that farmers must have some cushion against extreme events such as floods droughts, hailstorm associated with the climate. Incentives in case of crop failure must be provided to the farmers. Likewise, incentives, subsidies, tradeable permits shall be given to the small-scale businesses and individuals who adopt practices that minimize environmental damage.

6.3.2. Environmental taxes and environmental accounting

Environmental taxes, or green taxes, are financial instruments which are designed to discourage the practices that are unsustainable by imposing cost on pollution, emissions, resource depletion. Likewise, carbon tax is imposed on the industries and individuals as penalty for emitting greenhouse gases, thus pushing them to adopt less carbon intensive practices. Similarly, waste charges, which include charges on landfill usage encourage recycling and waste reduction efforts. Revenue generated from the environmental taxes can be reinvested into green initiatives, such as renewable energy projects or conservation programs.

Environmental Accounting or green accounting integrates environmental costs and benefits into financial decision-making. It involves measuring and reporting the environmental impacts of business activities, alongside traditional financial metrics. This helps organizations understand the true cost of their operations and encourages more sustainable practices. Environmental accounting can include components like environmental management systems, environmental performance indicators, life cycle assessments, and full cost accounting. Together, green taxes and environmental accounting provide a comprehensive framework for promoting environmental sustainability and accountability in both the public and private sectors.

I. Subsidies and Incentives

Shifting to newer technologies is often cost intensive. Businesses and individuals adopting greener practices shall be encouraged by provision of subsidies and financial incentives for reducing costs for adopting green technologies. Government of India has launched several schemes for providing financial support and subsidies for the renewable energy sector for production of wind, solar, and hydroelectric projects to reduce dependency on fossil fuels. Individual interested in the installing roof top solar energy plants are provided with subsidies by the Government of India. Similar subsidies are also given to the farmers to encourage the use of renewable energy. In another scheme popularly known as the FAME (Faster Adoption and Manufacturing of Electric Vehicles), Government of India promote the adoption and production of electric vehicles (EVs) nationwide by offering incentives

on EV purchases. Additionally, subsidies in the renewable energy and agriculture sector are vital tools that accelerate the process of transition toward sustainability while creating economic opportunities in emerging green industries.

II. Tradable Permits and Market Mechanisms

Tradable permits, also known as cap-and-trade systems, set a limit on emissions while allowing businesses to buy and sell emission allowances. This market-based approach creates flexibility and cost-effectiveness in reducing pollution. Companies with surplus allowances can sell them to others, encouraging efficient emission reductions. In Kyoto protocol flexibility mechanisms were introduced to encourage transition to clean energy through international emission trading (IET)mechanism whereby countries with surplus credits could trade their carbon credits in the international market. Similarly, water rights trading is encouraged for managing water resources which limit water extraction in stressed regions. Tradable permits promote innovation and technological advancements as businesses seek cost-effective ways to comply with caps.

III. Polluter Pays Principle (PPP)

The Polluter Pays Principle places the financial responsibility for environmental damage on those who cause it. This principle ensures accountability and incentivizes polluters to minimize their environmental impact. Under this principle, polluters are held accountable for the environmental harm they cause. This includes both preventing pollution and compensating for any damage caused. PPP aims to create an economic incentive for polluters to reduce their emissions or environmental impact. By making pollution more costly, it encourages businesses and individuals to adopt cleaner and more sustainable practices. Those industries releasing pollutants into air or water are required to bear cleanup and remediation costs. The Polluter Pays Principle aligns environmental costs with business operations, encouraging industries to adopt cleaner technologies.

6.4. ENVIRONMENTAL INDICATORS

Environmental indicators are the tools to quantify the human impacts on the terrestrial and aquatic ecosystems. These tools are used to assess the environmental responsibility and sustainability of individuals, organizations, or communities. The common indicators used are

(a) Energy efficiency, (b) Carbon footprint, (c) Water footprint, (d) Environmental impact indicators, (e) Bioindicators, (f) indoor air quality, etc. Environmental indicators provide critical data that helps inform policy decisions, scientific research, and public awareness. Being quantifiable, these indicators can be broadly utilized for the assessment of environmental conditions and changes such as air and water quality, energy efficiency, resource utilization, waste production, carbon emissions, etc. A systematic compilation of these indicators enables scientists, policymakers, and the public to understand the health of ecosystems, identify

emerging issues, and evaluate the effectiveness of environmental policies and actions. Noteworthy to mention that one of the key roles of these indicators is their importance in evidence-based decision making which in turn are used to set priorities, allocate resources, and develop strategies for sustainable development. For example, indicators related to greenhouse gas emissions and energy consumption are essential for crafting climate policies and tracking progress toward emission reduction targets.

Environmental indicators are effective ways of communication and education making it easier for the public and stakeholders to understand the effects of environmental degradation.

Check your progress No. 1

a. What are the key economic instruments used in environmental management?

……

……

……

……

……

……

……

b. Explain the Polluter Pays Principle.

……

……

……

……

……

……

……

……

c. Define environmental indicators?

……

……

…….....

…….....

…….....

…….....

6.5. SETTING OF STANDARDS

Environmental standards are put in place to maintain the environment and control the emission of pollutants. Environmental standards are the numerical values that are set to specify the maximum quantity of harmful pollutants that can be allowed to be released in the environment. Environmental standards are legal rules made through interventions of scientific knowhow and enforced through specified regulatory agencies for ensuring compliance and accountability among stakeholders. Additionally, establishment of clear guidelines and limits, environmental standards help industries and businesses minimize their environmental impact, adopt cleaner technologies, and improve their environmental performance. The types of environmental standards include:

a. **Emission Standards:** These are regulatory limits set to quantify the maximum quantity of pollutants released into the various environmental components (air, water, or soil). For example, limits are set by the Central Pollution Control Board (CPCG) to limit the emission of gases like sulphur dioxide and nitrogen dioxide from the thermal power plants.

b. **Ambient Standards***:* These standards define the maximum acceptable concentrations of pollutants in the environment. For example, maximum acceptable concentrations of criteria air pollutants have been defined under the National ambient air quality standards (NAAQS) set up by CPCB.

c. **Product Standards***:* These standards are established to regulate the environmental impact of specific products during their lifecycle. For example, Bureau of Indian standards has set up energy efficiency ratings for appliances.

d. **Process Standards***:* these standards specify the operational practices to minimize environmental damage from manufacturing units or services. For example, It has been made mandatory to have effluent treatment Plants for wastewater treatment for certain types of industries such Pharmaceutical industry, Dye industry, Paper and pulp industry, Food Processing industries.

6.6. INFORMATION EXCHANGE IN ENVIRONMENTAL MANAGEMENT

Information exchange involves sharing data, knowledge, and insights on environmental issues among various stakeholders, such as government agencies, businesses, research institutions, and communities. This process

aims to enhance decision-making and develop effective strategies for environmental protection. Often, it leverages digital platforms and networks to access and disseminate relevant information, fostering collaborative approaches to environmental management. Information exchange promotes transparency, cooperation, and accountability. Tools for information exchange include

a. **Environmental Reporting***:* Environmental reporting plays a vital role in promoting transparency and sharing progress on sustainability initiatives. It enhances the confidence of end-users in an organization by showcasing its commitment to good environmental practices. For instance, through Corporate Sustainability Reports (CSRs), organizations demonstrate their efforts to improve environmental quality and conserve natural resources.

b. **Environmental Databases***:* These platforms serve as user-friendly interfaces that provide real-time data on environmental conditions. For instance, the CPCB's website portal now offers real-time data for various locations across India. Similarly, data on forest fires and wildlife habitats is also accessible through these platforms.

c. **Public Awareness Campaigns***:* Transparent information exchange enhances public awareness and participation in environmental initiatives, promoting a sense of collective responsibility. It also supports international cooperation, as environmental issues often transcend national boundaries, requiring a unified approach.

d. **Stakeholder Consultations:** Systematic sharing of data, research findings, best practices, and policy updates among stakeholders, including governments, non- governmental organizations, researchers, and the public Workshops, conferences, and public hearings foster dialogue on environmental policies.

6.7. SURVEILLANCE IN ENVIRONMENTAL MANAGEMENT

Environmental surveillance is crucial for monitoring and preserving ecosystem health. It involves systematically collecting, analyzing, and interpreting data on environmental parameters such as air and water quality, biodiversity, and pollution levels. This ongoing monitoring enables early detection of environmental changes and potential threats, facilitating timely and effective responses to mitigate adverse impacts. Surveillance provides essential insights for evaluating environmental policies and regulations, ensuring they remain effective and relevant. By tracking conservation efforts and the implementation of sustainable practices, it supports adaptive management strategies. Additionally, it enhances transparency and accountability by making environmental data accessible to policymakers, researchers, and the public, fostering informed decision-making and encouraging public engagement in environmental protection. Common types of environmental surveillance include:

Air Quality Monitoring*:* A wide range of offline and online tools are available to measure air pollution. Nowadays the use of sensors in combination with satellite systems is widely. Data on air quality is accessible

through websites and mobile applications.

a. **Water Quality Surveillance**: To maintain the quality of water, continuous monitoring of rivers, lakes, and groundwater for contaminants is done.

b. **Deforestation Surveillance***:* The remote sensing and GIS tools detect land-use changes and deforestation trends across the globe. More information in this context can be added through field surveys.

c. **Biodiversity Surveillance***:* Conserving biodiversity is one of the biggest challenges for the environmentalist. Scientists conduct field surveys and use remote sensing tools to monitor species, populations and ecosystem health.

Check your progress No. 2

a. Explain the role of environmental standards.

……

……

……

……

……

……

……

b. Define environmental reporting.

……

……

……

……

……

……

……

c. Describe two types of environmental surveillance and their purposes.

……

……

……

……

……

……

6.8. LET US SUM UP

Environmental management tackles environmental challenges and supports sustainable development using various strategies. These include economic tools like taxes, subsidies, and permits to promote eco-friendly actions, while the Polluter Pays Principle holds polluters accountable. Environmental indicators help measure the health of ecosystems and the impact of policies, and standards are set to control pollution levels. Sharing information encourages collaboration among stakeholders, improving awareness and transparency. Surveillance involves regular monitoring of environmental conditions to quickly address emerging risks. Together, these approaches create a strong framework to protect nature, save resources, and secure a healthy future for upcoming generations.

6.9. KEYWORDS

- **Polluter Pays Principle (PPP):** Polluters bear the cost of environmental damage.
- **Environmental Indicators**: Quantifiable measures used to assess environmental conditions, such as air quality and biodiversity.
- **Environmental Surveillance**: Collecting, analyzing, and interpreting data onenvironmental parameters.

6.10. SELF-ASSESSMENT QUESTIONS

a. What are environmental standards, and how do they contribute to maintaining environmental quality?

b. What role do ambient standards play in defining acceptable pollutant concentrations in the environment, and how are they established?

c. What is the primary goal of environmental management in the context of sustainable development?

d. How does environmental management utilize scientific tools to address environmental challenges?

e. What role do green technologies play in promoting environmental sustainability?

f. Why is community involvement crucial in natural resource management?

6.11. SUGGESTED READINGS

1. Carson, R. (1962). *Silent Spring*. Boston: Houghton Mifflin.
2. Meadows, D. H., et al. (1972). *The Limits to Growth*. New York: Universe Books.
3. Ostrom, E. (1990). *Governing the Commons*. Cambridge: Cambridge University Press.
4. Daly, H. E. (1996). *Beyond Growth: The Economics of Sustainable Development*. Boston: Beacon Press.
5. Hardin, G. (1968). *The Tragedy of the Commons*. Science, 162(3859), 1243-1248.

LESSON : 7

CONCEPT AND TYPE OF BIODIVERSITY

STRUCTURE

7.1. INTRODUCTION

Science has been trying to classify and categorise nature. This has led to an understanding of how it is organised into plant and animal communities. There is so much life on earth that if we use it sustainably, we can keep developing new products from biodiversity for generations to come. This can only happen if we manage biodiversity as a precious resource and prevent species from going extinct.

The word biodiversity comes from combination of two words *'Bio'* meaning *'living'* and *'diversity'* meaning *'variation'*. Hence the variation among the living beings is called biodiversity. The living beings range from small sized microbes to large sized mammals. Whether small or large, each organism plays a unique role and is important for ecological balance and environment.

7.2 LEARNING OBJECTIVES AND LEARNING OUTCOMES

The course is designed to help the students

- understand the concept, importance and values of biodiversity,
- identify various threats to biodiversity, and
- explore the need for and strategies for its conservation.

After the completion of the course, students will be able to

- understand the significance of biological diversity, and
- effectively implement various conservation strategies for its sustainable management.

7.3 CONCEPT AND TYPES OF BIODIVERSITY

7.3.1 What is biodiversity?

'Biodiversity' or 'Biological diversity' refers to the variety and variability among all groups of living organisms. It includes the genetic variations among the individuals of a species, the diversity and richness of plant and animal species across different spatial scales- ranging from local to regional, national and global, and multitude of ecosystems, both terrestrial and aquatic, within a specific area.

7.3.2 Types of Biodiversity

Biodiversity is classified into three different types. It spans from the genetic variability within a species to the variety of species in a particular region, and the organisation of species in an area into distinctive plant and animal communities.

a. Genetic diversity

It forms the foundation of the biodiversity and refers to the variability caused due to countless possible combinations of genes within organisms, imparting unique traits and characteristics to each individual. Genes, the fundamental units of hereditary information, are transmitted from one generation to other. When variations arise within the genes of same species due to new combinations, it is referred to as genetic variability. For example, all wheat varieties belong to the species *Triticum aestivum*, but there are thousands of wild and cultivated varieties of wheat which show variations at the genetic level and differ in their colour, size, shape, aroma and nutrient content of the grain. This is the genetic diversity of wheat.

Each human being is unique, owing to variable genetic makeup. The genetic variability is crucial for maintaining a healthy and sustainable breeding population within a species. The diversity of wild species forms the 'gene pool' that has served as the foundation for the development of crops and domestic animals over thousands of years. Today, wild relatives of crop plants and animals are being used to develop new high-yielding varieties and to breed improved domestic animals.

b. Species diversity

The variety of plant and animal species present in a region constitutes its species diversity, which is observed both in natural and agricultural ecosystems. Certain areas harbour a higher species richness than others. Natural, undisturbed tropical forests exhibit a much greater species richness compared to timber plantations established by the Forest Department. Natural forest support local communities by providing many non-wood products, such as, fruits, fuelwood, fodder, gums, resins, and medicinal resources. In contrast, timber plantations do not provide such diverse resources essential for local consumption. Thus, the value of a natural forest, with its rich biodiversity far exceeds that of a plantation. Currently, scientists have identified and catalogued more than 1.7 million species on earth, with many new species, especially in the flowering plants and insects, still being discovered. Regions with high species diversity are referred to as 'hotspots' of biodiversity. India is one of the recognized mega-diverse countries of the world, harbouring nearly 7-8% of the recorded species of the world, and representing 4 of the 36 globally identified biodiversity hotspots.

Biodiversity hotspots in India

As per the International Union for Conservation of Nature (IUCN) criteria, following 4 regions in India have been recognized as biodiversity hotspots:

The Himalayas: Includes the entire Indian Himalayan region like Jammu and Kashmir, Himachal Pradesh, Uttarakhand, northern part of West Bengal (Darjeeling), Sikkim, northern part of Assam and Arunachal Pradesh and that falling in Pakistan, Tibet, Nepal, Bhutan, China and Myanmar.

Indo-Burma: Includes entire North-eastern India (except Assam), Andaman group of Islands and Myanmar, Thailand, Vietnam, Laos, Cambodia and southern China.

Sundalands: Includes Nicobar group of Islands (and Indonesia, Malaysia, Singapore, Brunei, Philippines)

Western Ghats and Sri Lanka: Includes entire Western Ghats, Tamil Nadu, Kerala, Karnataka, Goa, Maharashtra and Gujarat and Sri Lanka.

c. Ecosystem diversity

Earth hosts a wide range of different ecosystems, each characterized by its unique set of interconnected species adapted to the specific conditions of their habitats. Ecosystem diversity can be defined within a specific geographical area, or administrative unit, such as a country, a State or a district. It includes natural

landscapes like forests, grasslands, deserts, and mountains, etc., and aquatic ecosystems such as rivers, lakes, and oceans. Additionally, human-altered areas such as farmland or grazing lands contribute to the diversity of ecosystem in a region. An ecosystem is considered 'natural' when it remains relatively undisturbed by human activities, and 'modified' when altered for purposes such as agriculture or urban development. Wilderness areas represent ecosystems in their most natural state. India is known for its exceptional variety of ecosystems. Examples include the biogeographic zones of India, as illustrated in the table below, with each zone representing a distinct ecosystem.

BIOGEOGRAPHIC ZONES OF INDIA

S.No.	Biogeographic Region	Characteristics	% area covered	Climate	Predominant Ecosystems	Key Flora & Fauna	Conservation Status
1.	Trans-Himalayan Region	Cold and arid zone to the north of the Great Himalayan range and occurring between 4500 m and 6000 m above sea level. Biogeographic provinces are Ladakh Mountains, Tibetan Plateau, and Sikkim.	5.6	Cold Desert	Alpine Tundra	Tibetan Antelope, Wild Yak, Sea buckthorn	Protected Areas
2.	Himalayan Zone	The highest mountain chain in the world. Its 2400 km-long expanse spans tropical, subtropical, subalpine, and alpine ecosystems. Biogeographic provinces are Northwest Himalaya, West Himalaya, Central Himalaya, and East Himalaya.	6.4	Alpine	Coniferous Forests, Meadows	Snow Leopard, Himalayan Monal, Rhododendrons	Biosphere Reserves
3.	Indian Desert Zone	Hot and dry in summer and cold in winter. Its biogeographic provinces are Thar and Rann of Kutch.	6.6	Arid	Desert	Desert Fox, Great Indian Bustard, Cacti	Desert National Park
4.	Semi-Arid Region	A transition zone between desert and denser forests. Its biogeographic provinces are Punjab plains, Gujarat, Haryana and parts of Rajasthan.	16.6	Semi-Arid	Thar Desert, Grasslands	Blackbuck, Indian Bustard, Khejri Trees	Wildlife Sanctuaries
5.	Western Ghats	A global biodiversity hotspot consisting of plains and mountains with peaks 800 m – 1500 m above sea level on average. Its biogeographic provinces are Malabar Plains and Mountains.	4	Tropical	Rainforests, Shola Forests	Nilgiri Tahr, Lion-tailed Macaque, Orchids	UNESCO World Heritage Sites
6.	Deccan Plateau	A semi-arid region lying in the rain shadow of the Western Ghats. Its biogeographic provinces are Central Highlands, Chotanagpur, Eastern Highlands, Central Plateau, and Deccan South.	42	Semi-Arid	Scrublands, Dry Deciduous	Indian Leopard, Sloth Bear, Teak	National Parks
7.	Gangetic Plains	Fertile plains in the Himalayan foothills. Its biogeographic provinces are Upper and Lower Gangetic Plains.	10.8	Temperate	Deciduous Forests	Bengal Tiger, Ganges River Dolphin, Sal Trees	Wildlife Sanctuaries
8.	Northeast Region	Includes the plains and non-Himalayan hill ranges of north-eastern India spanning a range of lowland and montane vegetation types. Its biogeographic provinces are Brahmaputra Valley and North-east Hills.	5.2	Subtropical	Tropical Rainforests	Rhododendrons, Red Panda, Elephants	Biosphere Reserves
9.	Coastal region	India's 8000 km long coastline spans a range of terrestrial and aquatic ecosystems including forests (tropical dry evergreen and mangrove). Its biogeographic provinces are East Coast, West Coast and Lakshadweep.	2.5	Tropical	Mangroves, Coastal Scrubs	Sea Turtles, Fish Species, Coconut Trees	Coastal Regulation Zones
10.	Andaman & Nicobar Island	Consisting of nearly 600 islands. Its biogeographic provinces are Andamans and Nicobar group of islands.	0.3	Tropical	Tropical Rainforests	Mangroves, Coral Reefs, Sea Turtles, Dugong	Protected Areas, Sanctuaries

Check your Progress No. 1

1. What are the three types of biodiversity, and how are they different?

……

……

……

……

……

……

……

2. Explain genetic diversity with the help of an example.

……

……

……

……

……

……

……

3. What are biodiversity hotspots? Name biodiversity hotspots of India.

……

……

……

……

……

……

……

……

7.3.3. Importance and values of Biodiversity

Biodiversity plays a crucial role in the lives of living organisms, especially humans. It serves both intrinsic and practical purposes, meeting fundamental needs like food, water, shelter, fuel and medicine. In addition, it supports essential ecosystem services, including climate regulations, pollination, nutrient cycling and seed dispersal, along with countless other benefits yet to be fully understood.

Values of Biodiversity

Biodiversity holds various values which may be categorized into the following types:

- **Ecological value**: Biodiversity holds great ecological value because it is crucial for maintaining ecological balance. Any disruption in the intricate harmony among various organisms can lead to significant challenges, which may threaten the human survival.
- **Social Value**: Biodiversity has distinct social values attached with different societies. Social value refers to aesthetic, cultural, spiritual and recreational values and the resulting health benefits from these activities. Goods and services provided by ecosystems to our society include provisioning services such as food, fodder, fuel, fiber, etc., regulatory services such as climate regulation, purification of air and water, decomposition of waste, nutrient cycling, etc., the cultural values such as serving as source of inspiration for artisans, writers, painters, poets, sculptors, and musicians.
- **Ecosystem values**: The environmental significance of biodiversity can be understood by examining ecosystem functions. Ecosystem services include maintenance of soil fertility, retention groundwater through vegetation, and production of oxygen by terrestrial plants and microalgae.
- **Economic Value**: Biodiversity has great economic value because economic development depends upon efficient and economic management of biotic resources.
- **Consumptive Value**: The consumptive value can be assigned to things like food, fuel, leaves, forest products etc. which can be consumed locally and do not figure in national and international market.
- **Productive Value**: Biodiversity produces many products harvested from nature and sold in commercial market. Productive value of biodiversity relates to these products that are marketed commercially.
- **Ethical and Moral Value**: Ethical value is one of the indirect values of the biodiversity and is rooted in the understanding that humanity is part of the nature and human beings are just one species among others. It relates to biodiversity conservation, i.e. protecting all life forms as all species have an inherent right to exist.
- **Aesthetic Value**: Biodiversity makes the planet beautiful. Without it, Earth would resemble a barren, lifeless planet like many others in the universe. Biodiversity enriches life and enhances the beauty of the planet. The aesthetic value of the biodiversity has been expressed in many ways through art,

poetry, songs, literature, music and dance. Forests are closely linked with religion and culture. Many types of trees are worshipped in tribal and Hindus societies such as Peepal, Tulsi, Banana etc. Many birds, butterflies and mammals have aesthetic value for human beings. Eco-tourism generates significant revenue as people are drawn to wilderness areas to experience and appreciated the aesthetic beauty of the biodiversity.

7.3.4 Threats to Biodiversity

Biodiversity serves as a vital reservoir of resources for producing food, medicine and industrial goods. However, the growing demands driven by rapid population explosion have led to its steady depletion. Numerous plants and animal species have already gone extinct and many more are on the brink of extinction.

Biodiversity loss refers to the reduction of species due to displacement or extinction. While the loss of the single species might seem insignificant, scientists estimate that the current extinction rates are far above the natural background rate seen throughout Earth's history. The loss of biodiversity can trigger cascading effects within ecosystems due to intricate relationship between the species. For instance, the decline in one species may lead to the loss of others. The decline in the global biodiversity is a critical environmental challenge with profound implications for both humanity and the Earth's ecosystems. The 2024 Living Planet Report highlights about 73% decline in the average size of monitored wildlife populations over the past 50 years, with most severe losses in Latin America and the Caribbean (95%), Africa (76%), Asia–Pacific (60%), and in freshwater ecosystems (85%). Current species extinction rates are estimated to be 10–100 times higher than the natural baseline, mostly driven by anthropogenic pressures like overpopulation, habitat destruction, exploitation, and climate change.

The various factors posing a threat to the biodiversity include:

- **Habitat loss**

  Habitat loss includes habitat destruction, altering the physical environment such that a species can no longer live there, and habitat fragmentation, which involves dividing a habitat into discontinuous patches. The habitat loss or destruction occurs due to the large industrial and commercial activities associated with agriculture, irrigation, construction of dams, mining, fishing etc. The habitats are fragmented into pieces by roads, fields, canals, power lines, towns etc. The isolated fragment of habitats restricts the potential of species for dispersal and colonization. In addition, the habitat fragmentation also brings about microclimatic changes in light, temperature, wind etc.

- **Pollution**

  Pollution is the release of harmful chemicals or other materials into the environment. Some types of air pollution results in acid deposition and climate change. Nutrient pollution of water bodies

due to fertilizer overuse results in eutrophication. The most dreaded factor inducing loss of biodiversity is environmental pollution which include air pollution, Water pollution, industrial pollution, pollution due to chemical Pastes, pesticides radioactive materials etc.

- **Over exploitation**

  The natural resources are over exploited to meet growing rural poverty, intensive technological growth and globalization of economy. All these factors together may be responsible for the extinction of a number of species. Overexploitation involves removing organisms at a faster rate than they can be replenished. Examples include the poaching of elephants, unsustainable hunting for bush meat, overfishing, and overcollection of slow-growing plants and fungi.

- **Invasive species**

  Invasive species are those occurring outside of their historical distribution that cause ecological and/ or economic harm. Invasive species can overpredate or outcompete native species, sometimes causing their extinction or extirpation. Examples of invasive species include the Asian carp, zebra mussels, purple loosestrife, and the European starling.

- **Diseases**

  Since the animals are more vulnerable to infection, the anthropological activities may increase the incidence of diseases in wild species, leading to their extinction.

- **Shifting or Jhum cultivation**

  The shifting or Jhum cultivation by poor tribal people greatly affects the forest structure which is a store house of biodiversity.

- **Poaching of wildlife**

  A number of wildlife species are becoming extinct due to poaching and hunting.

- **Climate Change**

  The release of greenhouse gases, like carbon dioxide and methane, when burning fossil fuels for energy causes climate change. Not only does climate change involve an increase in average global temperature, but it also results in unpredictable weather patterns. Climate change threatens biodiversity through a variety of mechanisms and can cause species range shifts, mismatched biotic interactions, sea level rise, and ocean acidification.

7.3.5 Causes of Extinction of Species

A. Natural Causes of Extinction

- Climate Change is the major factor responsible for the extinction of species. Climate influence the

species existence at large scale. The unpredictable temperature rise or fall and variation in rain fall certainly affect the life cycle of all species. Those which could not keep up with the fluctuating environmental conditions and changing chemical make-up of their surroundings ultimately vanish. This creates a gap in the food chain and makes the survival of dependent species more difficult. Increase in global temperature has invited more epidemics and diseases to the existing plants and animals and pose a threat to their existence.

- Changes in Sea Levels or Currents also contribute to species extinction. These changes are due to melting freshwater. Marine life depends on the high density salted water that sinks and forms the currents. The spread of Ocean floor and its rise also affects sea level. A small rise in the ocean floor may submerge the nearby occupied land. The volcanic activity inside or near sea may dissolve harmful gases in the water, that changes the chemical composition and thus make life difficult for marine organisms.
- Asteroids/Cosmic Radiation- Collision of asteroids with earth surface completely destroys the impact site and the shock is felt all round the world. Such interplanetary objects including the outer space and Sun which are responsible for emission of cosmic radiations. It is hypothesized that excess exposure to cosmic radiation may lead to gene mutation and weakening of gene-pool of species in future.
- Acid Rain- Acid rain forms due to the reaction between rainwater and sulphur dioxide and/or nitrogen oxides in the atmosphere. It increases the soil acidity and adversely affects all living forms especially plants. It can also pollute rivers and lakes to a possibly lethal level.
- Disease/Epidemic- Every species on the planet has internal defense mechanisms and the ability to fight diseases. But, due to fluctuating climate certain species are losing their ability to combat diseases. Certain species are turning more prone to diseases and epidemics, which may lead to their subsequent extinction.
- Spread of Invasive Species- Invasive species are a threat to local species of a territory. They compete for the resources that the other species depend on. Once competition gets pronounced, the mechanism of survival of the fittest works and one of the species, usually the natural one, gets kicked off from the territory.

Natural factors that usually work at slow pace contribute a smaller sum towards species extinction, as compared to human factors that are responsible for maximum extinction.

B. Human Causes of Extinction

Human activities occur at a faster rate and cause higher extinction rates. Human activities that are mostly responsible for the present extinction rates are:

- Increased human population
- Destruction/Fragmentation of Habitat
- Pollution
- Climate Change/Global Warming

According to studies done by the international Union for Conservation of Nature and Natural Resources (IUCN), human induced extinctions is not a new phenomenon, but it is becoming much more rapid now.

Check your Progress No. 2

1. How do consumptive and productive values of biodiversity differ?

   ……

   ……

   ……

   ……

   ……

   ……

   ……

2. How does habitat loss impact biodiversity?

   ……

   ……

   ……

   ……

   ……

   ……

   ……

3. What are the causes of extinction of species?

   ……

   ……

.....

.....

.....

.....

7.4 STRATEGIES FOR CONSERVATION OF BIODIVERSITY

Human have been directly or indirectly dependent on biodiversity for sustenance to a considerable extent. However, increasing population pressure and development activities have led to a large-scale depletion of the natural resources. There is an urgent need not only to manage and conserve the biotic wealth but also restore the degraded ecosystems. Conservation of biodiversity and genetic resources is essential for food security, medicinal benefits and ecological balance in nature.

Conservation of biodiversity can be achieved by *In-situ* and *Ex-situ* conservation methods.

7.4.1 In-situ Conservation

In-situ conservation of biodiversity is the conservation of species within their natural habitat. In this method, the natural ecosystem is maintained and protected.

The in-situ conservation has several advantages. Following are the important advantages of *in-situ* conservation:

(a) It is a cost-effective and convenient method of conserving biodiversity.

(b) Many living organisms can be conserved simultaneously.

(c) Since the organisms are in a natural ecosystem, they can evolve better and can easily adjust to different environmental conditions.

Certain protected areas where *in-situ* conservation takes place include national parks, wildlife sanctuaries and biosphere reserves.

- **National Parks:** These are small reserves maintained by the government. Its boundaries are well demarcated and human activities such as grazing, forestry, habitat and cultivation are prohibited. For e.g., Kanha National Park, Bandipur National Park.
- **Wildlife Sanctuaries:** These are the regions where only wild animals are found. Human activities such as timber harvesting, cultivation, collection of woods and other forest products are allowed here as long as they do not interfere with the conservation project. Also, tourists visit these places for recreation.

- **Biosphere Reserves:** Biosphere reserves are multi-purpose protected areas where the wildlife, traditional lifestyle of the inhabitants, and domesticated plants and animals are protected. Tourist and research activities are permitted here.

7.4.2 Ex-situ Conservation

Ex-situ conservation of biodiversity involves the breeding and maintenance of endangered species in artificial ecosystems such as zoos, nurseries, botanical gardens, gene banks, etc. There is less competition for food, water and space among the organisms.

Ex-situ conservation has the following advantages:

(a) The animals are provided with a longer time and breeding activity.

(b) The species bred in captivity can be reintroduced in the wild.

(c) Genetic techniques can be used for the preservation of endangered species.

- **Botanical gardens**: Initially, botanical gardens were created for aesthetic reasons where different plants were grown for pleasure. However, over a period, the botanical gardens have become centres for scientific research for the propagation of many local and exotic plants.
- **Zoological Parks:** Zoos are places where animals are kept in captivity. Many such animals are rare or endangered and, in many cases, extinct in their natural habitat. The Zoos play an important role in the breeding of rare and endangered species. Sometimes, after successful breeding, many species are released in their natural environment. Thus, the Zoos are a major contributor in checking the extinction of the endangered species. The zoos also significantly contribute in creating awareness and interest in wildlife, specially among the children.
- **Gene banks/ Seed banks:** These are cold storages where seeds are kept under controlled temperature and humidity for storage. This is an important way of preserving the genetic resources. Seeds preserved under controlled conditions (minus temperature), remain viable for long durations of time. Besides storage, gene banks are also well equipped for scientific research related to seed processing, seed drying and testing.
- **Tissue banks:** There are many plant species that do not propagate through seeds but by vegetative means, for example, potato, sugarcane, garlic etc. The tissue banks conserve such vegetatively propagated materials. Other plant parts are also preserved in tissue banks for carrying out research related to tissue culture and biotechnology. This forms the basis for the generation of high yielding and disease resistance varieties of crops and vegetables.
- **Cryopreservation:** This is the newest application of technology for preservation of biotic parts. Here,

the organism or their parts are stored in liquid nitrogen (-196 degree C). The metabolic activities of the organisms are suspended under low temperature which are later used for research purposes.

Check your Progress No. 3

1. What is the difference between the *in-situ* and *ex-situ* conservation methods?

……

……

……

……

……

……

7.5 LET US SUM UP

Biodiversity does not have a general definition. It refers to our living environment, its beings, and the sustainable use of natural resources. It is divided into genetic, species and ecosystem diversity. Biodiversity is important to mankind and has multitude of values. However, various factors like habitat loss, pollution, overexploitation, invasive species, poaching, and climate change are accelerating the loss of biodiversity. *In-situ* conservation methods can help to protect the species within their natural habitats and *ex-situ* methods help to preserve the species outside their natural habitats.

7.6 KEYWORDS/GLOSSARY

1. **Biodiversity**: The variety and variability of life forms, encompassing genetic, species, and ecosystem diversity.
2. **Genetic Diversity**: The variation in genes within a species, resulting in unique traits for individuals.
3. **Species Diversity**: The variety and abundance of species in a specific region or ecosystem.
4. **Ecosystem Diversity**: The range of different ecosystems, including natural landscapes and human-modified areas.
5. **Sustainable Development**: Using biodiversity responsibly to ensure resources are available for future generations.
6. **Biodiversity Hotspots**: Regions with exceptionally high species richness and endemism.
7. **Ecosystem Services**: Benefits provided by ecosystems, such as nutrient cycling, pollination, and climate regulation.

8. ***In-situ* Conservation**: Conservation of biodiversity within its natural habitat (e.g., national parks).

9. ***Ex-situ* Conservation**: Conservation of biodiversity outside natural habitats (e.g., botanical gardens, gene banks).

7.7 SELF ASSESSMENT QUESTIONS

a. Define biodiversity. Why it is important?

b. How ecosystem diversity differs from species diversity? Explain with the help of examples.

c. What is ecosystem value of biodiversity, and how it is important?

d. What are the various values of biodiversity? Explain with examples.

e. What are the various threats to the diversity?

f. What factors are responsible for extinction of species?

g. What are various *in-situ* methods for the conservation of biodiversity?

h. What are various *ex-situ* methods for the conservation of biodiversity?

7.8 SUGGESTED READINGS

1. Barthlott, W. and Winiger, W. 2001. Biodiversity-A Challenge for Development Research and Policy. Springer-Verlag, New York.

2. Gaston, K.J and Spicer, J.I. 2004. Biodiversity: An Introduction. Blackwell Publishing Company, USA.

3. Huston, M.A. 1994. Biological Diversity: The coexistence of species on changing landscapes. Cambridge University Press, UK.

4. Krishnamurthy, K.V. 2018. An Advanced text book on Biodiversity- Principles and Practice: Oxford and IBH publishing company Pvt. Ltd. New Delhi.

5. Maiti P.K. and Maiti P. 2011. Biodiversity Perception, Peril and Preservation. PHI Learning Private Limited, New Delhi.

6. Ray S. and Ray A.K. 2010. Biodiversity and biotechnology. New central book Agency (P) Ltd. Kolkata.

7. Richard. B. Primack. 1998. Essentials of conservation biology. Sinauer Associates, Inc. USA.

8. Spicer, J. 2021. Biodiversity- A Beginner's Guide (revised and updated edition) Oneworld Publications.

LESSON : 8

STRATEGIES FOR CONSERVATION OF BIODIVERSITY-INSTITUTION AND EX-SITU ENVIRONMENTAL LEGISLATIONS

STRUCTURE

8.1 INTRODUCTION

Environment issues have posed significant challenges globally. India has also been affected by varied environmental problems and has taken various legislative and policy measures to combat environmental issues complying with international obligations and national duties. Environmental degradation and environmental pollution are the most serious risks being faced by humanity and other living organisms. The risk is so grave that it affects the survival of ecosystems and living organisms. The international community has made significant efforts to combat such hazards and have, apart from entering various treaties, established institutions to cope up with these environmental challenges. Various countries across the globe,

including India, have enacted legislations dealing with variety of environmental challenges. Though various legislative and policy measures have been taken at the national and international level, yet the environment remains a serious concern, and the efforts have not sufficed.

The concern for environment has its early beginning in India with the concern for public health, water supply, and disposal of waste. The rise in the awareness of environmental degradation due to impact of modern industrial development in the 1970s brought a major change in the perception at the national and regional level. The rapid growth of institutions to deal with environmental protection has been accompanied by the rise in public awareness about environmental Issues. Environmental laws in India form a comprehensive framework designed to safeguard the country's environment, natural resources, and ecological balance.

In 1860, for the first time, an attempt was made to control especially water and atmospheric pollution through criminal sanctions under the Indian Penal Code, 1860.

The post-independence era, until 1970, did not see much legislative activity in the field of environmental protection. Starting in the early 1970s, several key environmental legislations were enacted in the country to protect the environment and ecology comprehensively.

The history of environmental governance in post-independent India started 25 years after Independence when the then Prime Minister, Indira Gandhi, returned from the United Nations (UN) Conference on Human, Environment and Development in Stockholm in 1972.

Environmental laws on Water (Prevention and Control of Pollution) Act (1974), Air (Prevention and Control of Pollution) Act (1981) and Forest Conservation Act (1980) along with the umbrella act of Environment Protection Act (1986) were passed. An Environment Policy and Strategy Statement was issued in the year of the UN Conference on Environment and Development in 1992.

Within five years of Stockholm Conference, in the year 1976, under the 42nd Amendment, the Constitution of India was amended to include Protection and Improvement of Environment as constitutional mandate.

Initially, the Constitution of India had no direct provision for environmental protection. Global consciousness for the protection of environment in the seventies, Stockholm Conference and increasing awareness of the environmental crisis prompted the Indian Government to enact 42nd Amendment to the Constitution in 1976 in which Articles 48A and 51A(g) were incorporated.

Article 48A of the Constitution of India is a Directive Principle of State Policy enshrined in Part IV of the Constitution of India, requires the state to protect and improve the environment, and to safeguard the country's forests and wildlife.

Article 51A(g) of the Constitution of India is a fundamental duty enshrined in Part IVA of the Constitution

of India and casts a duty on every citizen to protect and improve the natural environment and have compassion for all living beings.

Thus, environment protection in India is governed by combination of constitutional and legislative provisions, policies, and judicial decisions aimed at ensuring the conservation of natural resources and sustainable development.

8.2. LEARNING OBJECTIVES AND OUTCOMES

The course is designed to introduce the students to

- Fundamentals of environmental law, and
- Legislative and constitutional measures for environment protection.

After the completion of the course, students will be able to

- understand the legal structure of the country regarding environment protection.

8.3. ENVIRONMENTAL LEGISLATIONS IN INDIA

ENVIRONMENTAL LAWS in India comprises a set of rules and regulations concerning air quality, water quality, and other aspects of the environment. The government of India has made numerous acts to protect the environment, biodiversity and the natural resources of the country and to combat various environmental challenges.

The important and impactful environmental laws and acts are listed and explained below.

8.3.1. WATER (PREVENTION AND CONTROL OF POLLUTION) ACT,1974

Water (Prevention and Control of Pollution) Act, 1974 (hereinafter referred to as Water Act) was enacted in pursuance to the resolutions passed by State legislatures under Article 252 of the Constitution of India. The Act was first in the series of laws dealing with pollution in India.

Objectives

The Act was passed with the following main objectives:

- to make provisions for prevention and control of Water Pollution
- to provide legal regime aimed at maintaining or restoring wholesomeness of water
- to establish the Central and State Pollution Control Boards to regulate and curb water pollution
- to assign to such Boards powers and functions relating to prevention and control of Water Pollution

As of date, the Act is applicable throughout the territory of India. The act consists of eight chapters and 64 sections. The latest amendment in the Water (Prevention and Control of Pollution) Act, 1974 was made in the year 2024.

Salient Features

The Act lays down a comprehensive definition of the word "Pollution" in the context of water pollution which means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisms.

Implementation Mechanism

Water Act provides for the establishment of Central Pollution Control Board (CPCB) at the National Level and for establishment of State Pollution Control Boards (SPCB) in States and provides them sufficient powers and functions to regulate, prevent and control water pollution by industries and to lay down standards for discharge of effluents in streams, essentially aiming to maintain the wholesomeness of water bodies across the country. Anyone violating any provision of the act can face legal consequences which are mentioned under Chapter VII of the act including fines and imprisonment. The Water Act also lays down the provisions for the establishment and composition of Central, State and Joint Boards.

Functions of CPCB

It advises the Central Government on any matter concerning the prevention and control of water pollution. CPCB performs these same functions for union territories along with formulating policies related to the prevention of water pollution and coordinating activities of different SPSBs.

- The primary goal of the Central Board as stated in accordance with the Water Act shall be to promote cleanliness of streams and wells in different areas of the States.
- Advise the Central Government on any matter concerning the prevention and control of water pollution.
- Co-ordinate the activities of the State Boards and resolve dispute among them.
- Provide technical assistance and guidance to the State Boards, carry out and sponsor investigations and research relating to problems of water pollution and prevention, control or abatement of water pollution.
- Collect, compile and publish technical and statistical data relating to water pollution and the measures devised for its effective prevention and control.

Functions of State Pollution Control Board

The function of the state board is to:

- Plan a comprehensive program for preventing and controlling the pollution of the wells and streams in the state and to secure its execution.
- Control sewage and industrial effluent discharge by approving, rejecting, and granting consent to discharge.
- Advise the State Government on any matter concerning the prevention, control or abatement of water pollution.
- Collaborate with the Central Board in organizing the training of persons engaged or engaged in programmes relating to prevention, control or abatement of water pollution.

Prevention and Control of Water Pollution

The Water Act, 1974, lays out key provisions under Chapter V to prevent and control water pollution in India. The chapter focuses on the role of Pollution Control Boards and provides mechanisms for monitoring, regulation, and enforcement.

- Powers have been given to the State Pollution Control Boards (SPCBs) to issue directions to industries, local authorities, and individuals to prevent, control, or abate water pollution and to set effluent standards and specify conditions for the discharge of pollutants into water bodies.
- SPCBs can grant or refuse consent to establish or operate an industry or process that discharges pollutants into water bodies based on compliance with prescribed standards.
- SPCBs are empowered to inspect industrial units and collect water samples to verify compliance.
- Non-compliance can result in penalties, including closure or restriction of operations. Violators of the provisions or directions under the Act are liable to face fines and imprisonment. Continued violations attract additional penalties.

8.3.2. WATER (PREVENTION AND CONTROL OF POLLUTION) CESS ACT, 1977

The Water (Prevention and Control of Pollution) Cess Act, 1977, was enacted by Parliament to enhance the resources of the Central and State Pollution Control Boards established under the Water (Prevention and Control of Pollution) Act by levying a ‘Cess’ on water usage by designated persons and authorities. This Act complemented the Water Act by generating revenue for the Boards, enabling them to function smoothly and achieve the objectives of the Water Act.

Cess Act,1977 was applicable in all the States and Union territories where Water Act, 1974 was applicable.

Water cess was levied only on industries and the local authorities. The 'Industry' as per the Act included any operation or process, or treatment and disposal system, which consumed water or gave rise to sewage effluent or trade effluent but did not include any hydel power unit. The 'Local Authority' meant a municipal corporation or a municipal council or cantonment board or any other body, entrusted with the duty of supplying water.

Levy/imposition of Cess

The 2003 Amendment in this Act extended its applicability to all the industries and the local authorities which were required to pay cess both on water consumption and supply.

Collection of Cess, Assessment Procedure and Rebate

The levy of water cess was linked to consumption of water for different purposes. Water meters of prescribed standards and norms were to be fixed by the water consumers/suppliers at the entrance of water supply connections. Where any person failed to install meter of prescribed standard, then the Central government could cause such meter to be installed and the cost of meter together with installation cost was to be recovered from the person.

An incentive was provided in the Act for installation of plant for treatment of sewage or trade effluent. If any person liable to pay cess, installed such plant for treatment of sewage or trade effluent, then he was entitled to 25% rebate on the amount of cess payable by him/authority.

Fines and Penalties

Under the act, if any person failed to pay the cess within the time specified in the assessment order, he was liable to pay the cess together with interest. Interest was chargeable at the rate of two percent per month. Fraction of a month was treated as equivalent to a month.

However, the act empowered the Central Government to exempt any industry, consuming water below the quantity specified in the notification, from the levy of water cess.

The Water (Prevention and Control of Pollution) Cess Act 1977 earlier made with the objective of augmenting the resources of the Pollution Control Boards, has been totally repealed through provisions of Section 18 of the Taxation Laws (Amendment Act) 2017 notified by Ministry of Finance (Department of Revenue) vide. G.S.R 665(E), New Delhi, the 28th June 2017. The water cess was earlier being collected by the State Pollution Control Boards / Pollution Control Committee's, but as per the GST guidelines the cess will be covered under GST with effect from 1st July 2017.

8.3.3. FOREST (CONSERVATION) ACT OF 1980

Forests are a vital important resource bestowed by nature, and it is the responsibility of every citizen to

protect and preserve these ecosystems. However, the accelerating rate of deforestation has disrupted the natural balance. Hence, it became crucial to enact laws to protect and conserve forests.

One of the earliest legal frameworks for forest protection was the Indian Forest Act, 1865, which was later replaced by Indian Forest Act, 1927. Indian Forest Act, 1927 was primarily focused on safeguarding the commercial interests of the British Empire of India, with little emphasis on the conservation and protection of the forests. After independence, Forest (Conservation) Ordinance was passed in 1980 which was later replaced by Forest (Conservation) Act, 1980, through section 5 of the act. The Forest Conservation Act, 1980 imposed restriction on the use of forests for non-forest purposes.

Purpose

The Forest (Conservation) Act, 1980 in India herein referred to as FCA (1980) was enacted to conserve forests and regulate the use of forest land.

As of date, the Act is applicable throughout India. The act consists of five sections. The latest amendment in the Forest (Protection) Act, 1980 was made in the year 2023.

Restrictions on the dereservation of forests

The FCA (1980) restricts the de-reservation of any reserved forests or use of forest land for non-forest purposes without the approval of Central Government. The Advisory committee constituted by the Central government under this act can grant approval for dereservation for any important unavoidable government project or developmental activity.

Constitution of Advisory Committee

For the purpose of the Act, the Central Government may constitute a committee to advise the government with regard to the grant of approval for dereservation purpose or any other matter which may be referred to it by the Central Government.

Rules and guidelines

The Central Government has been empowered under the amendment act of 2023 to issue such directions, to any authority, or any organisation, entity or body recognised by the Central Government, State Government or Union territory Administration, as may be necessary for the implementation of this Act.

The Central Government has been authorized to make rules and guidelines for the diversion of forest land for non-forestry purposes after following a proper procedure. The Act requires the approval of the Central Government before a state “deserves” a reserved forest, uses forest land for non-forest purposes, assigns forest land to private person or corporation, or clears forest land for the purpose of reforestation.

The Forest (Conservation) Act, 1980 was amended by the Forest (Conservation) Amendment Act, 2023, which came into force on December 1, 2023. The amendment act 2023 introduces exemptions for certain types of forest land, such as those located within 100km of the international borders or Line of Control or Line of Actual Control allowing them to be used for construction of strategic linear project of national importance without requiring forest clearance. It also exempts forest land along railway lines, public roads maintained by the Government, which provides access to a habitation, or to a rail, and roadside amenity up to a maximum size of 0.10 hectare in each case, from the Act. Additionally, it expands the list of permissible activities on forest land, including zoos, safaris, and eco-tourism. It also establishes guidelines for compensatory tree plantation to offset tree felling. All development projects utilizing forest land must include compensatory afforestation plans.

Also, any assignment of forest land to private entities requires central government approval with specific terms and conditions.

The act also imposes penalty for contravention of the provisions of section 2 (restriction on the dereservation of forests or use of forest land for non-forest purpose) in the amendment Act as simple imprisonment for a period which may extend to fifteen days.

Check your Progress No.1

1. What are the objectives of Water Act, 1974?

   ……

   ……

   ……

   ……

   ……

   ……

2. What is meant by ‘Water Cess” under Water (Prevention and Control of Pollution) Cess Act, 1977?

   ……

   ……

   ……

   ……

   ……

3. What is meant by 'restrictions on the dereservation of forests" under the Forest Conservation Act 1980?

……

……

……

……

……

……

8.3.4. AIR (PRESERVATION AND CONTROL OF POLLUTION) ACT OF 1981

The first law in India to address air pollution problem. It was enacted to implement the decisions made at the United Nations Conference on Human Environment in Stockholm in 1972, in which India participated.

Purpose

The act aims to control and prevent air pollution in India and its main objectives are:

- To provide for prevention, control, and abatement of air pollution.
- To provide for the establishment of the boards at the central and state levels to implement the act**.**
- To assign the Boards the powers and functions to implement the provisions of the Act.

The Air (Prevention and Control of Pollution) Act, 1981 extends to the whole of India. The Air Act, 1981 was amended in 1987, primarily to include noise as an air pollutant and further strengthen regulations to control air pollution in India. Some of the provisions of the act were also amended in 2023.

Salient Features

- The Air Act 1981 expanded the role of the boards both CPCB and SPCB established under Water Act (1974). These boards which were originally responsible for managing water pollution, were also tasked with controlling air pollution.
- The Air Act is divided into 7 chapters having 54 sections that aim to define the terms associated with air pollution and the procedure to be followed for preventing the air pollution problem.

Functions of the Central Board- The functions of the Central Board shall be to:

- To advise the Central Government on any matter concerning the improvement of the quality of air and the prevention, control or abatement of air pollution.

- To plan and cause to be executed a nation-wide programme for the prevention, control or abatement of air pollution.
- To co-ordinate the activities of the State and resolve disputes among them.
- To provide technical assistance and guidance to the State Boards, carry out and sponsor investigations and research relating to problems of air pollution and prevention, control or abatement of air pollution.

Functions of the State Board- The function of any State Board as specified in the act are as follows-

- To plan a comprehensive programme for the prevention, control or abatement of air pollution and to secure the execution thereof.
- To advise the State Government on any matter concerning the prevention, control or abatement of air pollution.
- To collect and disseminate information relating to air pollution.
- To collaborate with the Central Board in organizing the training of persons engaged or to be engaged in programmes relating to prevention, control or abatement of air pollution and to organize mass-education programme relating thereto.
- To inspect air pollution control areas at such intervals as it may think necessary, assess the quality of air therein and take steps for the prevention, control or abatement of air pollution in such areas.

Chapter IV of the act deals with prevention and control of air pollution. The State government in consultation with the State boards can declare any area or areas within the State as air pollution control area for the purpose of this Act. State government can also give instructions to the authorities for ensuring standards for emission from automobiles. There shall be restrictions on the establishment of any industrial plant in the air pollution control area without the previous consent of the State Pollution control board. Any person operating any industrial plant, in any air pollution control area shall discharge the emission of air pollutants within the standards laid down by the State Board.

Penalties have been fixed for contravention of certain provisions of the act both in terms of imprisonment or with a fine or in certain cases with both.

8.3.5. ENVIRONMENT (PROTECTION) ACT, 1986

The Environment (Protection) Act, 1986, herein referred to as EPA,1986, was enacted to implement the decisions made at the United Nations Conference on Human Environment in Stockholm in 1972. This act was passed under Article 253 (legislation for giving effect to international agreements) of the constitution of India,

Objectives

- An Act to provide for the protection and improvement of the environment and for matters connected therewith.

EPA, 1986 provides a comprehensive legislation for environment protection in India, enacted after Bhopal Gas Tragedy. The act extends to the whole of India and consists of five chapters and 26 sections. The act provides the definition of environment, environmental pollutants and environmental pollution. The potential scope of the Act is broad, with "'environment" defined to include water, air, land and the inter-relationships which exist among these, and human beings, and other living creatures, plants, microorganisms and property.

Central Government has been empowered under Sections 3-6 to take measures to protect environment. The prevention, control and abatement of environmental pollution is covered under Sections 7-21.

Salient Features

Environment Protection Act 1986 is called the Umbrella legislation as it covers a wide range of environmental issues and provides a comprehensive framework for their resolution. It provides a framework for the protection and improvement of the environment through measures such as:

- The Section 3 (I) of the act empowers the Central Government "to take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environment pollution"
- The Environment (Protection) Act, 1986 authorizes the Central Government to prohibit or restrict the setting and /or operation of any industrial facility on environmental grounds.
- It empowers the Central Government to establish authorities charged with the mandate of preventing environmental pollution in all its forms and to tackle specific environmental problems that are peculiar to different parts of the country.
- The most recent amendments to the Environment (Protection) Act, 1986 are the Environment (Protection) Sixth Amendment Rules, 2023 and the Environment (Protection) Amendment Rules, 2023. These rules were issued by the Ministry of Environment, Forest and Climate Change (MoEFCC) on May 17, 2023 and revised the emission standard of particulate matter for industrial boilers.
- The Environment (Protection) Rules lay down procedures for setting standards of emission or discharge of environmental pollutants.
- Eco-sensitive zones or ecologically fragile areas are notified by MoEFCC under EPA, 1986 – 10 km buffer zones around protected areas.

Statutory bodies under the EPA, 1986:

1. Genetic Engineering Appraisal Committee
2. National Coastal Zone Management Authority (later converted to National Ganga Council under the Ministry of Jal Sakti)

8.4 NATIONAL ENVIRONMENTAL EDUCATION ACT 1990

The **National Environmental Education Act of 1990** (NEEA) one of the earlier acts enacted by the United States Congress to promote environmental literacy and awareness through education. The Act emphasizes integrating environmental education into formal and informal learning settings to foster informed decision-making and responsible behaviour towards the environment.

The act was created by the United States Congress in response to several environmental problems, including global warming, ocean pollution, and species diversity decline. The act established a program within the Environmental Protection Agency (EPA) to carry out its goals. The EPA's Office of Environmental Education is responsible for implementing the program, which includes:

- **Grants**: Awarding grants to elementary and secondary schools to develop environmental curricula
- **Fellowships**: Awarding fellowships to post-secondary students
- **Advisory Council**: Establishing the National Environmental Education Advisory Council to advise on developing educational programs

The goals of the act include increasing public understanding and environmental literacy of the environment, promote environmental education programs, encourage professional development, addressing threats to human health and environmental quality, addressing international environmental problems and to recognizes exceptional contributions to environmental education through awards and honours.

The Act remains a cornerstone of efforts to promote environmental stewardship and awareness in the U.S.

B. Check your Progress-2

1. What is the objective of Air Act, 1981?

……

……

……

……

……

……

……

……

2. Write three powers of Central Government under Environment Protection Act, 1986?

……

……

……

……

……

……

……

……

3. What was the purpose of National Environmental Education Act, 1990?

……

……

……

……

……

……

……

8.5 LET US SUM UP

India has robust legal framework for environment protection, rooted in its Constitution and supported by various laws and regulations. Stockholm Declaration passed during Stockholm conference in 1972 motivated India to enact various legislations dealing with environmental issues and the beginning was made by enacting Wildlife (Protection) Act, 1972 followed by Water (Prevention and Control of Pollution) Act, 1974. This was followed by amendment of the Constitution by Constitution (Forty Second Amendment) Act, 1976 when provisions relating to environment were incorporated in the Directive Principles of State Policy in

the form of Article 48A and in Fundamental Duties {Article 51A(g)}. This led to development of environmental law, policy and jurisprudence in India. Thereafter, India has enacted various environmental legislations like Air (Prevention and Control of Pollution) Act, 1981; Environment (Protection) Act, 1986; The Wildlife (Protection) Act, 1972; Forest Conservation Act, 1980; The Biological Diversity Act, 2002; Public Liability Insurance Act, 1991; National Green Tribunal Act, 2010 etc. India has enacted various rules and regulatory mechanism for dealing with waste disposal and management in an environmentally sound manner. The environmental laws and constitutional provisions reflect India's commitment to balancing development with sustainability.

8.6 KEYWORDS/GLOSSARY

Air Pollutants: Any solid, liquid, or gaseous substance (including noise) that may cause harm to the environment or living beings when present in the atmosphere.

Air Quality Standards: Regulations defining acceptable levels of pollutants in the air to safeguard health and the environment.

Central Pollution Control Board (CPCB): The national authority responsible for planning and executing air pollution control programs.

State Pollution Control Boards (SPCBs): State-level bodies ensuring the implementation of pollution control measures.

Water Pollution: The contamination of water bodies making them harmful for human use or supporting life.

Reserved Forests: Forest areas designated for preservation and managed by the government, with restrictions on activities like logging.

Protected Forests: Forests given partial protection, where local communities may have limited rights.

Non-Forest Purposes: Activities like agriculture, mining, or urbanization, which require approval for diversion of forest land.

Afforestation: The process of planting trees to create forests in non-forested areas.

Environment: Encompasses water, air, land, and the interrelationship between living beings, including human beings, plants, and microorganisms.

Environmental Pollutant: Any substance, whether solid, liquid, or gaseous, present in a concentration that may harm the environment.

Environmental Pollution: The contamination of the environment by pollutants, leading to adverse effects on health, ecosystems, or property.

Hazardous Substance: Materials that pose a risk to health, safety, or the environment.

Environmental Clearance: Official permission required for projects likely to have an environmental impact, ensuring adherence to sustainability standards.

Environmental Education: Programs and initiatives aimed at increasing public awareness and understanding of environmental issues to promote sustainable practices.

Environmental Literacy: The knowledge and skills required to make informed decisions about environmental challenges and solutions.

Office of Environmental Education: A division established under the act to oversee and implement environmental education programs.

Environmental Education Grants: Financial support provided to schools, organizations, and institutions to develop and promote environmental education projects.

Environmental Internships and Fellowships: Opportunities for students and professionals to gain hands-on experience and training in environmental fields.

National Environmental Education Foundation: An organization created to support and enhance environmental education efforts across the United States.

SELF-ASSESSMENT QUESTIONS

1. How does the Indian Constitution address the issue of environmental protection?
2. Discuss in detail the powers and functions of Central Board under Water (Prevention and Control of Pollution) Act, 1974.
3. What is the difference between The Indian Forest Act of 1927 and Forest Conservation Act 1980?
4. Give salient features of Air (Prevention and Control of Pollution) Act, 1981.
5. Why is Environment Protection Act, 1986 called the umbrella act?
6. Give salient features of National Environmental Education Act, 1990.

8.8 SUGGESTED READINGS

1. Jaswal, P. S. and Jaswal, N. 2014. Environmental Law. Allahabad Law Agency, Allahabad.
2. Justice T S Doabia. 2022. Environmental & Pollution Laws in India 4th Edition. LexixNexis. Publishers.

3. Khan, I. A. 2002. Environmental Law (2ndEd.), Central Law Agency, Allahabad. Krishnamoorthy, B. 2017. Environmental Management: Text and Cases (3rdEd.), PHI learning Private Ltd, New Delhi.
4. Shastri, S. C. 2005. Environmental Law (2ndEd.), Eastern Book Company, Lucknow.
5. Tilak, A. S. 2009. Environmental Law (1stEd.), Snow White Publication, Mumbai.

****