CS-14

Environmental Science: Understanding the Earth's Ecosystems and Sustainability

Objective:

• The primary objective is to introduce students to the fundamental concepts of Environmental Science, including ecosystems, biodiversity, natural resources, pollution, climate change, and sustainability.
• The course aims to raise awareness about pressing environmental challenges faced globally and locally, such as air and water pollution, deforestation, habitat destruction, and climate change.
• Students will become familiar with environmental laws, regulations, and policies at local, national, and international levels, which govern environmental protection and conservation efforts.

Prerequisites:

• A fundamental understanding of basic science subjects.

Chapter - 1
Introduction to Environment Science

• Definition
• Environmental Issues and Challenges
• Principles and Scope
• Concepts of Ecology and Ecosystem

Background to Studying Environmental Science

Nowadays most of the world's population is facing different problems related to nature and they are studying the solutions to save nature and global problems, but on the other hand we even today do not try to understand our local problems related to nature. So, to the awareness of the problems of nature and pollution, the higher education commission has suggested adding Environmental Science to the course of different levels. Environmental Science is also well known as Environmental Studies in the Indian Colleges and Universities. Before that, it was part of science but nowadays it is a very common subject and the higher education commission has suggested including it as a general paper in all the courses.

Awareness in the field of environmental sciences is becoming a global talk. People worldwide are realizing its importance as they can smell a Polluted

tomorrow. Careful handling of today's environment would only serve as a legacy for tomorrow's generation. Hence, we need to be judicious in exploiting our resources optimally. To ensure sustainable development we need to know something about how our environment works. The environment can be defined as the set of conditions that surround an organism or the complex of socio-cultural conditions that affect an individual. Environmental Science is the systematic, scientific study of the environment in combination with living organisms.

INTRODUCTION

Ten years after the first Earth Day in 1970, environmental activist Senator **Gaylord Nelson** wrote a letter about the importance of the environment to the American people and the world. "So long as the human species inhabits the Earth," he wrote in the letter, "proper management of its resources will be the most fundamental issue we face. Our very survival will depend on whether or not we can preserve, protect, and defend our environment."

The word Environment is derived from the French word "Environ" which means "surrounding". Our surroundings include biotic factors like human beings, Plants, animals, microbes, etc, and abiotic factors such as light, air, water, soil, etc. Environment is a complex of many variables, which surrounds man as well as living organisms. The environment includes water, air, and land and the interrelationships that exist among and between water, air, and land and human beings and other living creatures such as plants, animals, and microorganisms. She suggested that the environment consists of an inseparable whole system constituted by physical, chemical, biological, social, and cultural elements, which are interlinked individually and collectively in myriad ways. The natural environment consists of four interlinking systems namely, the atmosphere, the hydrosphere, the lithosphere, and the biosphere. These four systems are in constant change and such changes are affected by human activities and vice versa.

Components of Environment

The environment has been classified into four major components:

1. Hydrosphere
2. Lithosphere
3. Atmosphere
4. Biosphere.

- Hydrosphere includes all water bodies such as lakes, ponds, rivers, streams oceans, etc. The hydrosphere functions in a cyclic nature, which is termed a hydrological cycle or water cycle. Lithosphere means the mantle of rocks constituting the earth's crust. The Earth is a

cold spherical solid planet of the solar system, which spins on its axis and revolves around the sun at a certain constant distance.

- Lithosphere mainly, contains soil, earth rocks, mountain etc. The lithosphere is divided into three layers-crusts, mantle, and core (outer and inner). Atmosphere The cover of the air, that envelopes the earth is known as the atmosphere.
- Atmosphere is a thin layer that contains gases like oxygen, carbon dioxide, etc., and which protects the solid earth and human beings from the harmful radiations of the sun. There are five concentric layers within the atmosphere, which can be differentiated based on temperature and each layer has its characteristics. These include the troposphere, the stratosphere, the mesosphere, the thermosphere, and the exosphere.
- Biosphere is otherwise known as the life layer, it refers to all organisms on the earth's surface and their interaction with water and air. It consists of plants, animals, and microorganisms, ranging from the tiniest microscopic organisms to the largest whales in the sea. Biology is 2 concerned with how millions of species of animals, plants, and other organisms grow, feed, move, reproduce, and evolve over long periods in different environments. Its subject matter is useful to other sciences and professions that deal with life, such as agriculture, forestry, and medicine. The richness of the biosphere depends upon several factors like rainfall, temperature, geographical reference, etc. Apart from the physical environmental factors, the man-made environment includes human groups, the material infrastructures built by man, the production relationships, and institutional systems that he has devised. The social environment shows how human societies have organized themselves and how they function to satisfy their needs.

Definition

Environmental science is an interdisciplinary academic field that integrates physics, biology, and geography (including ecology, chemistry, plant science, zoology, mineralogy, oceanography, limnology, soil science, geology and physical geography, and atmospheric science) to the study of the environment, and the solution of environmental problems. Environmental science emerged from the fields of natural history and medicine during the Enlightenment. Today it provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems.

Related areas of study include environmental studies and environmental engineering. Environmental studies incorporate more of the social sciences for understanding human relationships, perceptions, and policies toward the

environment. Environmental engineering focuses on design and technology to improve environmental quality.

Environmental science is based on the impact of human actions on terrestrial and aquatic ecosystems and develops ideas and plans for restoring these ecosystems. Environmental scientists also help planners develop and construct buildings and other modules to help benefit water resources and efficient land usage. Environmental research is commonly conducted among many different interdisciplinary sciences to produce one goal. Since most environmental issues deal with human activities, the study of economics, law, and social sciences is often used in conjunction with environmental science.

Environmental science deals with a wide range of issues including climate change, conservation, biodiversity, water quality, soil and groundwater contamination, natural resources, waste management, development, disaster reduction, and various pollutions. While the environment has been studied for as long as science has been around, only recently (in the 1960s and 1970s) has it become an active mainstream scientific investigation. Growing public awareness of environmental issues and a need for action is one factor in the growth of environmental science to what it is today.

"The focus of environmental science is to learn how the natural world works, understand how we interact with our natural world, and determine how we can address environmental issues to preserve that natural world around us," said **Dr. Kelly Thrippleton-Hunter.**

Environmental Science provides an overview of how science affects our environment. We focus on interactions between the solid Earth, its water, its air, and its living organisms, and dynamic, interdependent relationships between these four components.

Earth and environmental scientists also consider how these relationships produce environmental change at different timescales. To do this, they combine knowledge, models, and methods drawn from geology, biology, physics, and chemistry.

We also strive to understand past and present environmental processes so that reliable and scientifically based predictions can be made about the future.

Environmental Issues and Challenges

- ## What are environmental issues?

Environmental issues are the set of challenges and problems facing Earth and its natural systems. From climate change and pollution to overpopulation and energy use, these issues are complex and interconnected.

As they affect the health of the natural world, environmental issues can have significant impacts on human health and well-being, as well as organizations and business operations.

Environmental issues result from a combination of natural causes and human impact. While the Earth's ecosystems are designed to handle certain amounts of natural disturbances (such as forest fires and floods), human activities can create circumstances in which they happen with greater frequency or intensity.

Since the Industrial Revolution, the burning of fossil fuels and other activities have increased the number of greenhouse gas emissions in Earth's atmosphere, leading to an increase in global warming. The resulting climate change has accelerated the disruption of the environment and vital natural processes. Land use practices, extraction of natural resources, waste disposal and other human behaviors also contribute to environmental issues.

Environmental issues are the harmful effects of human activities on the environment. These include pollution, overpopulation, waste disposal, climate change, global warming, the greenhouse effect, etc.

Various environment protection programs are being practiced at the individual, organizational, and government levels to establish a balance between man and the environment.

Some of the current environmental issues that require urgent attention are:

- **Climate Change**

Climate change is a great concern in today's scenario. This problem has surfaced in the last few decades. Greenhouse gases are the major cause of climate change. Environmental changes have several destructive impacts such as the melting of glaciers, changes in seasons, epidemics, etc.

Climate change refers to the long-term changes in temperature, precipitation, and other weather patterns caused by human activities such as burning fossil fuels. These activities have increased the number of greenhouse gas

emissions released; these emissions trap heat within Earth's atmosphere, leading to increasing global temperatures.

According to NASA, the Earth's average surface temperature has risen by about 1°C since the late 19th century.[1] The results include melting glaciers, rising sea levels, disrupted ecosystems and an increase in severe weather events such as droughts, floods, heat waves and wildfires.

- **Global Warming**

The burning of fossil fuels, emissions from automobiles, and chlorofluorocarbons add to the greenhouse gases in the atmosphere. This has led to an increase in the earth's temperature causing environmental changes. This increase in temperature across the globe is known as global warming.

- **Ozone Layer Depletion**

The ozone layer is a layer of concentrated ozone gas. It protects us from the sun's harmful ultraviolet rays. This very important layer is being destroyed by CFCs (chlorofluorocarbons), which are used in industries and everyday life (e.g. aerosol cans).

The chlorine in these compounds destroys the ozone layer. The hole in the ozone layer leaves humans and wildlife exposed to harmful UV rays resulting in several skin diseases including cancer.

- **Water Pollution**

Beyond the ocean, Earth's other water supplies are also facing challenges. Safe drinking water is critical for human health; however, industrial waste, pesticides, and agricultural processes can pollute water sources. The presence of the resulting bacteria and chemical concentrations in drinking water can cause digestive problems, neurological illnesses, skin infections and more.

More than a billion people worldwide do not have access to clean water. As climate change and human actions shrink the available water supply, two-thirds of the world's population may face water shortages by 2025.5

The introduction of harmful substances into rivers, oceans, lakes, and ponds, which changes the physical, chemical, or biological condition of the water is called water pollution. The polluted water lacks oxygen and therefore the

organisms die. Water is the main source of life and therefore it is our prime duty to prevent it from any kind of pollution.

- **Air Pollution**

Air pollution refers to the presence of harmful substances such as carbon dioxide, methane, and nitrogen dioxide in the air that people breathe. The burning of fossil fuels, industrial processes, transportation, and wildfires can have a negative impact on air quality. Exposure to fine particles, ground-level ozone, and other pollutants can cause respiratory problems, heart disease, cancer, and other health conditions. According to the World Health Organization, outdoor air pollution causes 4.2 million premature deaths every year.[3]

Air pollution is the result of emissions from industries, automobiles, and the increasing use of fossil fuels. The gaseous emissions have added to an increase in the temperature of the earth. Not only this, but it also increases the risk of diseases among individuals.

- **Solid Waste Management**

Solid-waste management is defined as the discipline associated with the generation, storage, collection, transfer transport, processing, and disposal of solid waste in a manner that does not hurt the environment.

- **Deforestation**

Deforestation is the depletion of trees and forests at an alarming rate. The trees provide us with oxygen, and several raw materials and also maintain the temperature of the earth. Due to the depletion of trees for commercial purposes, there has been a drastic change in the earth's climate.

Forests are an abode to a large number of wild animals and plants. Destruction of forests has led to the elimination of a large number of plants and animal species affecting biodiversity.

- **Overpopulation**

The earth's population is increasing drastically. It is estimated to be more than seven billion. The increasing population has led to a shortage of resources. If this continues, it will be very difficult to sustain such a huge population. The other environmental issues including pollution, waste

management, deforestation, climate change, and global warming are all associated with overpopulation.

Loss of biodiversity

Biodiversity refers to the variety of life on Earth, including animals, plants, and microorganisms. From the Amazon to the tundra, biodiversity is essential to the ecological balance of the planet. A loss of biodiversity can lead to species extinction, put food and water supplies at risk and reduce carbon sequestration (the natural process of removing carbon dioxide from the atmosphere, which is essential to reducing climate change).

Human activities, such as deforestation, agricultural expansion, land use changes and pollution, contribute to the overall loss of biodiversity. The use of pesticides can also harm nontarget species and disrupt ecosystems. According to the World Wildlife Fund, the Earth has lost 69% of its wildlife populations since 1970.2.

- **SCOPE OF ENVIRONMENTAL SCIENCE**

Because of environmental studies has been seen to be multidisciplinary in nature so it is considered to be a subject with great scope. Environment is not limited to issues of sanitation and health but it is now concerned with pollution control, biodiversity conservation, waste management and conservation of natural resources. This requires expert eyes and hence is creating new job opportunities. The opportunities in this field are immense not only for scientists but also for engineers, biologists. There is a good chance of opportunity to find a job in this field as an environmental journalist.

The scope of environmental studies is very wide and it deals with many areas like i) Conservation of natural resources, ii) ecological aspects, iii) pollution of the surrounding natural resources, iv) controlling the pollution, v) social issues connected to it, and vi) impacts of human population on the environment.

1. Developing an awareness and sensitivity to the total environment and its related problems.

2. Motivating people for active participation in environmental protection and improvement.

3. Developing skills for active identification and development of solutions to environmental problems.

4. Imbibe and inculcate the necessity for conservation of natural resources.

5. Evaluation of environmental programmes in terms of social, economic, ecological and aesthetic factors.

Environmental science can be applied in the following spheres:

Ecosystem Structure and Function
The study of ecosystems mainly consists of the study of the processes that link the living organism or in other words biotic component to the non-living organism or a biotic component. So for the study of the environment, we should be aware of biotic and biotic components.

Natural Resource Conservation
Managing and maintaining forests which are natural resources and for the maintenance of wildlife forms a task under natural resource conservation. It is also a scope of environmental studies

Environmental Pollution Control
With the knowledge of environmental science, everybody can control the pollution. He/she can handle waste management and also look for ways to control pollution on the aspect of pollution control.

Environmental management
There are several independent environmental consultants who are working with Central and State pollution control Board. They offer advice to solve the problems of the environment the optimum solution for the upcoming problems. They give direction for controlling pollution due to industrial development. Several current consultants are working with government pollution control boobs, involved in policy making, pollution control, and maintenance of ecological balance.

The scope of environmental studies in the industry
Environmental scientists work towards the maintenance of ecological balance, they also work towards the conservation of biodiversity and regulation of natural resources as well as on the preservation of natural resources. Most of the industries have a separate environmental research and development section. These sections govern the impact that their industry has on the environment. Our environment is being degraded by the rapid industrialization. To combat this menace there is a growing trend towards the

manufacture of "green" goods and products. So we can say that there is a good scope in the field of industry from environmental studies.

Research and development

Research and development have tremendous scope due to increment in public awareness regarding the environment. Various universities and governmental organizations offer a scope for such research. These universities conduct research studies in order to develop the methods toward monitoring and controlling the source of environmental pollution. Due to an increasing threat from global warming, many steps are being undertaken for the reduction of greenhouse gases and the adoption of renewable energy resources. They generate awareness now regarding the use of solar energy for variety of purposes. This provides scope of environmental history in the field of research and development.

Social Development

NGO (Nongovernmental organizations) help in creating awareness regarding the protection of the environment and making the masses aware of various environmental issues . They also generate a public opinion in this field. They work towards disseminating information and in bringing about changes in political policies that are personally effect the environment. The social dimension of this profession includes controlling population explosion through organizing advisory awareness camps.

Principles of Environmental Science

The EU environmental principles act as guidance for judges and decision-makers, giving laws shape and meaning, and offering protection to our natural world. They are used in a whole host of government and public authority decisions, including planning applications, management of marine protected areas and dealing with contaminated land.

What are the environmental principles?

The precautionary principle:

Where there is uncertainty about the risk of environmental harm, the precautionary principle allows protective measures to be taken without having to wait until the harm materialises.

This principle is valuable in managing risk where there is uncertainty about the environmental impact of an issue.

The prevention principle:

This principle requires preventive measures be taken to anticipate and avoid environmental damage before it happens. It is central to the UK's planning policy and underlies lots of environmental legislation.

Environmental damage should be rectified at source:

Working alongside the prevention principle, this ensures damage or pollution is dealt with where it occurs. It operates in many areas of UK environmental policy to prioritise the way environmental damage is addressed.

The polluter pays principle:

As the name suggests this principle holds that the person who causes pollution should bear the costs of the damage caused and any remedy required. It plays a significant role in environmental management, acting as a deterrent and directing accountability for harm.

The integration principle:

This principle requires that environmental protection is integrated into all other policy areas, in line with promoting sustainable development. That is to say all government departments have responsibilities to protect our environment.

Why do environmental principles matter?

The EU environmental principles work together to ensure high environmental standards by directing how judges and other decision-makers should interpret the law.

For example, the Court of Justice of the European Union ruled that the Habitats Directive – which protects over 1000 vulnerable species – must be interpreted in line with the precautionary principle, in the leading *Waddenzee* case:

"So, where doubt remains as to the absence of adverse effects on the integrity of the site linked to the plan or project being considered, the competent authority will have to refuse authorisation."

In line with the polluter pays principle, a recent Court decision in Scotland found that an insolvent coal company could not just abandon its responsibility

to clean up contamination on the land where it had been operating. The Court said the costs of cleaning up the land must be enforced and treated as liquidation expenses, meaning they could not just abandon the land.EU environmental principles are used to interpret policies, provide a basis to scrutinise and challenge government actions in court, and guide local authority decision-making.

- **Concepts of Ecology and Ecosystem**

CONCEPT OF ECOLOGY AND ECOSYSTEM

The term Ecology was coined by Earnst Haeckel in 1869. It is derived from the Greek words Oikos- home + logos- study. So ecology deals with the study of organisms in their natural home interacting with their surroundings. The surroundings or environment consists of other living organisms (biotic) and physical (abiotic) components. Modern ecologists believe that an adequate definition of ecology must specify some unit of study and one such basic unit described by Tansley (1935) was ecosystem. An ecosystem is a self-regulating group of biotic communities of species interacting with one another and with their non-living environment exchanging energy and matter.

Now ecology is often defined as ‘‘the study of ecosystems’’. The ecosystem is a unit or a system which is composed of a number of sub-units, that are all directly or indirectly linked with each other. They may be freely exchanging energy and matter from outside—an open ecosystem or may be isolated from outside in term of exchange of matter—a closed ecosystem.

Ecology is the scientific study of the relationship between different components in the environment and ecosystem. It deals with the interaction between organisms and their environment.

- There are different living things and nonliving beings in the environment which act as energy sources and actors in the ecology. The ecology is studied at different levels, such as species, habitat, ecosystem etc.
- A biological organism’s habitat, which includes both living (biotic) and nonliving (abiotic) components, is generally referred to as its **environment**.
- There are various ecological challenges impacting nature on a worldwide basis. These include the loss of many plant and animal

species, environmental degradation, and population growth. Understanding the Earth's ecological processes is therefore essential to managing the Earth and its life support systems.

Ecology

- The word ecology emerged from two Greek words: **"Oikos" and "logos".** "Oikos" means "house" or "estate," and "logos" means "study." Its literal meaning is the study of nature's home or family. The term was coined by **Ernst Haeckel** in **1866**, however it was first introduced by Hans Reiter in 1885.
- Ecology is **"the scientific study of the connection between living creatures and their environment".**
- **Ernst Haeckel (1866- 1870) explained about ecology in the following way: Ecology is a body of knowledge concerning the relations of organism, both to their inorganic and to its organic environment; including friendly and inimical relation with those animals and plants with which it comes in contact with.**
- **Plant and animal ecology** used to be the two divisions of ecology. Modern ecology, on the other hand, makes no difference between plants and animals due to their interconnectedness.

Subdivisions of Ecology

➢ Autecology

- Autecology is the study of particular species or individuals in relation to their environmental surroundings.
- Species-specific and population-specific autecology are the two main methods to autecological research (a) species-specific autecology examines individual species, whereas population ecology analyses individuals of the same species.

➢ Synecology

- It is the study of the community of living organisms as an individual unit.
- Community ecology is focused on the study of biotic (living) communities composed of interdependent plants and animals in a given region. A community of living creatures and their surroundings is considered a unit of nature under ecosystem ecology.

➢ Habitat Ecology

- Habitat ecology involves ecological study of organisms' habitat or environment and its influence on them. Diverse habitats like terrestrial, freshwater, marine and estuarine habitats are studied.

❖ Ecosystem

- Plants, animals, and humans coexist alongside a diverse range of other plants and animals. Such **complex natural organisations with their living and non-living surroundings** that govern them and provide nourishment to as an **ecosystem** (ecological system).
- There are biotic and abiotic components in an ecosystem.
- **Abiotic** components are **non-living** elements like energy, water, atmospheric gases and wind, fire, gravity, topography, geologic subsystem, soil, etc.
- The distribution of organisms in the environment is determined by the availability of energy.
- **Biotic** components are the **living** elements like plants, animals, microorganisms etc.
- **Producers-** As autotrophs, green plants synthesise carbohydrates from basic inorganic raw materials like carbon dioxide and water in the presence of sunlight, for their own benefit as well as that of non-producing organisms.
- **Consumers- It is not possible for heterotrophs to photosynthesise, thus they must obtain their nutrition from animal or plant-based sources. There are two major categories of consumers: macro consumers and micro consumers.**
- **Macroconsumers** are divided into two groups based on the type of food they consume.
- Herbivores, such as cows and rabbits, are the principal eaters of plants.
- Carnivores only eat other animals for food. Tertiary consumers are carnivores that feed on secondary consumers, such as lions that devour wolves. Omnivores are organisms that devour both vegetation and animals, such as mankind.
- **Micro-consumers** include bacteria and fungus that degrade decaying organic matter (detritus) from plants or animals.

- **STRUCTURE OF ECOSYSTEM**

The structure of Ecosystem comprise of:

•The Composition of biological community including, species number, biomass, life history, and distribution in space.

•The quantity and distribution of non-living material, such as nutrient water, etc.

•The rage of condition of existence such as temperature, light.

- **FUNCTION OF ECOSYSTEM:**

•The rate of biological energy flow i.e. production & respiration rates of the community.
•The rate of material or nutrient cycles
•Biological or ecological regulation including both regulation of organism by environment and
regulation of environment by the organisms.

- **COMPONENTS OF AN ECOSYSTEM:**

There are two components of an ecosystem; Living components and nonliving components.
Non-Living Components: (**Abiotic**) Non-living components are the physical and chemical factors that directly or indirectly affect the living components e.g. air, water, land, rock, etc. Nonliving components are also called **Abiotic** components. Physical factors include sunlight, water, fire, soil, air, temperature etc. Chemical factors include moisture, salinity of water, soil nutrients, oxygen dissolved in water etc.

Living Components: Living components in an ecosystem are either producers or consumers. They are also called **biotic** components. Producers can produce organic components e.g. plants can produce starch, carbohydrates, cellulose from a process called photosynthesis. Consumers are the components that are dependent on producers for their food e.g. human beings and animals.

•Biotic Components are further classified into 3 main groups

•Producers •Consumers •Decomposers or Reducers

1. **Producer (Autotrophs):** The green plants have chlorophyll with the help of which they trap solar energy and change it into chemical energy of carbohydrates using simple inorganic compound namely, water and carbon dioxide. This process is known as photosynthesis. The chemical energy stored by the producers is utilized partly by the producers for their own growth and survival and the remaining is stored in the plants for their future use. They are classified into two categories based on their source of food.

a)Photoautotrophs: An organism capable of synthesizing its own food from inorganic substances using light as an energy source. Green plants and photosynthetic bacteria are photoautotrophs.

b)Chemotrophs: Organisms that obtain energy by the oxidation of electron donors in
their environments. These molecules can be organic (chemoorganotrophs) or inorganic (chemolithotrophs).

2. **Consumers (Heterotrophs):** The animals lack chlorophyll and are unable to synthesis their own food therefore they depend on the producers for their food. •They are known as heterotrophs (i.e. heteros= others, trophs= feeder).The Consumers are of 4 types:

(a) Primary Consumer: (Herbivores) i.e. Animal feeding on plants, e.g. Rabbit, deer, goat etc.
(b) Secondary Consumers: The animal feeding on Herbivores are called as secondary Consumer or primary carnivores. e.g. Cats, foxes, snakes.
(c) Tertiary Consumers: These are large carnivores which feed on secondary consumers. e.g. Wolves
(d) Quaternary Consumers: They are also called omnivores these are largest carnivores, Which feed on tertiary consumers and are not eaten up by any other animals. e.g. lion and Tiger.

3. **Decomposers or Detrivores:** Bacteria & fungi belong to this category. They break down the dead organic matter of producers & consumers for their food and release to the environment the simple inorganic and organic substances. These simple substances are reused by the producers resulting in a cyclic exchange of material between biotic & abiotic environments.

Types of Natural Ecosystems

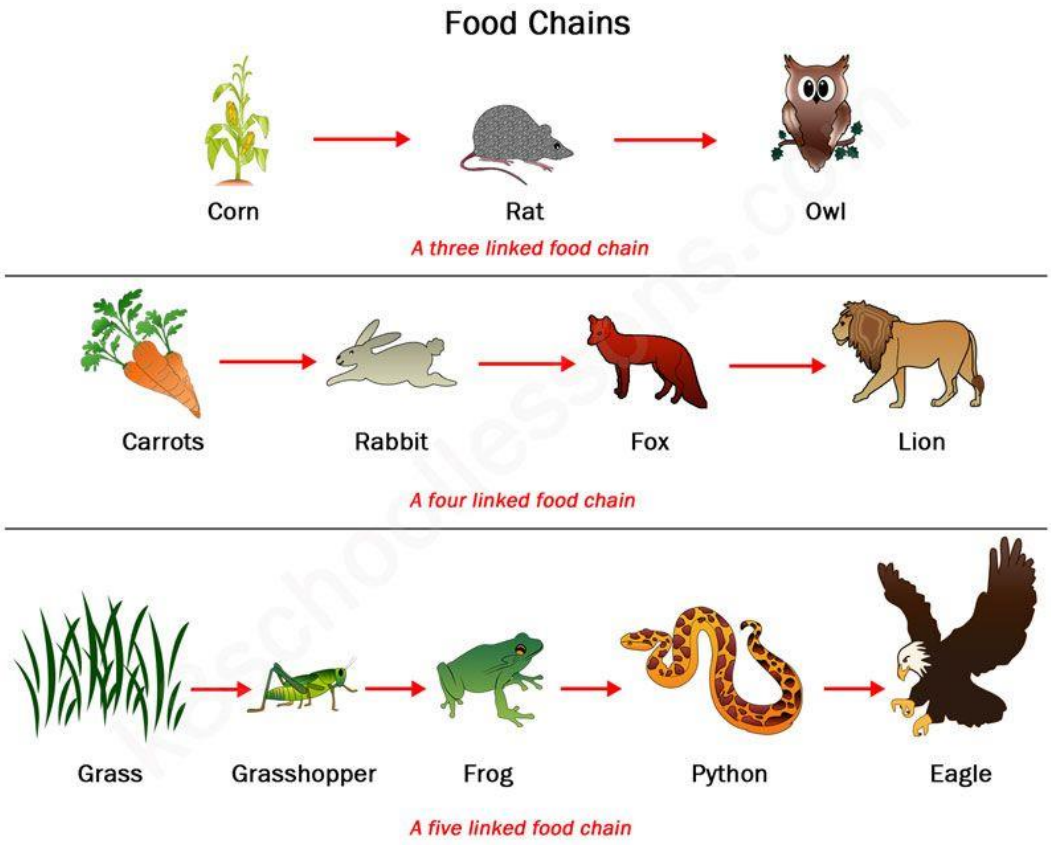
Terrestrial Ecosystem

- **Ecosystems based on land** are called terrestrial ecosystems.
- Forests, deserts, grasslands etc are terrestrial ecosystems.
- Forests make up about 31% of the earth's total land. There are three different types of forest ecosystems– **temperate forest, tropical rainforest, coniferous forest.**
- Both **hot and cold deserts exist**. Arid air, excessive heat and cold throughout the day and night, as well as a lack of rainfall characterise these habitats. Due to this, the flora is limited and the desert is home to few fauna.
- **Temperate grasslands** and the **Tropical Savannas** are the two types of grasslands.

Aquatic Ecosystem

- **Ecosystems based on water** are called the aquatic ecosystem.
- As the name implies, the **freshwater ecosystem** is a type of aquatic environment that contains consumable water. These include lakes, rivers, ponds, streams, and wetland habitats, among others.
- The **marine ecosystem** is an aquatic habitat that contains saltwater and is home to a variety of organisms. This ecosystem is the largest and most extensive on the planet. They not only contain oceanic beds, but also estuaries, tidal zones, saline swamps, mangroves, coral reefs etc.

Food Chain



- Organisms are connected through a prey and predator relationship. A **series of such nutrition dependencies** form the food chain.
- **Trophic level** refers to each level in the food chain. As the first trophic level, green plants or producers are responsible for maintaining the balance of the food chain. Herbivores make up the second trophic level, and predators make up the upper trophic levels.
- Green plants transform radiative energy into chemical energy, which is stored as food.

- Each species in a food chain consumes the species before it in the chain to transform the food energy from a particular source.

Food Web

- The **interlinkages between the food chains create the food web.**
- In nature, there is no such thing as an isolated or simple food chain. Plants can provide nourishment for deer, cows, grasshoppers, and rabbits concurrently.
- A food web depicts all possible energy and nutrition exchanges among species , whereas a food chain tracks only one channel in the food web.