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ENVIRONMENT



for

**State Engineering Services Exams,
SSC, PSUs, Banking, RRB and
Other Exams**

by Mr. B. Singh



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Preface

This comprehensive textbook on **Environment** provides all the requirements of the students, i.e., comprehensive coverage of theory, fundamental concepts and objective type questions articulated in a lucid language. This concise presentation will help the readers grasp the topics of **Environment** with clarity and apply them with ease to solve objective questions quickly.

This book covers the syllabus of States Engineering Services Exams including APPSC, MPPSC, MPSC, BPSC, UPPSC; SSC, PSUs, Banking, RRB and other examinations. All the topics are given the emphasis they deserve so that mere reading of the book clarifies all the concepts. The book incorporates theory as well as previous years of various State Engineering Services Examinations, UPSC ESE, etc. It also contains plenty of objective type questions for practice. This book has been very well targeted for aforementioned exams covering all the aspects of subject matter required for these examinations.

We have put-in our sincere efforts to present detailed theory and MCQs without compromising the accuracy of answers. For the interest of the readers, some notes, do you know and interesting facts are given in the comprehensive manner.

Our team has made their best efforts to remove all possible errors of any kind. Nonetheless, we would highly appreciate and acknowledge if you find and share with us any printing and conceptual errors. It is impossible to thank all the individuals who helped us, but we would like to sincerely thank all the authors, editors and reviewers for putting-in their efforts to publish this book.



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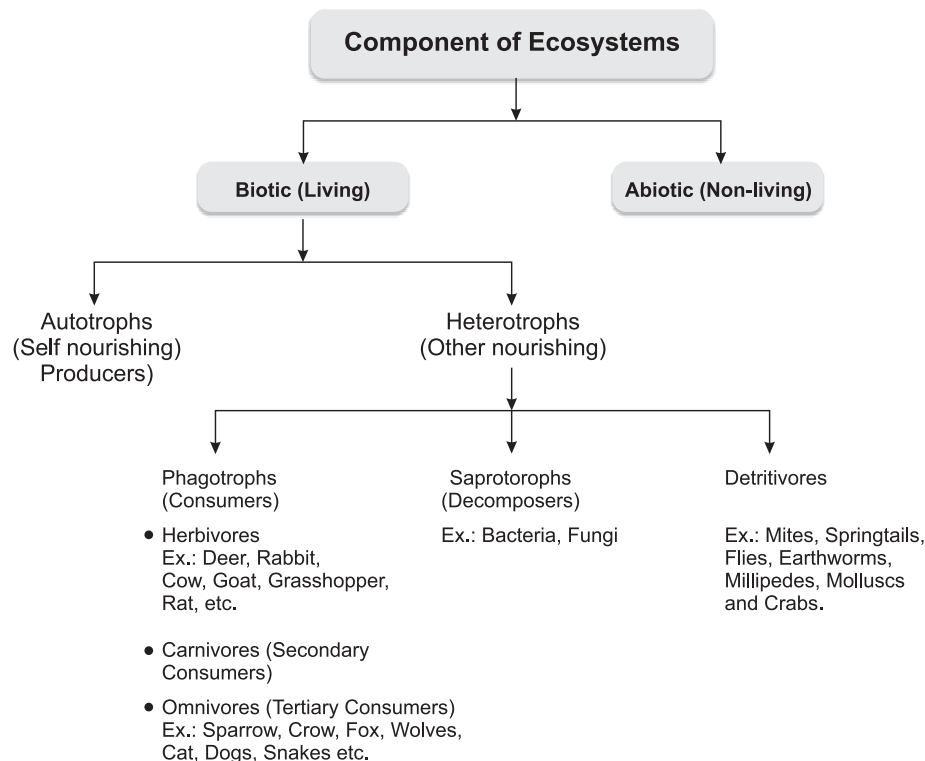
Basics of Environment, Ecology and Ecosystem

Introduction

Ecology can be defined as the study of relationships between organism and their environment it also refer as interaction of an organism with its environment and interaction with member of same species as well as other species. The term was coined by a German Biologist Ernst Haeckel in 1866. The word "Oikos" means home + "logy" means study together form Ecology.

Environment is the surrounding in which the organisms live whereas the ecosystem involves the interaction between the environment and the organisms living in it.

Ecology	Environment	Ecosystem
Ecology includes the study of relationships between living organisms and their environment.	Environment' means surrounding in which organisms live. It is the sum total of conditions that surround us at a given point in time and space.	An ecosystem is a functional unit of nature where a community of living organisms interact among themselves and with the surrounding physical environment. An ecosystem is a sub-part of Ecology.



Ecosystem

An ecosystem is a complex set of relationship among the living resources, habitats, and residents of an area. It includes plants, trees, animals, fishes, birds, micro-organisms, water, soil, people, etc. Everything that lives in an ecosystem is dependent on the other species and elements that are also part of ecological community.

Ecosystems include living organisms, the dead organic matter produced by them, the abiotic environment within which the organisms live and exchange elements (soils, water, atmosphere), and the interactions between these components.

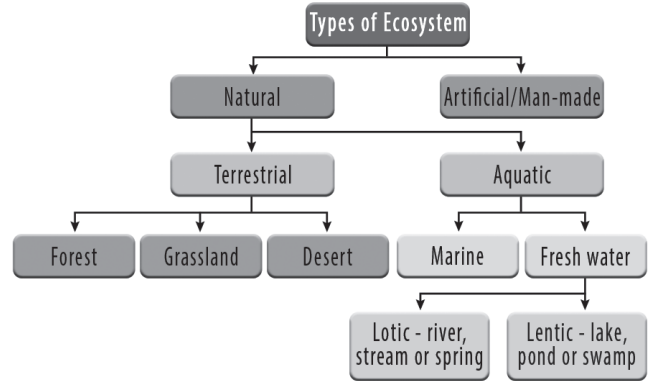
When an ecosystem is healthy (i.e., sustainable) it means that all the elements live in balance and are capable of reproducing themselves.

The term 'ecosystem' was first coined by A.G. Tansley in 1935.

The concept of ecosystem was initially given by E.P. Odum who is widely considered as "Father of ecosystem/ ecology".

Ecosystem is a functional unit which as biotic community of organism integrated with the physical environment (which comprise of the abiotic components) through the energy and nutrient flows.

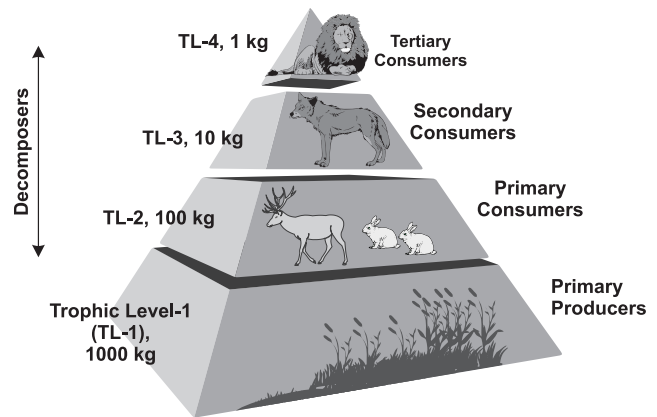
Types of Ecosystem



Characteristics of Ecosystem

Ecosystem is a subset of Biosphere, wh

A. Structure of Ecosystem

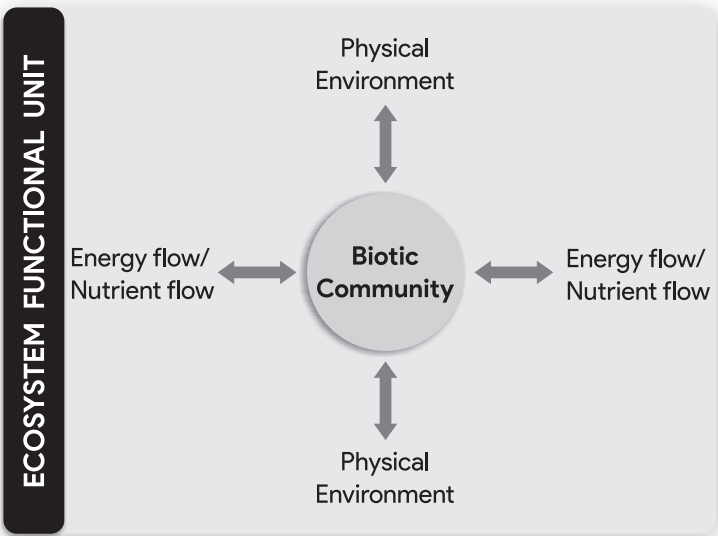


Ecosystem is a subset of Biosphere, wherein various species, their populations and communities interact with each other along with non-living things like land, sunlight, wind, humidity, etc., called as abiotic elements, whereas, the living things are called as biotic elements.

B. Functions of Ecosystem

The ecosystem has some functional properties which keep all the components interlinked and running together. The components of the ecosystem are seen to function as a unit when the below-mentioned aspects are considered:

- Productivity
- Decomposition
- Energy Flow
- Nutrient Cycling



Pollution

Pollution

Pollution is defined as the presence of matter (gas, liquid, solid) or energy (heat, noise, radiation) whose nature, location, or quantity directly or indirectly alters characteristics or processes of the environment, and causes or damage to the condition, health, safety, or welfare of living organism.

It is an undesirable change in the physical, chemical or biological characteristics of air, water, soil and other physical domains that may harmfully affect the life or create a potential health hazard for any living organism.

It can occur naturally, for example through volcanic eruptions, or as the result of human activities, such as the spilling of oil or disposal of industrial wastes.

Pollutant

Any substance that causes pollution is called pollutant. A pollutant may include any chemical or geochemical substance (dust, sediment, etc.), biotic component or its product, or physical factor (heat) that is released either naturally or anthropologically into the environment.

Classifications of Pollution

There are several types of pollution, and they may come from different sources and have different consequences. These are classified as:

(i) On the basis of part of environment

- (a) Air Pollution
- (b) Water Pollution
- (c) Soil Pollution

(ii) On the basis of its origin

- (a) Natural (e.g. volcanic eruptions)
- (b) Anthropogenic (man made pollution such as industrial pollution, agricultural pollution, etc.)

(iii) According to the physical nature of pollutant

- (a) Gaseous Pollution
- (b) Dust Pollution
- (c) Noise Pollution
- (d) Radioactive Pollution, etc.
- (e) Plastic Pollution

Air Pollution

Air pollution may be defined as the presence of any solid, liquid or gaseous substance in the atmosphere in such concentration that may be directly and indirectly injurious to humans or other living organisms, plants, property or interferes with the normal environmental processes.

Air pollution comes from a wide variety of sources. Some of the sources include vehicle or manufacturing exhaust, forest fires, volcanic eruptions, dry soil erosion and other natural sources, and building construction or demolition.

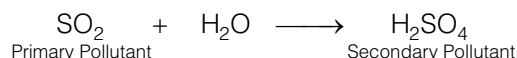
Automobiles of all classes emit CO, SO₂, unburnt hydrocarbons and nitrogen oxide. It is estimated that a car (without cleaning device) on burning 1000 litre of fuel emits 350 kg of CO, 0.6 kg of SO₂, 0.1 kg of lead with other pollutants.

Depending on the concentration of air pollutants, several effects can be noticed. The effect of pollution can be seen as higher rain acidity, crop depletion, higher rates of asthma, etc.

Types of Air Pollutants

Air pollutants can be categorized into two groups:

- (i) **Primary Air Pollutants:** These are derived from direct burning of source like coal which causes release of pollutants. The example of primary pollutants are CO₂, CO, SO₂, Hydrocarbons like CH₄ (Methane), ethylene, particulate matters, Nitrogen dioxide (NO₂), etc.
- (ii) **Secondary Air Pollutants:** They are formed because of reaction of primary pollutants among themselves. About 10% of global air pollution is caused by secondary pollutants. The examples of secondary air pollutants are photochemical smog, acid rain, etc.



Composition of Primary Air Pollutants

The primary air pollutants are composed of:

1. Particulate Matter

It comprises solid particulates or liquid droplets (aerosols) which are small enough to remain suspended in air, e.g. smoke, dust, asbestos, fibres, pesticides, some metals (including Hg, Pb, Cu and Fe) and also biological agents like tiny dust mites, spores and pollen.

The atmospheric particle having diameter 7-10 mm, generally settle out in less than a day, whereas particles with diameter 1 mm or less can remain suspended in air for weeks. These suspended particulate matter in the lower atmosphere (troposphere) causes human respiratory illness like asthma, chronic bronchitis, etc.

Air Pollutants and their characteristics		
Pollutants	Source	Consequences
SO ₂ and H ₂ S	Burning of coal, Volcanic eruption, Biological decomposition	Causes acid rain which finally affects growth and development of flora. It also causes skin cancer in human.
Hydrogen Flouride	Active Volcano	It retards growth of plants and leaves.
Nitrous dioxide (NO ₂)	Burning of organic waste, motor vehicle.	Causes acid rain in form of HNO ₃ .
Hydrocarbons like methane, ethylene	Incomplete combustion of fuel, motor vehicle exhaust, petroleum refineries.	They trigger the growth of secondary pollutants.
CO	Released from automobile and defective furnaces.	It affects Central Nervous system (CNS) of human because it has 200 times more affinity for haemoglobin than O ₂ and form a stable compound which is known as Carboxy-Haemoglobin (CoHb). $\text{Co} + \text{Hb} \rightarrow \text{CoHb}$ CoHb block the passage of O ₂ and causes suffocation and finally death.

It also lowers the temperature at the earth's surface by altering radiation.

Fly Ash

Fly ash is a by-product from burning pulverized coal in electric power generating plants. During combustion, impurities in the coal fuse in suspension and float out of the combustion chamber with the exhaust gases.

Climate Change

4

Introduction

Climate change is a long-term change in the statistical distribution of weather patterns over periods of time that range from decades to millions of years. It may be a change in the average weather conditions or a change in the distribution of weather events, for example, greater or fewer extreme weather events. Climate change may be limited to a specific region, or may occur across the whole Earth.

In recent times, Climate Change pertains to the change in the climate because of human induced factors that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

Due to domestic and industrial coal burning, the concentration of radiative gases like CO_2 , CH_4 , N_2O and CFCs is increased in the lower atmosphere which is a major factor for climate change.

Signs and Effects of Climate Change

Signs of Climate Change

- Higher Temperature
- Melting Glaciers
- Shrinking Sea Ice
- Wilder Weather
- Changing Rain and Snow Patterns
- Less Snowpack
- More Droughts
- Thawing Permafrost

Effects of climate change on mankind and surroundings

- Agriculture
- Energy Recreation
- Forests
- Plants, Animals and Ecosystems
- Coastal Areas
- Water Supplies



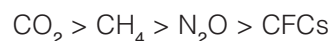
Climate is an outcome of interaction of temperature, humidity, etc. of a particular place for long period of time which should not be less than 35 years, whereas the weather of a place is an outcome of interaction of temperature, humidity, etc. for shorter period of time.

Greenhouse Gases

Greenhouse gases are made of three or more atoms. This molecular structure makes it possible for these gases to trap heat in the atmosphere and then re-emit it towards the surface which further warms the Earth. This continuous cycle of trapping heat leads to an overall increase in global temperatures.

The word 'Greenhouse gases' was coined by Joseph Fourier.

The increased amounts of greenhouse gases in the atmosphere are affecting the global climate and this phenomenon is now recognized as Global Climate Change. Sequence of greenhouse gases according to their harmful effect are:



For each greenhouse gas, a Global Warming Potential (GWP) has been calculated to reflect how long it remains in the atmosphere, on average, and how strongly it absorbs energy.

Types of Greenhouse Gases

There are basically two types of greenhouse gases:

- (i) **Controlled** : CO_2 , CH_4 , Nitrous Oxide (NO_2), CFC, HFC and SF_6

(ii) Uncontrolled: Water vapour (H_2O), Ozone

The excessive increase in concentrations of these greenhouse gases in the atmosphere would retain more and more of the infrared radiation, resulting in enhanced greenhouse effect.

(a) Carbon Dioxide (CO_2)

CO_2 is the most abundant greenhouse gas in atmosphere.

The level of CO_2 in the atmosphere has increased from the pre-industrial level of 280 ppm to about 407 ppm in 2017. This has been largely the result of fossil fuel burning, deforestation and change in land use.

Greenhouse Effect

- The Greenhouse effect is a natural process that warms the Earth's surface. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases. The absorbed energy warms the atmosphere and the surface of the Earth.
- Greenhouse gases include water vapour, carbon dioxide, methane, nitrous oxide, ozone and some artificial chemicals such as chlorofluorocarbons (CFCs).
- A greenhouse is a building made of glass that allows sunlight to enter but traps heat inside, so the building stays warm even when it's cold outside. Because gases in the Earth's atmosphere also let in light and trap heat, therefore, this phenomenon is known as the "greenhouse effect."

(b) Methane (CH_4)

- Methane concentration in atmosphere has become more than doubled (1750 ppb) than its concentration during the pre-industrial times.
- Methane is largely a product of incomplete decomposition and is produced by a group of bacteria called methanogens under anaerobic conditions.
- The major sources of methane include wetlands, fermentation in cattle and flooded rice fields, etc.

(c) Chlorofluorocarbons (CFCs)

- Chlorofluorocarbons are non-toxic and non-flammable, highly stable and synthetic gaseous compounds of carbon and halogens.
- These compounds were synthesized during the 20th century. The concentration of these gases in the atmosphere has now increased.
- Major sources of CFCs are leaking from air-conditioners, refrigeration units, evaporation of industrial solvents, production of plastic foams and propellants in aerosol spray cans.
- The CFCs can persist for 45 to 260 years or more in the atmosphere.
- It is estimated that CO_2 contributes about 60% of the total global warming whereas the shares of CH_4 and CFCs are 20% and 14% respectively.

(d) Hydrofluorocarbons (HFCs)

- HFCs are chemicals used in comfort air conditioning and refrigeration applications.
- They are non-flammable, recyclable, highly effective, energy-efficient refrigerants. They exhibit low toxicity.
- HFCs are emerging as the preferred replacements of CFCs and Hydrochlorofluorocarbons (HCFCs).
- Substituting HFCs for CFCs have actually reduced the global climate change impact.

(e) Nitrous Oxide (N_2O)

- N_2O is produced during nylon production, burning of nitrogen-rich fuels, livestock waste, breakdown of nitrogen rich fertilizers in soil and nitrate contaminated ground water.
- A smaller contribution to global warming is made by N_2O (6%).

(f) Sulphur Hexafluoride (SF_6)

- Sulphur hexafluoride (SF_6) is an inorganic, colorless, odourless, non-flammable, extremely potent greenhouse gas which is an excellent electrical insulator.



Previous Years' Questions & Practice Questions

1. Which recent International agreements have a bearing on Disaster Management?

- (a) Sendai Framework
- (b) Sustainable Development Goals 2015-2030
- (c) Paris Agreement on Climate Change
- (d) All of the above

[APPSC (AEE) : 2016]

Ans. (d)

2. At which stage of disaster management cycle, would "response" be the main activity?

- (a) Pre-disaster
- (b) Disaster
- (c) Post-disaster
- (d) Devastating

[APPSC (AEE) : 2016]

Ans. (c)

3. As per the High Powered Disaster Management Committee Report, 2001, in terms of vulnerability, as L2 type indicates manageability with resources at

- (a) Village level
- (b) Taluk/Mandal level
- (c) District level
- (d) State level

[APPSC (AEE) : 2016]

Ans. (b)

4. Which of the following agencies in India provides financial support for the promotion of alternative energy usage?

- (a) CERN
- (b) NCERT
- (c) SDBI
- (d) IREDA

[BPSC (AE) : 1995]

Ans. (d)

5. Which of the following air pollutants are responsible for acid rain within and downwind area of major industrial emission?

- (a) H₂S and oxides of Nitrogen
- (b) SO₂ and oxides of Nitrogen
- (c) CO₂ and H₂S
- (d) CH₄ and H₂S

[BPSC (AE) : 1995]

Ans. (b)

6. Which of the following is going to introduce "Green Toilets"?

- (a) Air India
- (b) Delhi Metro
- (c) Indian Railways
- (d) Karnataka Roadways

[BPSC (AE) : 1995]

Ans. (c)

7. Which of the following contribute most to electricity generation in India?

- (a) Thermal sources of energy
- (b) Hydroelectric sources of energy
- (c) Nuclear sources of energy
- (d) Non-conventional sources of energy

[BPSC (AE) : 1995]

Ans. (a)

8. What is carbon footprint?

- (a) The total set of greenhouse gas emission caused by an organization, person or event
- (b) The total amount of carbon dioxide emission caused by an organization, person or event.
- (c) A tradable certificate or permit representing the right of emitting one tonne of carbon dioxide.
- (d) None of the above

[BPSC (AE) : 1995]

Ans. (b)

9. Which of the following is not a fossil fuel?

- (a) Petroleum (b) Uranium
(c) Natural gas (d) Coal

[BPSC (AE) : 2001]

Ans. (b)

10. The increased content of carbon dioxide in the atmosphere causes

- (a) Skin cancer
(b) Respiratory diseases
(c) Global warming
(d) Smog

[BPSC (AE) : 2001]

Ans. (c)

11. The most polluted river of India is

- (a) Ganga (b) Sutlej
(c) Tapti (d) Mahanadi

[BPSC (AE) : 2001]

Ans. (a)

12. If all the plants of the world die, all the animals will also die due to the shortage of

- (a) Nitrogen
(b) Oxygen
(c) Carbon monoxide
(d) Carbon dioxide

[BPSC (AE) : 2001]

Ans. (b)

13. Which of the following sources of energy is different from others?

- (a) Gobar gas (b) Bitumen
(c) Anthracite (d) Coke

[BPSC (AE) : 2001]

Ans. (a)

14. An instrument that measures air pressure is

- (a) Anemometer
(b) Thermometer
(c) Barometer
(d) Lactometer

[BPSC (AE) : 2012]

Ans. (c)

15. What type of energy radiates from hot objects and can be seen by cameras?

- (a) Infrared ray
(b) Ultraviolet ray
(c) X-ray
(d) Gamma ray

[BPSC (AE) : 2012]

Ans. (a)

16. Fly-ash, a well-known pollutant is produced by

- (a) Oil refinery
(b) Fertilizer plant
(c) Cement plant
(d) Thermal power plant

[BPSC (AE) : 2017]

Ans. (d)

17. Biodegradables are the substances

- (a) That are inert
(b) That persist in environment for a long time
(c) That may harm the various members of the ecosystem
(d) That are broken down by biological processes

[BPSC (AE) : 2018]

Ans. (d)

18. Which of the following processes is used to treat contaminated media by altering environmental conditions to simulate growth of microorganism?

- (a) Bioaccumulation
(b) Bioaugmentation
(c) Biodegradation
(d) Bioremediation

[BPSC (AE) : 2018]

Ans. (d)

19. The headquarters of "International Solar Alliance" is located in

- (a) Paris (b) Bonn
(c) Haryana (d) Bihar

[BPSC (AE) : 2018]

Ans. (c)