

**BLOCK**

**4**

**CONSERVATION OF ENVIRONMENT**

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**UNIT 12**

**ENVIRONMENTAL CONSERVATION AND MANAGEMENT**

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**UNIT 13**

**ENVIRONMENTAL IMPACT ASSESSMENT-METHODS AND  
TECHNIQUES**

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**UNIT 14**

**ENVIRONMENTAL STANDARDS AND MONITORING**

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**GLOSSARY**

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# **BGGCT- 135**

## **ENVIRONMENTAL GEOGRAPHY**

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### **BLOCK 1 INTRODUCTION TO ENVIRONMENTAL GEOGRAPHY**

- Unit 1 Concepts and Scope of Environmental Geography
  - Unit 2 Ecology and Ecosystems
  - Unit 3 Biogeography
- 

### **BLOCK 2 HUMAN-ENVIRONMENT RELATIONSHIPS**

- Unit 4 Equatorial Regions
  - Unit 5 Desert Regions
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  - Unit 7 Coastal Regions
- 

### **BLOCK 3 ENVIRONMENTAL PROBLEMS AND MANAGEMENT**

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  - Unit 9 Air Pollution
  - Unit 10 Solid and Liquid Waste
  - Unit 11 Biodiversity Loss
- 

### **BLOCK 4 CONSERVATION OF ENVIRONMENT**

- Unit 12 Environmental Conservation and Management
  - Unit 13 Environmental Impact Assessment-Methods and Techniques
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### **BLOCK 5 ENVIRONMENTAL ISSUES, PROGRAMMES AND POLICIES**

- Unit 15 Environmental Issues
  - Unit 16 United Nations and the Environment
  - Unit 17 Environmental Policies with Special Reference to India
-

## BLOCK 4: CONSERVATION OF ENVIRONMENT

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In the previous block we have discussed in details about various environmental problems namely air pollution, solid and liquid waste and loss of biodiversity. Simultaneously we have also discussed their management. Major focus of the present block is to understand various issues related to environmental conservation. There are three units in the block that describe and explain various aspects of environmental conservation namely Environmental Impact Assessment (EIA), environmental standards and monitoring. Let us discuss briefly about each unit.

**Unit 12 Environmental Conservation and Management:** As the title of the unit suggests we will describe and explain the concept of environment, environmental conservation and management. We will also explain meaning, scope and assessment of environmental conservation and management. In the final section we will elaborate different facets related to sustainable development. After reading this unit, you will be convinced that sustainable development and conservation of the environment are necessary for the survival and well-being of the present and future generations.

**Unit 13 Environmental Impact Assessment-Methods and Techniques:** In this unit you will learn about the meaning, methods and applications of environmental impact assessment (EIA). This unit will help you to promote an understanding of how EIA is conducted and how it works as important scientific tool for decision making and environmental conservation with holistic approach.

**Unit 14 Environmental Standards and Monitoring:** This unit deals with the environmental standards and monitoring process to know the state of environment. It will help in understanding the standards, norms and regulation as a base for the achievement of the goals of sustainable development. It will also help you to know the environmental standards in relation to various environmental parameters and its implications on the environment

We hope after studying this block, you will have a holistic understanding about environmental problems and management at global and national level.

Our best wishes are with you in this endeavour.

# UNIT 12

## ENVIRONMENTAL CONSERVATION AND MANAGEMENT

### Structure

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- |   |  |
|---|--|
| 12.1 Introduction<br>Expected Learning Outcomes   | 12.4 Sustainable Development<br>Concept and Meaning of<br>Sustainable Development<br>Environmental Sustainability<br>Earth Summit<br>Millennium Development Goals<br>(MDGs)<br>Sustainable Development Goals<br>(SDGs) |
| 12.2 Concept of Environment and<br>Environmental Conservation<br>and Management<br>Concept of Environment<br>Environmental Conservation<br>and Management | 12.5 Summary   |
| 12.3 Meaning, Scope and<br>Assessment<br>Meaning of Environmental<br>Conservation and Management<br>Scope and Assessment of<br>Environment Conservation   | 12.6 Terminal Questions<br>12.7 Answers<br>12.8 References and Further<br>Readings   |

### 12.1 INTRODUCTION

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Everything that surrounds or affects an organism during its entire life span is collectively known as the environment. It is comprised of both living and non-living components which are also known as biotic and abiotic components respectively. All organisms are dependent on their environment for food, energy, water, oxygen, shelter and other needs. We have studied about these aspects of environment in Block 1. Due to undesirable changes in various components of the environment and destruction of the natural resources, we are facing so many environmental and health problems. You might be thinking about various measures to be adopted for mitigating these negative impacts. Conservation of the environment has become an important concern for humankind to minimise the above mentioned consequences. Through careful planning and management of environmental problems like pollution (Air, water, soil, and land) deforestation, loss of habitat and biodiversity can be significantly reduced.

In this unit, we will describe concept of environment, environmental conservation and management in section 12.2. In section 12.3 we will explain meaning, scope and assessment of environmental conservation and management. In the final section i.e. section 12.4 we will elaborate different facets related to sustainable development. After reading this unit, you will be convinced that sustainable development and conservation of the environment are necessary for the survival and well-being of the present and future generations.

## **Expected Learning Outcomes**

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After completing the study of this unit, you should be able to:

- define the meaning and scope of environment;
- explain the concepts related to environmental conservation and management
- describe the scope of environmental conservation and management;
- explain about sustainable development;
- analyse various steps taken for the conservation of the environment.

## **12.2 CONCEPT OF ENVIRONMENT AND ENVIRONMENTAL CONSERVATION AND MANAGEMENT**

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Before explaining in detail about scope and assessment methods of environmental conservation, we must know about the concept of environment, environmental conservation and management in brief. We have already discussed in detail about the concept of environment in Unit 1. However in the below given section we will recapitulate in brief the concept so that it would be easier for you to contextualise and relate it.

### **12.2.1 Concept of Environment**

The environment can be defined as the physical surrounding of man/woman of which he/she is a part and on which he/she is dependent for his/her activities like, production, consumption as well as physiological functioning. His physical environment varies from water, air and land to natural resources like soil and plants, animals and ecosystems, energy carriers etc. The interaction and relationship between environment and organism are highly complex. Organisms cannot live alone without interacting with other organisms. Each organism has another organism as a part of its environment. Each and everything which we need for our sustenance form our environment. The environment is very dynamic and not static. Both biotic and abiotic components and factors of the environment keep changing continuously.

Environment performs several functions like it provides resources, assimilates the waste material, sustains life and provides aesthetic services. All these services mentioned above are known as ecosystem services and can be

grouped under three categories. These three categories are (i) provisioning, regulating, and (iii) socio-cultural.

**Table 12.1 Components of Environment**

<b>Abiotic</b>	<b>Biotic</b>
Atmospheric Gases	Green Plants
Wind	Non-Green Plants
Water	Decomposers
Energy	Parasites
Temperature	Symbionts
Fire	Man
Land and Topography	Animal
Soil	
Geologic Substratum	

After knowing about the major components of environment and its importance, let us understand the concept of environmental conservation and management,

### **12.2.2 Environmental Conservation and Management**

The term environmental conservation defines anything we do to protect our planet and conserve its natural resources. In simpler terms we can express environmental conservation as the management of natural resources, in a planned way, to retain diversity and the balance in nature. It also includes optimum and judicious use of natural resources in such a way that the needs of the present generation are met and at the same time enough resources are available for the future generations to meet their own needs.

The world is experiencing rapid population growth, particularly in the developing countries. The rapid population growth is causing a situation of resource stress because resources are in the limited volume to support a certain number of populations. Apart from number, the present-day lifestyle and rapid industrial development have resulted in over-exploitation of our natural resources. This has increased human activities in the natural ecosystem and resulted many environmental problems such as loss of wildlife, pollution of air, water, land and noise, deforestation, diminishing fossil fuels (coal, oil and natural gas), concentration of pesticides and insecticides in harmful proportions in the bodies of living organisms. These actions have led to many global environmental problems namely loss of biodiversity, desertification, global warming, climate change and depletion of ozone layer.

Till now you must have realised that the major focus of any environmental management is to reduce or minimise exploitation of natural resources.

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#### **SAQ I**

What are the two major components of the environment?

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## **12.3 MEANING, SCOPE AND ASSESSMENT**

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After discussing the concept of environment and environmental conservation and management, in this section we will explain meaning, scope and assessment of environmental conservation and management. Let us first discuss meaning of environmental conservation and management in the below given sub-section.

### **12.3.1 Meaning of Environmental Conservation and Management**

The recent advancement in the field of technology and rapid industrial development has had a bad impact on our natural resources. The large-scale extraction and exploitation of non-renewable resources such as minerals, oil and coal or damage done to the physical environment have created a serious threat to our ecosystem. The energy resources like coal and petroleum are depleting at a faster rate, and once these are depleted, we have to depend on some other source of energy. The problems regarding depletion of natural resources occur due to over-exploitation and unplanned development. The resources are available in the limited amount to cater to a certain population. Population pressure is leading to over-exploitation of natural resources faster than the regeneration capacity of the environment. For example, it takes a long time in the formation of coal and petroleum. These are also non-renewable resources. Therefore, it is very important for us to protect and ensure the conservation of our natural resources. There are various ways to conserve natural resources. The central idea of the conservation of natural resources is the optimum utilisation. The optimum use of the resources can be obtained by the principle of reducing the use, re-using the resources and recycling the materials. Generally, when the environmental problems arise, environmental managers plan to reduce the wastage or damage.

The major environmental problems have been degradation in the quality of natural resources - for example, degradation in the natural quality of land, soil, water and air etc. At the same time loss to the wildlife, flora and fauna, is leading towards serious disruption in the ecosystem. These destructions to the natural ecosystem further causing bigger global problems like global warming and climate change. Various efforts have been made for the conservation of our environment in the last three decades.

**Environmental Management Plan:** Therefore there is a need for sound and effective Environmental Management Plan. Can you suggest what should be considered while making an Environmental Management Plan? An Environmental Management Plan should ideally consist of the following:

1. Administrative and technical set-up for management of environment. institutional arrangements proposed with other organizations /government authorities for effective implementation of proposed environmental management plan;



2. Mechanism of self-monitoring for compliance with environmental regulations;
3. Integrating environmental management plans in the development process, measures for minimizing use of natural resources, such as water, land, energy, etc., and make provision for reuse and recycle;
4. Environmental audit of various mitigation measures proposed for different components/sections; and
5. Setting up environmental management cell and formulation of monitoring protocol for various environmental components.

By now, you must have a clear idea about concept and meaning of environmental conservation and management. Let us now discuss scope and assessment of environmental conservation.

### **12.3.2 Scope and Assessment of Environment Conservation**

The environment is an integration of several subjects that includes both science and social studies. The scope of environmental conservation and management is extremely wide and covers some aspects of nearly every major discipline. The scope also includes a technological and economic aspect of environmental conservation and management.

The major scopes of the environmental conservation are as follows;

- i) Control of environmental pollution and natural resource utilisation and development
- ii) Addressing issues related to global warming and climate change.
- iii) Management of extreme events i.e. natural hazards and disasters
- iv) Development in the field of environmental engineering.
- v) Ecosystem management and habitat conservation etc.

Environmental management is completely a growing and dynamic concept. It is mainly related to the management of the environment encompassing a business or development. It generally represents the organisational structure, responsibility sequences, processes and preconditions for the implementation of environmental corporate policy. The major functions of good environmental management are setting of the target and monitoring, information and communication management, supporting the decision making. Environmental management also includes internal and external auditing of various projects and its implementation.

### **12.3.3 Environmental Impact Assessment**

Environmental Impact Assessment (EIA) is a formal procedure generally used for the prior assessment of positive or negative environmental consequences of a plan, policy, program, or project prior to the final decision to move forward with the proposed action. EIA is an approach which seeks to improve development by a prior assessment.

Environment impact assessment includes;

- (i) Appraisal of existing environmental conditions
- (ii) Appraisal of existing and proposed production methods
- (iii) Probable impacts of the existing and proposed project.
- (iv) Review of technology and required improvement.

We will discuss Environmental Impact Assessment in detail in the next unit.

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## SAQ 2

a. Conservation of the environment is important for:

- (i) Animals
- (ii) Plants
- (iii) Animals and plants
- (iv) All organisms

b. National parks and sanctuaries are established for:

- (i) Conservation
- (ii) Pets
- (iii) Hunting
- (iv) Recreation

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## 12.4 SUSTAINABLE DEVELOPMENT

Till now you must have realised that the ultimate aim of environmental planning and management is to proper utilisation of resources without doing any harm or minimum harm to the environment.

### **12.4.1 Concept and Meaning of Sustainable Development**

"There's enough in the world to meet the needs of everyone but there's not enough to meet the greed of everyone". - Mahatma Gandhi

The concept of sustainable development is derived from the Agenda 21 document of Earth Summit in 1992. The world commission on environment and development (Brundtland Commission) defined Sustainable Development as that which ***"meets the needs of the present without compromising the ability of the future generations to meet their own needs"***. If you closely read this definition you can understand the essence behind this concept. One can say that this is an ideal or cherished goal for which every country or society has been striving. It advocates for maintaining a balance between economy, society and environment. Therefore it is being argued that any development would be sustainable if it is environment friendly, economically viable and socially inclusive and desirable.

Let us analyse this in detail in the section given below.

### **12.4.2 Environmental Sustainability**

Environmental sustainability is comprised of sustainable yield of renewable resources, sustainable disposal of waste and development of renewable substitute of non-renewable resources. There are certain conditions of

environmental sustainability. The first is the rate of harvest of natural resources should not exceed the rate of regeneration. Secondly, the rate of waste generation should be less than the assimilative capacity of the environment, and lastly, comparable renewable resources should be developed for the depletion of nonrenewable resources. The concept of sustainability also provides an understanding about the major threat to our physical environment due to increased human activities. Unplanned and unregulated exploitation of natural resources are leading towards risk of depletion. Therefore, it has become very important to sustain or maintain our natural environment.

There are three principles of sustainability. When these three principles are strictly adhered, this gives a complete solution to the problem of sustainability. These three principles are three pillars that provide a strong base for sustainability. These three pillars are social sustainability, environmental sustainability and economic sustainability (Fig. 12.1). The most important among these is environmental sustainability. If the problems related to environmental sustainability are not tackled effectively, then other principles of sustainability cannot be made strong. The environment is the greater system on which most all other activities are dependent. Therefore, the first and foremost criteria before starting any developmental activities, it has to be assessed that whether such activities are environmentally bearable or not. Simultaneously, it has to be assessed whether it is economically viable and socially equitable or not.



**Figure 12.1: Environmental Sustainability**

After discussing in detail about sustainable development, let us discuss certain important summit and conferences that shape the direction of conceptualisation and implementation of plans and programmes related to sustainable development.

### **12.4.3 Earth Summit**

In the year 1992, more than a hundred heads of different countries met in Rio de Janeiro in Brazil, for the first International Earth Summit. The summit was organised for addressing the urgent issues and problems of environmental conservation and socio-economic development at the global level. The

assembled leaders signed the Declaration on “Environment and Development which is referred as Agenda 21. It was a comprehensive plan of action to be taken globally, nationally and locally by organisations of the UNO, governments and major groups in every area in which human impacts on the environment”. The Rio Convention endorsed the global Forest Principles and adopted Agenda 21 for achieving Sustainable Development in the 21st century.

#### **12.4.4 Millennium Development Goals (MDGs)**

Another major effort for achieving sustainable development were made in September 2000, wherein world leaders came together at the United Nations Headquarters in New York to adopt the United Nations Millennium Declaration. This was an effort towards continuing the momentum which was initiated in the Rio Summit. The Declaration committed nations to a new global partnership to reduce extreme poverty and hunger, and set out a series of eight time-bound targets for the next fifteen years i.e. 2000-2015. This commitment is known as the Millennium Development Goals (MDGs). There are eight goals with 21 targets. To check the progress made in each target, a series of measurable indicators were also formulated. The MDGs emphasized three areas. These are human capital, infrastructure and human rights. The basic rationale behind this was of increasing living standards.

The 8 MDG Goals are as follows:

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development

#### **12.4.5 Sustainable Development Goals (SDGs)**

After the Rio Summit, 1992, the countries of the world met again in 2012 at the United Nations Conference on Sustainable Development, popularly coined as Rio+20 in Rio de Janeiro. The main takeaway of the conference was a document titled “**The Future We Want**”, in which the new agenda for the post-2015 era was posted in front of world communities. The world leaders have shown their commitment to migrate from the Millennium Development Goals (MDGs) to the Sustainable Development Goals (SDGs). These are the post 2015 intergovernmental development agreement. The predecessor was the Millennium Development Goals. SDGs are the group of seventeen goals which consist of 169 targets and 304 indicators, as proposed by United Nation General Assembly’s Open Working Group on

SDGs to be achieved by 2030. After the negotiations, the agenda titled “Transforming Our World: the 2030 agenda for Sustainable Development” was formally adopted at the United Nations Sustainable Development Summit. SDGs are the outcome and non-binding document of Rio+20 conference (2012) held in Rio De Janerio. The group of seventeen goals are presented in the below given figure 12.2.



**Fig. 12.2: Seventeen Sustainable Development Goals**

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### SAQ 3

How many goals are there in SDGs?

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### SAQ 4

How many goals and targets were there in Millennium Developmental Goals?

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## 12.5 SUMMARY

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In this unit you have studied:

- Environmental conservation and management is the protection of our natural resources and natural ecosystem through careful planning and executing various policies and programmes.
- Environment provides us with a variety of goods and services necessary for our sustenance. However, the development of modern farming or cultivation, Industrialization, rapid population growth has had a great impact on planets natural resources due to over exploitation. Therefore, conservation of our natural resources is a must in the present situation.
- Environmental sustainability is comprised of sustainable yield of renewable resources, sustainable disposal of waste and development of

renewable substitute of non-renewable resources. There are certain conditions of environmental sustainability.

- SDGs are the group of seventeen goals which consist of 169 targets and 304 indicators, as to be achieved by 2030. After the negotiations, the agenda titled “Transforming Our World: the 2030 agenda for Sustainable Development” was formally adopted at the United Nations Sustainable Development Summit.

## **12.6 TERMINAL QUESTIONS**

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1. What is Environment? Why has it become important in recent years?
2. What do you understand by environmental conservation? Why is its need for the conservation of the environment?
3. What are the major threats to the environment?
4. What is sustainable development?

## **12.7 ANSWERS**

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### **Self-Assessment Questions (SAQ)**

1. biotic or living and abiotic or non-living
2. a-iv; b-i
3. Seventeen
4. Eight goals and 24 targets

### **Terminal Questions**

1. Refer to Section 12.2
2. Refer to Section 12.3
3. Refer to Section 12.3
4. Refer to Section 12.4

## **12.8 REFERENCES AND FURTHER READINGS**

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# UNIT 13

## ENVIRONMENTAL IMPACT ASSESSMENT-METHODS AND TECHNIQUES

### Structure

13.1	Introduction Expected Learning Outcomes	13.4	Environmental Impact Assessment Methods and Techniques Ad hoc Method Matrix Method Networks Method Map Overlays Method
13.2	Meaning and Classifications of Environmental Impact Assessment Meaning of Environmental Impact Assessment Classification of Environmental Impact Assessment	13.5	Environmental Impact Assessment Process in India
13.3	Scope of Environmental Impact Assessment	13.6	Summary
		13.7	Terminal Questions
		13.8	Answers
		13.9	Further/Suggested Readings

### 13.1 INTRODUCTION

In the previous unit, we have discussed in detail about environmental conservation and management. You might recall that environmental impact assessment is one of the major components of environmental management. We have also discussed briefly about various components of environmental impact assessment in the previous unit. This must have provided you an idea about Environmental Impact Assessment. In this unit we will discuss in detail various aspects of environmental impact assessment.

In this unit, we will describe meaning of Environmental Impact Assessment in section 13.2. In this section, we will also describe classification of Environmental Impact Assessment. In section 13.3 we will explain the scope of Environmental Impact Assessment. Section 13.4 will elaborate different

methods and techniques related to Environmental Impact Assessment. In the final section i.e. section 13.5 we have presented a brief discussion on Environmental Impact Assessment Process in India. In brief, this unit will help you to promote an understanding of how EIA is conducted and how it works as important scientific tool for decision making and environmental conservation with holistic approach.

## **Expected Learning Outcomes**

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After reading this unit, you should be able to:

- Describe the basic concepts of Environmental Impact Assessment;
- Elaborate the scope of Environmental Impact Assessment;
- Explain various methods and techniques of Environmental Impact Assessment; and
- Describe Environmental Impact Assessment processes in India.

## **13.2 MEANING AND CLASSIFICATION OF ENVIRONMENTAL IMPACT ASSESSMENT**

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You might know that Environmental Impacts Assessment (EIA) is one of the important assessment tools with the policy makers, planners, developers and native community of the concerned region, where developmental projects are planned to implement. This tool is an integrated part of the environmental management and planning system to maintain environmental sustainability and ecological stability. Therefore, EIA is mandatory for environmental management, planning and mitigating measure. The ultimate aim of this exercise is to address and minimize negative impacts and maximize positive impacts.

### **13.2.1 Meaning of Environmental Impact Assessment**

Before discussing in detail about Environmental Impact Assessment the first and foremost thing comes to our mind is what does it mean? Therefore, let us discuss some of the definitions and try to derive the meaning.

According to **Morris and Therivel (2001)** EIA can be defined as:

***“a process by which information about the environmental effects of a project is collected, and taken into account by the relevant decision making body before a decision is given on whether the development should go ahead or not”.***

According to **Bartlett and Kurian (1999)** EIA is considered as:

***“a science and an art, as it uses combination of scientific approaches to investigate, evaluating and predicting the environmental impacts while accepting the social-political nature of decision-making and public***

***participation of stakeholders during planning and implementation of developmental project.”***

According to International Association for Impact Assessment (IAIA) and IEA (1999) Environmental Impact Assessment is:

***‘the process of identifying, predicting, evaluating and mitigating the biophysical, social and other relevant effects of development proposals prior to major decisions being taken and commitments being made’.***

Can you identify some of the commonalities amongst all the definitions cited above? Some of the aspects which are implicitly or explicitly mentioned in these definitions are as follows:

1. It ensures that environmental considerations are explicitly addressed and incorporated into the development decision-making process.
2. It anticipates and avoids, minimise or offset the adverse biophysical, social and other relevant effects of development proposals.
3. It protect the productivity and capacity of natural systems and the ecological processes which maintain their functions; and
4. It promotes development that is sustainable and optimise resource use and management opportunities.

Therefore, we can summarise that EIA is a systematic process and a legislated element of the project development process in many countries. It requires consultation and public participation and the publication of an EIA report, describing the likely significant impacts in detail.

Do you know whether we assess EIA in a singular way or in diverse ways? Yes, we assess in a diverse ways. Similarly, EIA can be classified on the basis of purpose, spatial units, temporal scale and types of developmental activities. Let us discuss the classification of EIA in the below given section.

### **13.2.2 Classification of Environmental Impact Assessment**

On the basis of the purpose, spatial unit and time scale EIA are classified into following types as given below. You will get more clarity when we will discuss various methods in section 13.4.

**(i) Rapid EIA:** Rapid EIA is based on preparation of assessment report compiled on the basis of one season data to see the likely environmental impacts of any proposed development activity as per the guidelines and requirement of the concerned departments/ agencies namely Ministry of Environment Forest and Climate Change (MoEF & CC) and Central Pollution Control Board (CPCB). Rapid EIA is speedier process to complete EIA within short period of time. This helps to decide whether, comprehensive EIA is required or not.

**(ii) Comprehensive EIA:** Comprehensive EIA is usually undertaken after the initial screening of rapid EIA. More than two season data is required for analysis and preparation of comprehensive EIA. The purpose of comprehensive EIA is to assess some detrimental effects on the environment and identifying potential impacts and modeling exercise have been carried out to predict and evaluate impacts to prepare management plan to make project eco-friendly and sustainable. The main difference between rapid EIA and comprehensive EIA is the time scale.

**(iii) Cumulative Impact Assessment (CIA):** CIA is the process of systematically analyzing and evaluating combined socio-economic and environmental changes on the basis of combined effects from different project in specific geographical region. It aims to consider the effects of multiple actions or impacts on the environment. CIAs are conducted across the actual and potential impacts of a number of activities or projects that may combine over time and/or space

**(iv) Strategic Environment Impact Assessment (SEA):** *“SEA is a systematic process for evaluating the environmental consequences of proposed policy, plan or programme initiatives in order to ensure they are fully included and appropriately addressed at the earliest appropriate stage of decision-making on par with economic and social considerations”* (Sadler and Verheem, 1996).

**(v) Regional and Sectoral EIA:** Regional EIA fulfills the need for micro-level environmental integration which may not be able to address at individual projects or activity. It will address cumulative impacts at regional scale to develop regional developmental plan in the context of individual project level EIA. Regional EIA approach makes possible appropriate integration of socio-economic development and management and conservation of natural resources within the carrying capacity of the particular ecosystem and limitations to achieve sustainable development goals.

Sectoral EIA will help to address specific environmental issues and a problem that may be during a project planning and implementation at some specific sector. EIA should be conducted at the context of regional and sectoral level planning. Sectoral level development plans can integrate with sectoral environmental concerns.

**(vi) Project Level EIA:** Project level EIA refers to the developmental activity in isolation and at individual project level. Thus, it may not effectively integrate the cumulative effects of the development of a region.

**(vii) Life Cycle Assessment:** Life cycle assessment is based on the assessment of the impacts during all stages of a project i.e. designing or planning, implementation and production stages of the project. This approach is beneficial to minimize the environmental costs and give options to lower the adverse impacts for the longevity of the project.

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## SAQ I

### Choose the correct alternative/s

(a) "EIA is a systematic process and a legislated element of the project development process". Which of the following statements are not correct explanations of the statement?

- (i) Ensure that environmental considerations are explicitly addressed and incorporated into the development decision-making process;
- (ii) Increase the carrying capacity of the region;
- (iii) Anticipate and avoid, minimise or offset the adverse significant biophysical, social and other relevant effects of development proposals;
- (iv) Minimize the project cost and increase the employment in the region.

(b) Which one of the following EIA methods is appropriate to assess the effects of multiple actions within one geographical region?

- (i) Strategic Environment Impact Assessment (SEA)
  - (ii) Cumulative Impact Assessment (CIA)
  - (iii) Comprehensive EIA
  - (iv) Regional EIA and Sectoral EIA
- 

## 13.3 SCOPE OF ENVIRONMENTAL IMPACT ASSESSMENT

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Till now, we have discussed about meaning of EIA by citing some of the widely used definitions. We have also discussed various types of EIA conducted all over the world the basis of the purpose, spatial unit and time scale. This must have given you a fair amount of idea about the scope, utility or purpose of EIA. In this section we will discuss the scope of EIA.

- (i) **Scientific tool to determine the impacts:** As mentioned in the previous section, EIA is a scientific tool to determine the impacts; beneficial or adverse, of various project activities on the natural and human environment. It can be applied in such a way to act as a bridge to the science of environmental analysis and the policy implications for resource management. It will strengthen the knowledge of decision makers about the environmental costs and risks of a project so that alternatives mitigation measures can be considered prior to a decision to set up a project.

Rio Declaration, 1992 has also endorsed the significance of EIA through Principle 17 of the Declaration. Under this principle It calls for use of EIA as a national decision making instrument assessing the project activities for adverse impacts on the environment. Priority was also given to the role and responsibility of national competent authority in the decision making process.

- (ii) **Investigate, identify, evaluate and predict environmental impacts at an early stage:** It aims to investigate, identify, evaluate and predict environmental impacts at an early stage in project planning and design. It will also be helpful to find solutions to reduce adverse impacts, shape projects to suit the local environment and locally acceptable.
- (iii) **Develop confidence building and fulfil the gaps of communication:** EIA is also helping to develop confidence building and fulfil the gaps of communication among project proponents, regulatory agencies and all stakeholders and target groups of the concerned developmental project activities. In other words, EIA is helpful to fill the gaps between project proponents, local communities and government and other stakeholders who are directly or indirectly linked with the various stages of project activities.
- (iv) **Participation of all the stakeholders in the decision-making process:** EIA is primarily an opportunity to allow all the stakeholders to participate in the decision-making process who are directly and indirectly linked and are potentially affected.
- (v) **Reflects the social and cultural viewpoints:** As EIA supports the public participation and reflects the social and cultural viewpoints and therefore it is not restricted only to scientific opinions alone. This may also enhance the transparency and accountability of the implementing agency to maintain confidence among all the stakeholders for smooth functioning and environmental sustainability.
- (vii) **Studies the status and future of various bio-physical and social aspects associated with the project:** As a tool, EIA studies the status and future of forest wealth, geology, seismology, soil erosion, sedimentation, flood control, micro-climate, fisheries, rehabilitation and resettlement, public health, water logging and salinity of soil, etc.
- (viii) **Provide baseline information and management option:** EIA provide appropriate baseline information and management option for those who are involved in the project activities and strengthening projects in more environmental friendly manner.

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## SAQ 2

### Choose the correct alternative/s

- (a) EIA is based on which of the following parameters?
  - (i) Demography, natural and cultural landscape, cultural heritage, ambient air quality, local climate, soil and water quality, fauna and flora.
  - (ii) Investigation of baseline information and prediction of the environmental impacts of a proposed project.
  - (iii) EIA studies the status and future of forest wealth, soil erosion, flood control, micro-climate, rehabilitation and resettlement, and public health.

- (iv) Population census survey of the community surrounding a project area.
- (b) Which one of the following best fits to the purpose of EIA?
- (i) To get the clearance from the Ministry of Environmental Forest and Climate Change.
  - (ii) To provide employment to the local community.
  - (iii) To generate socio-economic data through a baseline field survey.
  - (iv) To develop tourism related activities.
- 

## **13.4 ENVIRONMENTAL IMPACT ASSESSMENT: METHODS AND TECHNIQUES**

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Till now we have discussed meaning and scope of EIA. Do you have any idea about methods and techniques for assessing environmental impact? In this section, we will discuss about various assessment methods and techniques. Let us be very clear that no single method of EIA will fulfill all the required criteria of environmental impact assessment. Varieties of methods and techniques are available to conduct EIA. We have to choose a particular method as per the requirement and purpose. Therefore we should know some of the widely used methods. Followings four methods of EIA are discussed below along with their advantages and disadvantages.

### **13.4.1 Ad hoc Method**

As the name suggests, ad hoc method is not a scientific method as they do not structure the problem. If this is the case, you might be wondering the relevance of using this method. This method is used in the situation where time is a constraint or there is a lack of information. Following are the characteristics of ad hoc methods:

1. In this method team of experts assembled for a short period of time.
2. On the basis of their experience, training and institution they prepare an EIA report.
3. It is not sufficient to rely on ad hoc report when scientific methods are available.
4. In this method cause and effect relationship between project activity and environment components may not exist.
5. Specific environment component likely to be affected by the project action may require further identification.
6. Ad hoc methods usually fail to provide considerable information about economic, social and bio-physical components.

Key Area of the Assessment Process	Criteria	L denotes Criteria Completely Satisfied P denotes Criteria Partially Satisfied N denotes Criteria Not Satisfied
Cost / Time Effectiveness Criteria	1. Expertise Requirements	L
	2. Data Requirements	L
	3. Time Requirements	L
	4. Flexibility	L
	5. Personnel Level of Effort	P
Impact Identification	6. Comprehensiveness	N
	7. Indicator-based	N
	8. Discriminative	N
	9. Time Dimension	N
	10. Spatial Dimension	N
Impact Measurement	11. Commensurate	N
	12. Quantitative	N
	13. Measures Changes	N
	14. Objective	N
Impact Assessment	15. Credibility	P
	16. Replicability	N
	17. Significance-based	N
	18. Aggregation	N
	19. Uncertainty	N
Communication	20. Alternative Comparison	P
	21. Communicability	P
	22. Summary Format	N

**Fig. 13.1: Example of Ad hoc Method**

**Limitations:** This method is very easy to use, but it has also some limitations. Some of the limitations are as follows:

- i. It may not encompass all the relevant impacts.
- ii. The criteria used to evaluate impacts are not comparable. The relative weights of various impacts cannot be compared.
- iii. it is inherently inefficient as it requires sizeable effort to identify and assemble an appropriate panel of experts for each assessment; and
- iv. It provides minimal guidance for impact analysis while suggesting broad areas of possible impacts.

### **13.4.2 Matrix Method**

One of the earliest matrix methods was developed by Leopold et al. in 1971. The matrix proposed by **Leopold and his co-author** is a qualitative environmental impact assessment method. The main purpose of the Leopold Matrix is the identification of impacts and the determination of their magnitude and importance. In a Leopold matrix and its variants, the columns of the matrix correspond to project actions (for example, flow alteration) while the rows represent environmental conditions (for example, water temperature).

Major characteristics are:-

1. The impact associated with the action columns and the environmental condition row is described in terms of its magnitude and significance.



2. In this method project actions are related to environmental components. Matrix methods identify interactions between various project actions and environmental parameters and components.
3. They incorporate a list of project activities with a checklist of environmental components that might be affected by these activities.
4. Actions are ranged horizontally (columns) and components are listed vertically (rows) (Refer Fig. 13.2).
5. The cells of the matrix, representing an interaction between a component and an action, are bisected diagonally.
6. Impacts are investigated and scored subjectively by experts on a 1-10 scale of increasing importance or magnitude.
7. The score for magnitude is placed in the top left-hand corner of each cell and the score for importance placed in the bottom right hand corner.

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operation phase/ on-going site maintenance	Post-operation/ decommissioning phase
WATER	surface water hydrology & channel morphology			
	surface water quality			
	groundwater hydrology			
	groundwater quality			
LAND	Landscape			
	soils			
	geology			
AIR	local air quality			
	regional / global air quality			
FLORA & FAUNA	aquatic ecology			
	terrestrial ecology			
HUMAN ENVIRONMENT	socio-economics			
	health and safety			
	amenity			
	nuisance			
	architectural and archaeological heritage			

**Fig. 13.2: Examples of Matrices Methods based on prompt lists of project actions and potential impacts (Source: Bond & Steward, 2002)**

**Advantages:**

- The major advantages of this method is to visually describe relationship between two sets of factors, expanded or contracted to meet needs of the proposal being assessed, Identify impacts of different phases of project, construction, operation.
- Help separate site-specific impacts from impacts affecting region.

### **13.4.3 Networks Method**

This method is used to solve the problem of identifying second and higher order impacts during EIA. Major characteristics are:

1. Using network diagram helps to describe these linkages, providing some indication of how an ecosystem operates.
2. Different levels of information can be displayed in a network diagram. "Holistic" characteristic approach of network is to recognize series of impacts which may be activated by a single project action.

**Limitations of Networks Method are:**

- A network may be a generalization of reality unless relationships between individual ecosystem components are adequately understood.
- Individual ecosystem or social system elements may not be easily recognized in the diagram, especially when the level of detail increases.
- Networks cannot describe temporal aspects of ecosystem dynamics.

### **13.4.4 Map Overlays Method**

In this method, a series of overlaid map transparencies can be used to help identify, predict and communicate the intensity and geographical extent of impacts (Shopley and Fuggle, 1984, McHarg, 1969). Major Characteristics of map overlay methods are:-

1. A study area is divided into appropriate spatial units and information on a number of attributes and environmental characteristics, such as environmental factors and human activities, is collected.
2. Transparencies showing the proposed development, the geographic extent of each attribute and each potential impact are overlaid.
3. Significant spatial interactions are identified and can be assessed. These maps are overlaid to produce a composite picture (see Fig. 13.3).
4. The resulting composite maps characterize the area's physical, social, ecological, land use and other relevant characteristics, relative to the location of the proposed development.
5. To investigate the degree of associated impacts, any number of project alternatives can be located on the final map.

**Importance;** The overlay method is effective in considering:

- Sensitive lands, requiring protection from human activity (e.g., shorelines, wetlands, etc.),
- Hazard lands, requiring protection from the environment (e.g., floodplains, unstable slopes, volcanic slopes, etc.),

- Renewable resource areas, where the environment needs to be protected from human activities (e.g., aquifer recharge zones, fish and wildlife habitat, etc.),
- Cultural heritage areas of scientific/ educational value, historical, architectural resources).

**Limitations of Map overlays:** Maps tend to over simplify the impacts. Specific interrelationships between environmental factors are not readily obtainable. Although in this method it is possible to depict "before" and "after" conditions but, it cannot describe ecosystem dynamics through time.

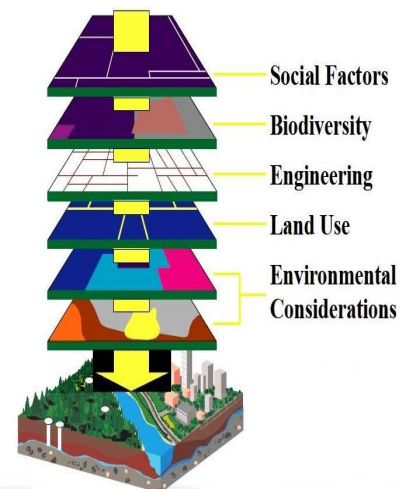
**Geographic information systems (GIS):** GIS is a computer-based system incorporating collection, storage, recovery, transformation and display of spatial Data. Geographic information systems (GIS) have potential for storing and accessing large data, can combine data from many different sources for use in geographic analysis, are efficient at performing multiple map overlays and manipulations, can generate descriptive and analytical statistics.

Major characteristics are

1. Allow number of different scenarios to be investigated quickly and efficiently with map outputs. For example, GIS can show how a natural resource will be affected by a decision.
2. Based on real-time remote sensing data, areas that suffer most from deforestation may be identified and analyzed on the basis of overlaying data on soil types, the species required, the likely growth and yield, and the impact of regulatory measures applicable to the area (Asian Development Bank, 1991).

**Limitations of geographic information systems in EIA:**

- Many commercial GISs are expensive and require highly trained personnel.
- Digital data is costly and often difficult to acquire and requires costly hardware and software setups.



**Fig. 13.3: Map overlay method**

### SAQ 3

**Choose the correct alternative/s**

(a) For identification of impacts and determination on the basis magnitude and importance, which of the following methods is appropriate for EIA?

- (i) Ad hoc method
- (ii) Geographic information system.
- (ii) Matrix Method
- (iv) Network method

(b) If you want to show the land use and land cover changes before and after a developmental project, which of the following is a suitable method:

- (i) Matrix Method
  - (ii) Geographic information system.
  - (iii) Ad hoc method
  - (iv) Network method
- 

## 13.5 ENVIRONMENTAL IMPACT ASSESSMENT PROCESSES IN INDIA

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After discussing meaning, scope, methods and techniques, let us understand the implementation processes of Environmental Impact Assessment in India. As we have discussed in the beginning of the unit, Environmental Impact assessment is conducted for all developmental projects and activities on the basis of their category. In India according to 2006 EIA notification developmental projects and activities are broadly categorized in to two categories on the basis of spatial extent of potential impacts on human health, natural and man-made resources. Let us discuss briefly about these two categories project and activities.

**(i) Category A Projects and Activities:** All projects or activities included as Category 'A' in the Schedule, including expansion and modernization of existing projects or activities and change in product mix, shall require prior environmental clearance from the Central Government in the Ministry of Environment, Forests and Climate Change (MoEF & CC) on the recommendations of an Expert Appraisal Committee (EAC) to be constituted by the Central Government for the purposes as per 2006 notification.

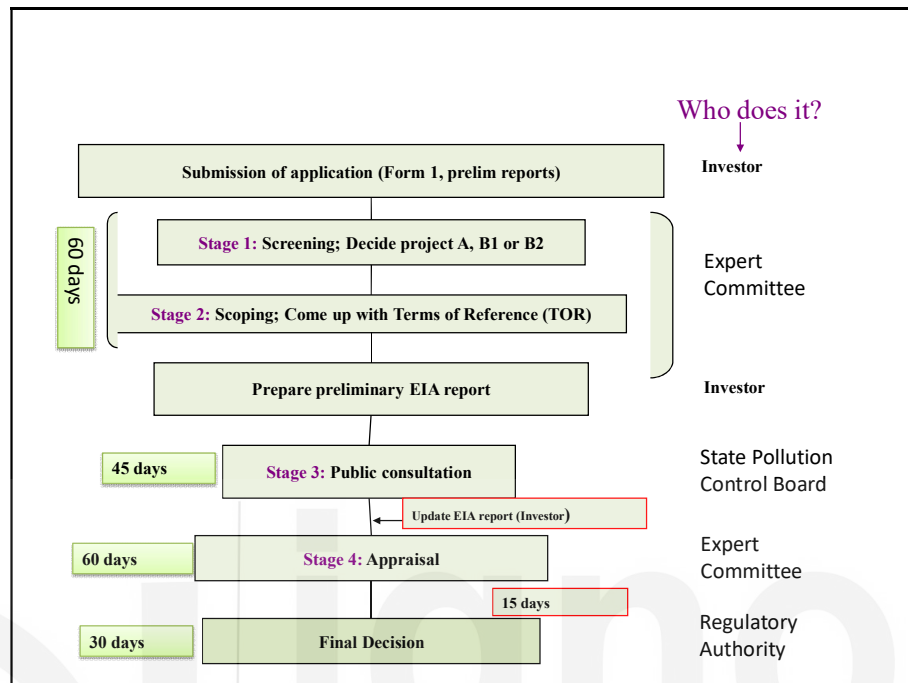
**(ii) Category B Projects and Activities:** All projects or activities included as Category 'B' in the Schedule, including expansion and modernization of existing projects or activities as specified in sub paragraph (ii) of paragraph 2, or change in product mix as specified in sub paragraph (iii) of paragraph 2, but excluding those which fulfill the General Conditions (GC) stipulated in the Schedule, will require prior environmental clearance from the State/Union territory Environment Impact Assessment Authority (SEIAA). The SEIAA shall take its decision on the recommendations of a State or Union territory level Expert Appraisal Committee (SEAC).

**Environmental Impact Assessment Process:** Environmental Impact Assessment process to get environmental clearance for new projects will comprise of a maximum of four stages. These four stages in sequential order are:

1. Stage (1) Screening (Only for Category 'B' projects and activities)

2. Stage (2) Scoping
3. Stage (3) Public Consultation
4. Stage (4) Appraisal
1. **Stage (1) - Screening:** In case of Category 'B' projects or activities, this stage will entail the scrutiny of an application seeking prior environmental clearance made in Form 1 by the concerned State level Expert Appraisal Committee (SEAC) for determining whether or not the project or activity requires further environmental studies for preparation of an Environmental Impact Assessment (EIA) for its appraisal prior to the grant of environmental clearance depending upon the nature and **location specificity of the.** The projects requiring an Environmental Impact Assessment report shall be termed Category 'B1' and remaining projects shall be termed Category 'B2' and will not require an Environment Impact Assessment report. For categorization of projects into B1 or B2 except item 8 (b), the Ministry of Environment and Forests shall issue appropriate guidelines from time to time.
2. **Stage (2) - Scoping:** Scoping is the second stage of EIA. It refers to the process by which the Expert Appraisal Committee in the case of Category 'A' projects or activities, and State level Expert Appraisal Committee in the case of Category 'B1' projects or activities, including applications for expansion and/or modernization and/or change in product mix of existing projects or activities, determine detailed and comprehensive Terms of Reference (TOR) addressing all relevant environmental concerns for the preparation of an Environment Impact Assessment (EIA) Report. Applications for prior environmental clearance may be rejected by the regulatory authority concerned on the recommendation of the EAC or SEAC concerned at this stage itself. In case of such rejection, the decision together with reasons for the same shall be communicated to the applicant in writing within sixty days of the receipt of the application.
3. **Stage (3) - Public Consultation:** "Public Consultation" refers to the process by which the concerns of local affected persons and others who have plausible stake in the environmental impacts of the project or activity are ascertained with a view to taking into account all the material concerns in the project or activity design as appropriate. The applicant may alternatively submit a supplementary report to draft EIA and EMP addressing all the concerns expressed during the public consultation.
4. **Stage 4: Appraisal:** Appraisal means the detailed scrutiny by the Expert Appraisal Committee or State Level Expert Appraisal Committee of the application and other documents like the Final EIA report, outcome of the public consultations including public hearing proceedings, submitted by the applicant to the regulatory authority concerned for grant of environmental clearance. This appraisal shall be made by Expert Appraisal Committee or State Level Expert Appraisal

Committee concerned in a transparent manner in a proceeding to which the applicant shall be invited for furnishing necessary clarifications in person or through an authorized representative.



**Fig 13.4: Summary of EIA process and tentative time line to complete EIA process in India as per MoEF, 2006, EIA regulations.**

#### SAQ 4

Choose the correct alternative/s

State level Expert Appraisal Committee (SEAC) determining whether or not the project or activity requires further environmental studies for preparation of an Environmental Impact Assessment (EIA) is a part of:

- (i) Stage (1) Screening (Only for Category 'B' projects and activities)
- (ii) Stage (2) Scoping
- (iii) Stage (3) Public Consultation
- (iv) Stage (4) Appraisal

### 13.6 SUMMARY

In this unit you have studied:

- EIA help to understand and inform the decision maker and general public about the environmental consequences of a developmental

project. EIA is also helping for environmental monitoring and minimise adverse impacts and to achieve the sustainable development goals.

- The scope of EIA are to act as a scientific tool to determine the impacts; investigate, identify, evaluate and predict environmental impacts at an early stage; develop confidence building and fulfil the gaps of communication; participation of all the stakeholders to in the decision-making; reflects the social and cultural viewpoints; studies the status and future of various bio-physical and social aspects associated with the project; and provide baseline information and management option
- On the basis of the purpose, spatial unit and time scale EIA are classified into various types. These are rapid EIA, Comprehensive EIA, Cumulative Impact Assessment, regional and sectoral EIA, Strategic Environment Impact Assessment, Project Level EIA and Life Cycle Assessment
- There are various methods and techniques are available for Environmental Impact Assessment. However, no single method of EIA will fulfil all the required criteria of environmental impact assessment. We have to choose a particular method as per the requirement and purpose. Some of the widely used methods namely ad hoc method, matrix method, network methods and map overlay methods are discussed along with their advantages and disadvantages.
- Environmental Impact Assessment process to get environmental clearance for new projects will comprise of a maximum of four stages. These four stages in sequential order are: Stage (1) Screening (Only for Category 'B' projects and activities); Stage (2) Scoping; Stage (3) Public Consultation; and Stage (4) Appraisal

### **13.7 TERMINAL QUESTIONS**

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1. What is EIA? Describe any four aspects of EIA.
2. Describe any five points about the scope of EIA with examples.
3. Briefly explain matrix method and map overlay methods of EIA process.
4. Give details of environmental clearance process in India and major approaches used to complete EIA process.

### **13.8 ANSWERS**

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#### **Self-Assessment Questions (SAQ)**

1. a–ii, iv; b-i
2. a- i, ii; b-iv

3. a-iii, b-ii

4. i

### **Terminal Questions**

1. Refer to Section 13.2

2. Refer to Section 13.3

3. Refer to Section 13.4

4. Refer to Section 13.5

### **13.9 FURTHER SUGGESTED READINGS**

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1. Glasson, J., Therivel, R. and Chadwick, A. (1994) *Introduction to Environmental Impact Assessment* (2<sup>nd</sup> edition), UCL press, London, pp. 8-37.
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## ENVIRONMENTAL STANDARD AND MONITORING

### Structure

14.1	Introduction		Purpose of Environmental Monitoring
	Expected Learning Outcomes		Methods and Techniques of Environmental Monitoring
14.2	Environmental Standards: India and Global		14.4 Ambient Air Quality Standard
	Environmental Standards	14.4	14.5 Water Quality Standards
	Classification of environmental standards	14.5	14.6 Environmental Awareness Programme
	Global Environmental Standards	14.6	14.7 Summary
	Environmental Standards in India	14.7	14.8 Terminal Questions
14.3	Monitoring Environmental Quality: Methods and Techniques	14.8	14.9 Answers
	Environmental Monitoring	14.9	14.10 References and Further Readings
		14.10	

### 14.1 INTRODUCTION

In the previous unit we have studied about meaning and scope of Environmental Impact Assessment (EIA). We have also discussed various methods and techniques used for EIA. You may recall that EIA is mandatory for environmental management, planning and mitigating measure to address and minimize negative impacts and maximize positive impacts. Similarly, we use various standards to check the quality of management. This is a continuous process and hence we need monitoring in regular intervals. This unit explains about the environmental standards and monitoring process to know the state of environment.

In this unit, we will describe meaning of environmental standards and monitoring in section 14.2. In section 14.3 we will explain the scope of environmental standards and monitoring. Section 14.4 will elaborate different

methods and techniques related to monitoring environmental quality. In this section we will also discuss the environmental standards related to various environmental parameters and its implications on the environment. In the final section i.e. section 14.5 we have presented a brief discussion on environmental awareness programme. After reading this unit, you will be convinced that the standards, norms and regulation as a base for the achievement of quality environment in specific and the goals of sustainable development in general.

## **Expected Learning Outcomes**

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After reading this unit, you should be able to:

- State the basic concepts of environmental standards and monitoring;
- Describe different environmental standard and their use in monitoring environmental quality and sustainability;
- Describe the ambient air quality and water quality standards;
- Explain various ways of raising environmental awareness among the people.

## **14.2 ENVIRONMENTAL STANDARDS: INDIA AND GLOBAL**

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After Second World War there has been rapid increase in population and unprecedented economic growth. This has resulted in a massive degradation and destruction on the planet in terms of deforestation, pollution of air, water and soil, ozone depletion, species extinction, and global warming. Plastic pollution, bio-degradable and non –biodegradable waste generation, excessive levels of nitrogen and phosphorous in soil from artificial fertilizers, pesticides and insecticides have deteriorated the Earth's environment bringing ecological disequilibrium and environmental instability. The rate of destruction was accelerated mainly due to lack of awareness about maintaining environmental standards and strict monitoring processes to protect the planet from the destruction due to anthropogenic activities. Therefore, there is a need for strict adherence of environmental standard to check further deterioration of environment and simultaneously improving the environmental condition.

Before discussing environmental standard at global as well as national level, let us discuss the meaning of environmental standard.

### **14.2.1 Environmental Standard**

In simpler terms environmental standards refer to the maximum permissible concentration of harmful or potentially harmful pollutants which can be released that guarantees an acceptable health condition or environmental quality. Environmental standards help in setting a permissible limit of the pollutants to protect the human and environment health.

In other words these standards are numerical values and range of permissible limit prescribed by the governments across the globe and implemented by regulatory agencies in the respective countries to decide the environmental quality. Therefore it is obvious that it may vary from one nation to other nation and geographical location. The obvious question which might be striking to you is that why do we set such limits? Simply this is because it helps to control the concentration of pollutants, effluents waste or industrial discharge to land, water and air.

How do we express these standards? This is generally expressed in terms of the permissible concentration of pollutants in unit of air emitted or in waste water discharge from source or in terms of total load of pollutants per time unit, unit of production or unit of energy or materials inputs.

Till now you might have understood the concept of environmental standards. Let us now have a brief discussion on classification of environmental standards.

### **14.2.2 Classification of Environmental Standards**

Environmental standards are classified on the basis of impacts, geographical location, sources of emission and ecologically sensitivity of the area. According to United State Environmental Protection Agency (USEPA), these are two types on the basis scale of impacts.

- (i) **Primary Standard:** Primary standards are the limits and permissible values carried out to protect human health. This is based on the numerical permissible value allowable to protect the human health but not other components of the environment. Primary standard as per the clean air act of USEPA provide public health protection to vulnerable groups of children, elderly people suffering from asthmatic and respiratory diseases e.g. drinking water, air quality and soil quality standards.
- (ii) **Secondary Standard:** The purpose to set up secondary standard is to provide human welfare and safeguard of environment. In other words secondary standards are the limits and permissible values that provide human welfare and safeguard of environment. It includes protection against the decreased visibility due to smog and dust and damage to crops, flora and fauna and buildings e.g. ambient air quality standard, waste water standard etc.

On the basis of the above criteria it is further classified into attainment and non-attainment area. That area which meets the primary or secondary standards as per the national ambient air quality standards is called attainment area. The areas which does not meet the National ambient air quality standard or primary and secondary standard for the pollutants are non-attainment area.

Classification of Environment Standards on the basis of the nature, source and spatial units of pollutants are:

1. **Ambient Environmental Standards:** An ambient environmental standard refers to the surrounding concentration of pollutants which cannot be explored directly based upon the various emissions that lead to ambient quality level. It is very important to know the emission source of pollutants to achieve ambient standard. *Sources of pollutants may be helpful to achieve the standard*. Ambient standards expressed in terms of average concentration level or pollutants generated from various point and non-point sources.

Meteorological and hydrological phenomena play an important role in ambient standard. That is the reason for taking an average over a time period or over a geographic area. National Ambient Air Quality Standard set by Central Pollution Control Board is based on 24 hours and 8 hours.

2. **Emission Standard:** Emission standards are the permissible limit which never-exceeds beyond set limit applied directly coming from an industry or other sources. Emission standards are based on data related to the emission generation performance and cost of available technology. The emission or effluent standard is related to the preferred method of control. The great advantage of such a standard is its direct relevance to the polluting activity. It can be set on a wide variety of different bases. For example,

- (i) emission rate (e.g., kilograms per hour),
- (ii) emission concentration (e.g., parts per million of biochemical oxygen demand, or BOD, in wastewater),
- (iii) total quantity of residuals (rate of discharge times concentration times duration),
- (iv) residuals produced per unit of output (e.g., SO<sub>2</sub> emissions per kilowatt hour of electricity produced, grams of CO per tonne of asphalt produced),
- (v) residual content per unit of input (e.g., sulphur content of coal used in power generation),
- (vi) Percentage removal of pollutant (e.g., 60-percent removal of waste material before discharge).

3. **Source standards:** Source standards are the maximum permissible limits of the pollutants from their source of origin. The percentage of concentration of various form of pollutants discharge to the ambient environment from different source e.g. emission from power plants and generators or noise level Are examples of source standards.

4. **Performance Standards:** Performance standard refers as exposure standard to the end result of the polluters to whom it depends upon to regulate and achieve the target of the environmental standard. These standards are set for workplace, food items and used for drinking water quality control. It specifies daily or concentration of chemical intake that is

considered safe over a lifetime of exposure. For example workplace standards are set in terms of maximum number of accidents or level of risk to which worker exposed. Acceptable level of the ambient air has also been set at various workplaces in countries. Farmer to reduce their use of particular pesticides in the field is another examples of exposure or performance standard.

5. **Biological standards:** These are standards that relate to the concentration of pollutants in biological fluids and tissues. The advantage of biological standards is that they include contamination from all sources, which may vary from person to person, thus their use provides an accurate picture of exposure. One disadvantage is that it is difficult to implement biological standards because this may require compulsory sampling. However, such standards can be useful for screening on the basis of volunteer samples. For example washing and dumping of tailings or waste sludge from factories into stagnant water of lakes impacts aquatic flora and fauna.
6. **Technology standards:** Technology standards specify the technologies, techniques, or practices including design, engineering, input, and output standards which polluters must adopt or meet to protect the environment during manufacturing stage. In contrast to emission standards, technology standards impose on polluters certain decisions and technologies to be used. This is some form of 'technology forcing' for polluting industries to adopt technological change in order to meet environment standards.

Till now you have learnt about the meaning of environmental standards and classification of environmental standards in to various types. After knowing meaning and types, you might be thinking about the sources from where we will get the environmental standards. In the below given section we will discuss about environmental standards at global level.

### **14.2.3 Global Environmental Standards**

At global level we generally follow the norms and standards set by World Health Organisation (WHO) particularly related to air and water in general and ambient air quality and drinking water in particular. Why is it so? The reason is obvious. This is because deterioration in quality of these two basic necessities of life does affect our health.

WHO produces international norms on ambient air quality and water quality in the form of guidelines that are used as the basis for regulation and standard setting world-wide. These guidelines promote the protection of public health by advocating for the development of locally relevant standards and regulations adoption of preventive risk management approaches covering catchment to consumer and independent surveillance to ensure that safety plans are being implemented and effective and that national standards are being met.

Apart from WHO all the countries have their own environmental standards. We will discuss about numerical values and range of permissible limit for ambient air and drinking water prescribed by the WHO and Governments of India in section 14.5 and 14.6 respectively. Before that let us have a brief discussion on environmental standards in India.

#### **14.2.4 Environmental Standards in India**

In India we generally follow the norms and standards set by different organisations of Government of India. You might have heard about ISO? ISO stands for International Organisation for Standards. ISO is an international agency composed of the national standards bodies of more than 160 countries including India. There are many ISOs namely 9000, 9001 etc. Do you know which the organisations responsible for devising environmental standards are? For example we follow the Central Pollution Control Board (CPCB) guidelines for standard air quality including ambient whereas we follow Bureau of Indian Standards (BIS) for drinking water.

In this section, let us discuss environmental standards prescribed for two basic necessities of life i.e. air and water.

Government of India has laid down National Ambient Air Quality standards (NAAQS) for twelve air pollutants. As mentioned above Central Pollution Control Board (CPCB) is the nodal agency for These twelve pollutants are namely PM<sub>10</sub>, PM 2.5, Carbon Monoxide (CO), Sulphur Dioxide (SO<sub>2</sub>), Nitrogen Dioxide (NO<sub>2</sub>), Ammonia (NH<sub>3</sub>), ground level Ozone (O<sub>3</sub>), Lead, Arsenic, Nickel, Benzene and Benzo (a) Pyrene. It helps in assessment of air quality with respect to various pollutants and development of preventive and corrective measures for mitigation. Compliance with NAAQS can lead to significant abatement of air pollution in the country. Further, the Government has notified 115 emission / effluent standards for 104 different industrial sectors besides 32 general ambient standards for various pollutants. Compliance to the notified environment standards is likely to protect and improve the quality of the environment.

As mentioned above, BIS has set specifications in IS-10500 and subsequently revised it in the year 2012. This is popularly known as Uniform Drinking Water Quality Monitoring Protocol. There have been provisions of some parameters apart from those mentioned in revised standards of 2012 may also be measured if the States deem it necessary. This standard has two limits. One relates to acceptable limits and the other one is on permissible limits. The permissible limits are applicable in the absence of alternate source. Therefore, If any parameter exceeds the limit as prescribed in the above said two limits then that water is considered unfit for human consumption.

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#### **SAQ I**

Fill in the blanks with suitable words

- (i) \_\_\_\_\_ are the limits and permissible values carried out to protect human health.

- (ii) Secondary standard is to provide \_\_\_\_\_ and safeguard of \_\_\_\_\_.
- (iii) IS-10500 and subsequently revised it in the year 2012 is popularly known as \_\_\_\_\_.
- 

## **14.3 MONITORING ENVIRONMENTAL QUALITY: METHODS AND TECHNIQUES**

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After discussing environmental standards, its types and bench mark standards identified at India and global level, the obvious question that might be arising in your mind is how to maintain that standard? To maintain the standard, there is a need for constant monitoring of different parameters of environment. To do that there are various laid down methods and techniques to monitor environmental standards. Before discussing that we should know the meaning and purpose of environmental monitoring. Let us discuss these briefly.

### **14.3.1 Environmental Monitoring**

Environmental monitoring is critical to understand whether the quality of our ambient natural environment improving or deteriorating by different anthropogenic activities. Environmental monitoring is a scientific and technical tool to access environmental conditions and trends. Environmental monitoring is collection of information and observation of data to understand the state of environment.

Environmental monitoring supports policy development and regulate environment quality standards, laws and its implementation and develop base line information for reporting to national policy makers and international forums and general public to take appropriate decision for implementation of developmental project.

It refers to systematic sampling of ambient air, water, soil, and biota in order to take observation and analysis of the collected observation to study the structure and composition of various components of the environment. Environmental monitoring is vital to control and mitigate the adverse impacts of desired and undesired changes in the environment by anthropogenic activities and to assess the risk and development of management plans.

### **14.3.2 Purpose of Environmental Monitoring**

After knowing the meaning of environmental monitoring, let us understand the purpose of environmental monitoring. Below given are some of the purposes of environmental monitoring.

- Environmental standards are set on the basis of the legislation, regulations, guidelines and recommendation of the technical experts. These standards mostly relate to biodiversity and the quality of

ecosystems, genetic resources, animal and plant species, ambient air and water quality, fertility of soil, sites of natural and cultural heritages and anthropogenic parameters.

- The purpose of environmental monitoring is to understand the state of environment and warn the users or producers responsible for deteriorating the environmental quality to take mitigation measures to maintain the environmental quality.
- It is helpful to regulate the concentration of the level of pollution which cannot be released without causing unacceptable harm to the health of human and physical environment.
- Collection of toxicological information to know and evaluate chemical effects of various chemical concentrations present in the environment.
- Environmental monitoring is also used for developing environmental management plan and conduct environmental impact assessment.
- Environmental monitoring ensure the effectiveness of the implementation of Environmental Management Plan and other mitigating measures during, before and after construction of any developmental projects.
- Major Indicators of environmental monitoring are air quality, water quality, soil quality, noise level, solid waste management and physical, biological and chemical composition of different component of the environment. It will enhance the people's role on preservation and protection of the environment and maintain the environmental quality.
- Environmental monitoring permit the projects or activities to avoid adverse impacts of environmental degradation and control environmental pollution to improve the health and quality of human and other life forms to achieve the goals of sustainable development.
- Environment monitoring on the basis of environmental standard will help to provide information on the environmental status, preservation of ecological balance regulate exploitation of natural resources as well as preventing the threats to the environment.
- Maintaining a balanced relationship between the economic development and environmental protection; fostering the use of products and technologies that to ensure preservation and protection of the ecological system.

### **14.3.3 Methods and Techniques of Environmental Monitoring**

As discussed in the earlier section 14.2 environmental monitoring is a systematic and regular observation and measurement of environmental parameters of water, air, soil etc. and of changes in terms of environment



quality and quantity. The next obvious question that comes to our mind is that how to assess or monitor the environmental quality? Environmental monitoring involves three basic types of activities:

- (i) **Measurements and observation:** Measurement of data using various instruments and collection of samples from the field on the basis of developed standards.
- (ii) **Evaluation and analysis:** this is based on the collected samples analysed in the laboratory.
- (iii) **Developing and dissemination** of warnings based on predetermined standard for awareness of all concerned.

After knowing the three major activities performed in environmental monitoring, the question is what are the methods used for environmental monitoring? Broadly there are three methods widely used all over the world for this purpose. These methods are as follows:

- (i) **Ground Based Sampling and Measurements**
- (ii) Model Based Monitoring
- (iii) Satellite Based Monitoring:

Let us discuss all the above mentioned methods briefly.

- (i) **Ground Based Sampling and Measurements:** As the name suggests this type of monitoring is being carried out by collecting data from sample sites based on decided parameters. For example various sites have been identified by Central Pollution Control Board (CPCB) and State Pollution Control Board (SPCB) for monitoring air pollution. Similar kinds of processes used by respective bodies in the country as well as in the states for monitoring water, soil and noise pollution. Once the sample is collected these samples are tested in the laboratories. Today, we have also facilities at the sample sites where automated instruments are placed to monitor and record in real time situations.
- (ii) **Model Based Monitoring:** Powerful models, methods, and systems that have been developed for the purpose of environmental monitoring are now leaving the laboratory setting, and some of them are already being applied. When they are applied in countries that have well established environmental authorities and a high population density, these applications are actually additional measures to protect the environment. However, the situation in less developed or less densely populated countries is quite different. For these countries, the new techniques of environmental monitoring can offer totally new opportunities for better environmental protection.
- (iii) **Satellite based Monitoring:** Do you know how can we use satellite for environmental monitoring purpose? We use satellites placed in a geostationary orbit that allows satellites to continuously monitor a

particular region uninterrupted. **Satellites** in a low earth orbit **can** directly **monitor the climate** from their position within or just above the **atmosphere**, and **can** provide near-global coverage as they scan over different swathes of ground with each orbit.

Satellite remote sensing technology has been widely used in environmental monitoring all over the world. With the advancements of optical, infrared, microwave and hyperspectral satellite remote sensing techniques, today we are applying these techniques in atmospheric, hydrological and ecological environment. This includes monitoring of aerosols, particulate matter, pollution gases, and greenhouse gases in the field of atmospheric environmental monitoring. As far as the hydrological environmental monitoring is concerned, we use it for monitoring of water blooms, water quality, oil spills, water pollution and drinking water safety. In the case of the ecological monitor satellite based monitoring has been extensively used for wildlife habitat monitoring, environmental damages from mines development, soil contamination and biodiversity richness.

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## SAQ 2

Match the following

Method	Issues
a. Atmospheric monitoring	(i) Wild life habitat
b. Hydrological monitoring	(ii) Aerosols
c. Ecological monitoring	(iii) Oil spills

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## 14.4 AMBIENT AIR QUALITY STANDARDS

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Do you know what does ambient air mean? In simple terms it is atmospheric air in its natural state, not contaminated by **air-borne** pollutants. You have read about composition of atmospheric gases in its natural state in the course on Physical Geography. Can you recall the composition of atmospheric gases? Nitrogen and oxygen comprises 99% of the atmospheric gases. So, ambient air is typically comprises of 78% nitrogen and 21% oxygen. The remaining 1% is made up of a combination of carbon, helium, methane, argon and hydrogen. Ambient air quality is a major concern to live a healthy life. You might also know that air is never found clean in nature due to natural and human made pollutants. Gases such as Carbon monoxide (CO), Carbon dioxide (CO<sub>2</sub>) Sulphuric Acid (H<sub>2</sub>SO<sub>4</sub>) and other greenhouse gases are continuously increasing due to anthropogenic activities.

Air quality standards are legal limits placed on levels of air pollutants in the ambient air, during a given period of time. They characterize the allowable

level of a pollutant or a class of pollutants in the atmosphere, and thus define the amount of exposure permitted to the population or the ecological systems.

Under the provisions of the Environment Protection Act, 1986, the national ambient air quality standards for the pollutants namely TSPM, PM<sub>10</sub>, SO<sub>2</sub>, and NO<sub>2</sub>) have been notified. These standards are based on land use and are different for residential, industrial and sensitive areas. These standards need to be reviewed based on health consideration to protect sensitive population with margin of safety. The Central Pollution Control Board (CPCB) has developed National Standards for Effluents and Emission under the statutory powers of the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981. These standards have been approved and notified by the Government of India, Ministry of Environment & Forests, under Section 25 of the Environmental (Protection) Act, 1986. For further knowledge about ambient air quality and other air quality standards, you can refer to the Central Pollution Control Board website [www.cpcb.nic.in](http://www.cpcb.nic.in). The Ministry of Environment and Forest (MoEF), Govt of India, vide gazette notification, G.S.R826 (E), dated 16.11.2009 have notified the National Ambient Air Quality Standards by amending the Environment (Protection) Rules 1986.

**Table 14.1: National Ambient Air Quality Standards**

Sl. No	Pollutant	Time Weighted Average	New Standards (Schedule VII, Rule 3 (3B) 16th Nov 2009)	
			Concentration in ambient air	
			Industrial Area Residential, Rural & other Areas	Ecologically sensitive area (Notified by Central Govt.)
1.	Sulphur Dioxide (SO <sub>2</sub> )	Annual Avg*	50.0 µg/m <sup>3</sup>	20.0 µg/m <sup>3</sup>
		24 hours**	80.0 µg/m <sup>3</sup>	80.0 µg/m <sup>3</sup>
2.	Oxides of Nitrogen (NO <sub>2</sub> )	Annual Avg*	40.0 µg/m <sup>3</sup>	30.0 µg/m <sup>3</sup>
		24 hours**	80.0 µg/m <sup>3</sup>	80.0 µg/m <sup>3</sup>
3.	Particulate matter (size less than 10µm)	Annual Avg*	60.0 µg/m <sup>3</sup>	60.0 µg/m <sup>3</sup>
		24 hours**	100.0 µg/m <sup>3</sup>	100.0 µg/m <sup>3</sup>
4.	Particulate matter (size less than 2.5µm)	Annual Avg*	40.0 µg/m <sup>3</sup>	40.0 µg/m <sup>3</sup>
		24 hours**	60.0 µg/m <sup>3</sup>	60.0 µg/m <sup>3</sup>
5.	Lead (pb)	Annual Avg*	0.50 µg/m <sup>3</sup>	0.50 µg/m <sup>3</sup>
		24 hours**	1.0 µg/m <sup>3</sup>	1.0 µg/m <sup>3</sup>
6.	Carbon Monoxide (CO)	8 hours	2.0 mg/m <sup>3</sup>	2.0 mg/m <sup>3</sup>
		1 hours	4.0 mg/m <sup>3</sup>	4.0 mg/m <sup>3</sup>

7.	Ozone	8 hours**	100.0 $\mu\text{g}/\text{m}^3$	100.0 $\mu\text{g}/\text{m}^3$
		1 hours	180.0 $\mu\text{g}/\text{m}^3$	180.0 $\mu\text{g}/\text{m}^3$
8.	Ammonia (NH <sub>3</sub> )	Annual Avg*	100.0 $\mu\text{g}/\text{m}^3$	100.0 $\mu\text{g}/\text{m}^3$
		24 hours**	400.0 $\mu\text{g}/\text{m}^3$	400.0 $\mu\text{g}/\text{m}^3$
9.	Benzene	Annual Avg*	5.0 $\text{ng}/\text{m}^3$	5.0 $\text{ng}/\text{m}^3$
10.	Benzo (a) pyrene	Annual Avg*	1.0 $\text{ng}/\text{m}^3$	1.0 $\text{ng}/\text{m}^3$
11.	Arsenic	Annual Avg*	6.0 $\text{ng}/\text{m}^3$	6.0 $\text{ng}/\text{m}^3$
12.	Nickel		2.0 $\text{ng}/\text{m}^3$	

**Source: Central Pollution Control Board, MOEF&CC, Government of India**

- \*Annual Arithmetic mean of minimum 104 measurements in a year taken twice a Week 24 hourly at uniform interval,
- \*\* 24 hourly / 8 hourly or 1 hourly monitored values as applicable shall be complied with 98 % of the time in a year. However, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

### SAQ 3

What are air quality standards?

## 14.5 WATER QUALITY STANDARD

Water is most important element in the biosphere and very vital to all form of life. It help in the movement, circulation and cycling of nutrients in the atmosphere, lithosphere and hydrosphere. You might know that in the past faecal pollution of drinking water caused waterborne diseases which wiped out a large number of populations of cities in different parts of the world. The major sources of water pollution are domestic waste in urban areas and industrial waste which is discharged into natural water bodies. Water pollutant may be broadly classified in to the following category:

1. Organic pollutants
2. Inorganic pollutants
3. Sediments
4. Radioactive materials
5. Thermal pollution

To maintain the water quality and to ensure the safeguards of public health and protection of drinking water and other water sources, various international and national agencies and Governments have developed water quality standards which are given in Table 14.2.

WHO produces international norms on water quality and human health in the form of guidelines that are used as the basis for regulation and standard setting in developing and developed countries. The guidelines developed by WHO are prepared through a vast global consultative process involving WHO member states (India is a member state), national authorities and international agencies, in consultation with the WHO Expert Advisory Panel.

**Table 14.2 International Standard for drinking water**

Parameter	Max. permissible USPH standard	WHO Standard	European Standard (Mg/L)
pH	6-8.5	6.5-9.2	6.5-8.5
Sp. conductance ( $\mu$ mho $\text{cm}^{-1}$ )	300	-	400
Arsenic	0-05	0.05	-
Ammonia	0-5	0-5	-
BOD	5.0	6.0	-
Boron	1.0	-	-
Calcium	100	100	100
Cadmium	0.01	0.01	-
Chromium (VI)	0.05	0.05	-
Copper	1.0	1.5	-
Chloride	250	500	25
Cyanide	0.05	0.05	-
COD	4.0	10.0	5.0
Iron	0.	1.0	-
Lead	0.05	0.1	-
Magnesium	30	150	-
Manganese	0.05	0.5	-
Mercury	0.001	0.001	-
Nitrate+Nitrite	10	45	-
Phenol	0.001	0.002	0.5
Polynuclear aromatic Hydrocarbon (PAH)	0.002	0.2	0.002
Pesticides (total)	0.005	-	0.005

<i>E. Coli</i>	100/100 mL	10/100 mL	-
Total hardness (CaCo <sub>3</sub> )	-	500	-
Total dissolved solid	-	500	-

**Source: De, A.K., 2003**

As mentioned earlier BIS has prescribed two limits namely acceptable limits and permissible limits. The second one is applicable in the absence of alternate source of water. According to BIS 1500-2012 the acceptable limit of bacteria and other major contamination are as follows:

Sr. No.	Parameters	Acceptable Limits	Permissible Limits
1	pH value	6.5-8.5	No relaxation
2	Turbidity	1	5
3	Total hardness as CaCo <sub>3</sub> , mg/l, Max	200	600
4	E.coli presence/absence	Shall not be detectable in any 100ml sample	Shall not be detectable in any 100ml sample
5	Total iron as Fe, mg/l, Max	0.3	No relaxation
6	Taste	Agreeable	Agreeable
7	Odour	Agreeable	Agreeable
	pH value	6.5-8.5	No relaxation

**Source: Bureau of Indian Standards, 2012**

Till now you might have realized the importance of setting standards and also monitoring the standards. But, this would be more effective if we create awareness among the masses. We will discuss about environmental awareness in the next section.

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#### SAQ 4

What are the two limits of water quality prescribed by Bureau of Indian Standards and why?

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## 14.6 ENVIRONMENTAL AWARENESS

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Education for environmental awareness is essential for the younger generation as well as for the older generation. It also needs to cover both urban and rural populations. The beneficiaries at the grassroots level are as much a clientele for environmental education as are the policy makers, the decision makers and the project implementers. Hence, environment education needs to be conveyed to these different categories of people through formal education systems, non-formal education systems and the use of mass media.

The best way to make any law, act, and rule effective by creating awareness amongst the stakeholders is creating awareness. Therefore, this is also equally applicable to environmental problems. Let us understand how to create environmental awareness.

Environmental awareness is bottom to top approach to involve the people in environmental conservation and management. Environmental awareness acquaints the people to minimize the adverse impacts on the environment and participate in the government initiative to protect the environment. Awareness and participation needs to increase due to the recent changes in the nature of environmental problems.

Following are the major ways of creating environmental awareness programme:

1. **Formal environmental education programme:** Environmental education is one of the most important aspects of environmental management. Its primary objective is to teach the components of environment, ecology, ecosystem, human-environment relationship and environmental problems in educational curriculum to inculcate this knowledge among the school going children and College and university going youth.

The whole education system can be broadly divided into two major stages, namely, school and university education. Let us analyse what is the place of environment education at these two levels.

**School Level:** Four components are required to develop the awareness about environment education at the school level. These are (i) awareness, (ii) exposure to real life situations, (iii) concepts related to conservation of environment, and (iv) sustainable development. These four learning outcomes are properly addressed in terms of the requirements at primary, secondary and senior secondary levels. Let us discuss these four in brief.

- (i) **Awareness:** This is the first stage that involves making the individual conscious about the physical, social and aesthetic aspects of environment. One has to appreciate the fact that humans are only one of the numerous species on the Earth; they are linked with the life

support systems. These elements are crucial to the well being of human kind as well as other species.

- (ii) **Real-life situations:** It brings people closer to the environment. These conditions are location-specific, with different environment aspects being emphasised in different areas.
- (iii) **Concept of environmental conservation:** The main focus would be on sustainable utilisation of resources and not on exploitation. Contrary to the earlier notion of resource like water, soil and air being unlimited, the emphasis is now on their finite nature and thus the limits to the growth of living systems.
- (iv) **Sustainable development** aims at utilisation of resources not only by the present generation but their preservation for the future generations also, so that life can be sustained for a long period of time.

At the primary stage of education, greater emphasis could be laid on awareness followed by real-life situation and conservation. This would prepare the child to understand the need for sustainable development at a later stage. The focus could be on sensitising child to environment. From the secondary stage onwards, the emphasis on awareness will begin to decrease in favour of increased know ledge about real-life situations, conservation and sustainable development. And at the higher secondary stage, conservation should get a priority over other factors. The methodologies may range from observation to practical experiences and action—oriented feedback.

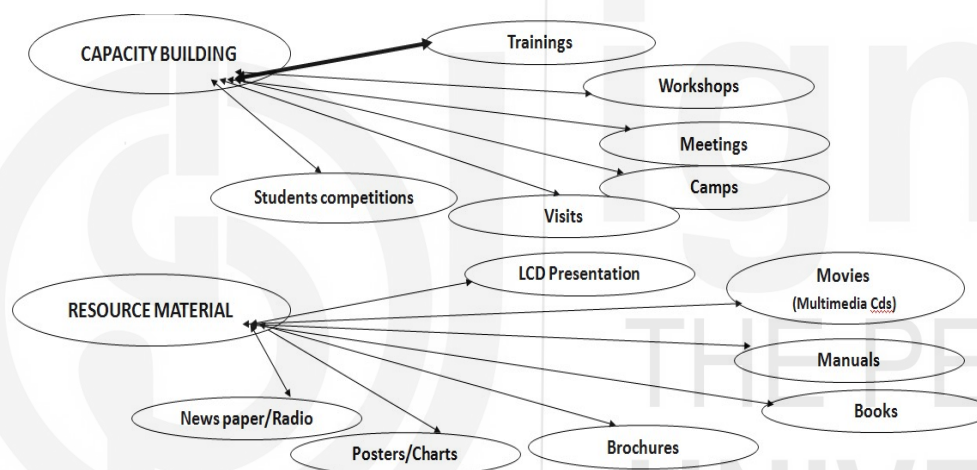
**University Stage:** In higher education there are three major components – teaching, research and extension. Out of these three components, the last being the weakest link. In higher education, irrespective of the field- medical, engineering, science, social science, humanities fine arts, management or law – the relevant aspects of environment should be part of the curriculum. Recently under the Choice Based Credit System (CBCS) proposed by University Grants Commission (UGC) prescribed a Compulsory course on Environmental Studies for all the undergraduate students across all the universities in the country.

- 2. **Informal environmental awareness programme:** In the formal sector the target groups are well defined and within the boundaries of formal education system. The case is just opposite in the informal sector where the target groups are diverse and heterogeneous. This can be done only through the channels of adult education. Though programmes for adult education are already in progress, the time has come to emphasise environmental education for sections like women, tribals, agricultural labour, industrial workers, slum-dwellers and residents of drought-prone areas. The neo-literates from these groups will help to spread the environmental message to the grassroots level. Voluntary agencies have played an important role in adult education apart from the Directorates of Adult and Continuing Education. Some methods for creating environmental awareness are:



- (i) Information packs like posters, slides and audio-visual materials which can be utilised by the adult education centres as well as by the workers of other development agencies like agricultural extension services and primary health centres.
- (ii) Special exhibitions and programmes in rural areas at the time of fairs and festivals.
- (iii) Celebration of important day related to environment namely world environment day, earth day, ozone day etc.
- (iv) Organisation of play, *Nukkad Natak* (street play) in different occasions as mentioned above

Environmental awareness programme help in understanding environmental policy and regulations associated with it. Environmental awareness programme at Panchayt level brings community awareness. To participate in environment management and conservation, tools and technique which can be use for environmental awareness are given in Fig.1



**Fig. 14.1: Tools and techniques used for environmental awareness among different communities**

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### SAQ 5

State any three examples of informal environmental awareness programme.

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## 14.7 SUMMARY

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- The conservation and protection of the environment in general as well as of its specific elements like air, water, forest, sea, wildlife, flora and fauna and human health is controlled through several environmental laws, rules, regulations, guidelines and environmental standards.
- Environmental sustainability has become an essential aspect for protection of the environment and human health. Over the last few years

emphasis on sustainable development and green economy and community oriented practices has come to the forefront. Human induced changes are driving the earth's physical and biological changes. Deep sense of understanding is required to know the anthropogenic changes to conserve our environment.

- Air quality standards are legal limits placed on levels of air pollutants in the ambient air, during a given period of time. They characterize the allowable level of a pollutant or a class of pollutants in the atmosphere, and thus define the amount of exposure permitted to the population or the ecological systems.
- To maintain the water quality and to ensure the safeguards of public health and protection of drinking water and other water sources, various international and national agencies and Governments have developed water quality standards. WHO produces international norms on water quality and human health in the form of guidelines that are used as the basis for regulation and standard setting in developing and developed countries. In India Bureau of Indian Standards prepares standards for drinking water.
- Environmental awareness is bottom to top approach to involve the people in environmental conservation and management. Environmental awareness acquaints the people to minimize the adverse impacts on the environment and participate in the government initiative to protect the environment. There are two major ways i.e. formal and informal of creating environmental awareness programme.

## **14.8 TERMINAL QUESTIONS**

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1. What is environmental standard? Describe primary and secondary standards with suitable examples.
2. What is environmental monitoring? State any five purpose of environmental monitoring.
3. What are the three methods of environmental monitoring? Explain any two methods with suitable examples.
4. What is ambient air? Why is it important? Describe ambient air standards proposed by WHO and Central Pollution Control Board of India.
5. Describe formal and informal environmental awareness programme with suitable examples.

## 14.9 ANSWERS

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### Self Assessment Questions

1. (i) Primary standards; (ii) human welfare, environment; (iii) Uniform Drinking Water Quality Monitoring Protocol
2. A-ii; b-iii; c-i
3. Air quality standards are legal limits placed on levels of air pollutants in the ambient air, during a given period of time. They characterize the allowable level of a pollutant or a class of pollutants in the atmosphere, and thus define the amount of exposure permitted to the population or the ecological systems.
4. Acceptable limits and permissible limits. The second one is applicable in the absence of alternate source of water.
5. Special exhibitions and programmes in rural areas at the time of fairs and festivals; celebration of important environment related days, Information packs like posters, slides and audio-visual materials which can be utilised by the adult education centres as well as by the workers of other development agencies like agricultural extension services and primary health centres.

### Terminal Questions

1. Refer to Section 14.2
2. Refer to Section 14.2
3. Refer to Section 14.3
4. Refer to Section 14.4
5. Refer to Section 14.6

## 14.10 REFERENCES AND FURTHER READING

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## GLOSSARY

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<b>Agenda 21</b>	: Agenda 21 is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment.
<b>Ambient environmental standards</b>	: It refers to the surrounding concentration of pollutants which cannot be explored directly based upon the various emissions that lead to ambient quality level.
<b>Biological standard</b>	: These are standards that relate to the concentration of pollutants in biological fluids and tissues.
<b>Environmental standards</b>	: These are numerical values and range of permissible limit primarily set by the government and implemented by regulatory agencies to decide the environmental quality
<b>Environmental conservation</b>	: It refers to the management of natural resources, in a planned way, to retain diversity and the balance in nature
<b>Environmental impact assessment</b>	: The process of identifying, predicting, evaluating and mitigating the biophysical, social and other relevant effects of development proposals prior to major decisions being taken and commitments being made.
<b>Environmental sustainability</b>	: It is comprised of sustainable yield of renewable resources, sustainable disposal of waste and development of renewable substitute of non-renewable resources.
<b>Life cycle assessment</b>	: Life cycle assessment is based on the assessment of the impacts during all stages of a project i.e. designing or planning, implementation and production stages of the project.
<b>Millennium development goals</b>	: A global partnership to reduce extreme poverty and hunger, and set out a series of eight time-bound targets for the next fifteen years i.e. 2000-2015. This commitment is known as the Millennium Development Goals (MDGs).
<b>Performance standards</b>	: Refers as exposure standard to the end result of the polluters to whom it depends upon to regulate and achieve the target of the environmental standard.
<b>Primary standards</b>	: These are the limits and permissible values carried out to protect human health
<b>Secondary</b>	: These are the standards to protect human welfare and

<b>standards</b>	safeguard of environment.
<b>Technology standards</b>	: It specify the technologies, techniques, or practices including design, engineering, input, and output standards which polluters must adopt or meet to protect the environment during manufacturing stage
<b>Regional EIA</b>	: It fulfills the need for micro-level environmental integration and address cumulative impacts at regional scale to develop regional developmental plan in the context of individual project level EIA.
<b>Sectoral EIA</b>	: It addresses specific environmental issues and a problem that may be during a project planning and implementation at some specific sector.
<b>Source standards</b>	: These are the maximum permissible limits of the pollutants from their source of origin.
<b>Sustainable development</b>	: Meeting the needs of the present generation without compromising the ability for future generation to meet their own needs.



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