2024

ENVIRONMENT

for

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

by **Mr. B. Singh**

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Preface

B. Singh (Ex. IES)

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.

B. Singh (Ex. IES)
CMD, MADE EASY Group

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ENVIRONMENT

Basics of Environment, Ecology and Ecosystem

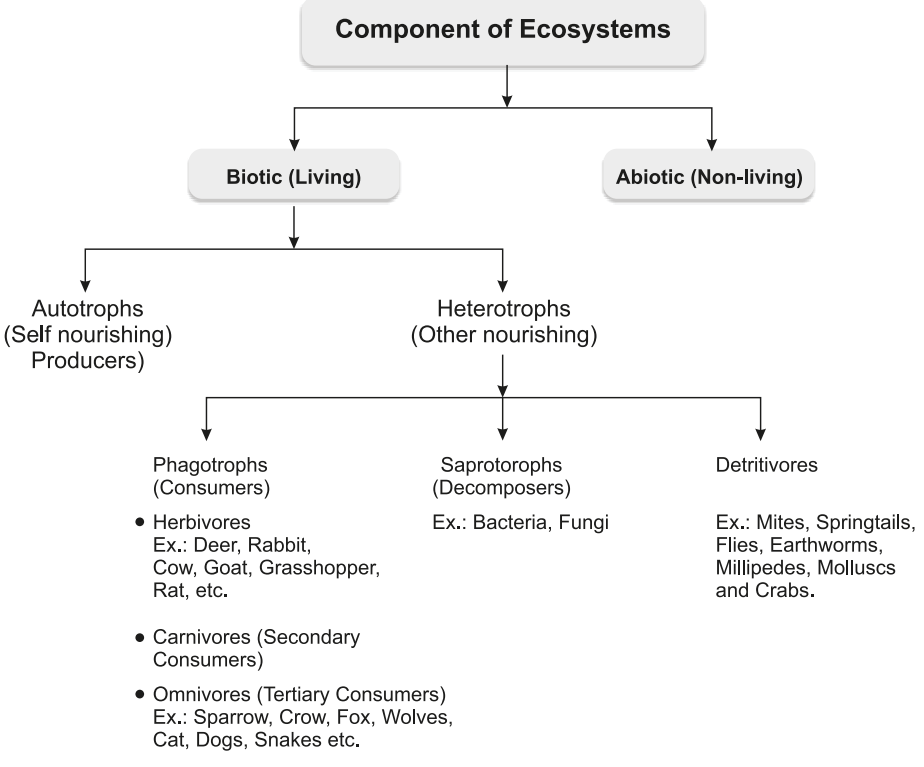
1

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 world "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.

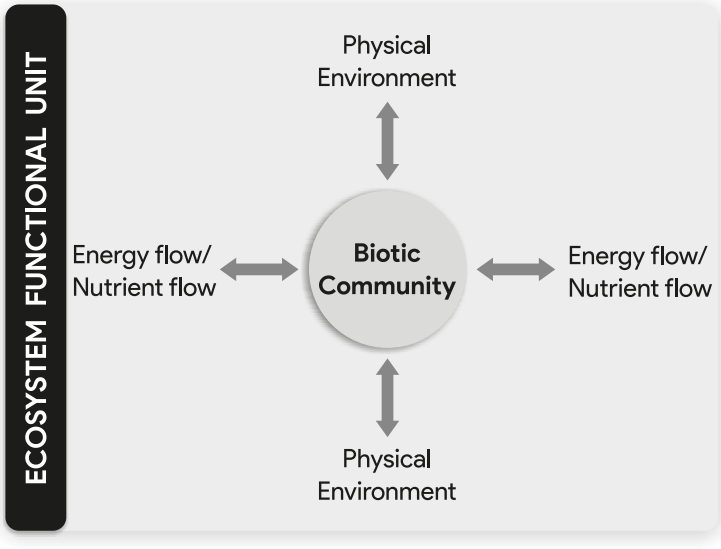
Ecosystems include living organisms, the dead organic matter produced by them, the abiotic environment within which the organisms live and exchange elements (soils, water, atmosphere), and the interactions between these components.

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

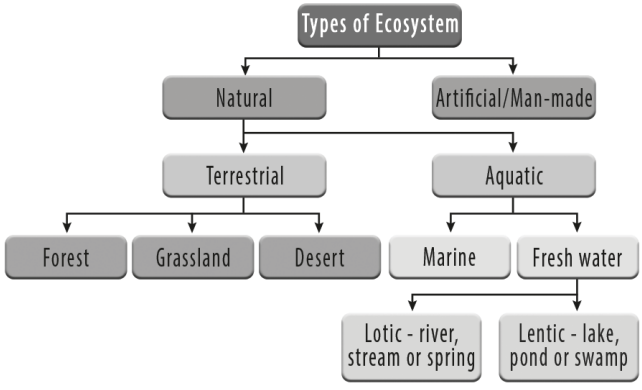
The term 'ecosystem' was first coined by A.G. Tansley in 1935.

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.



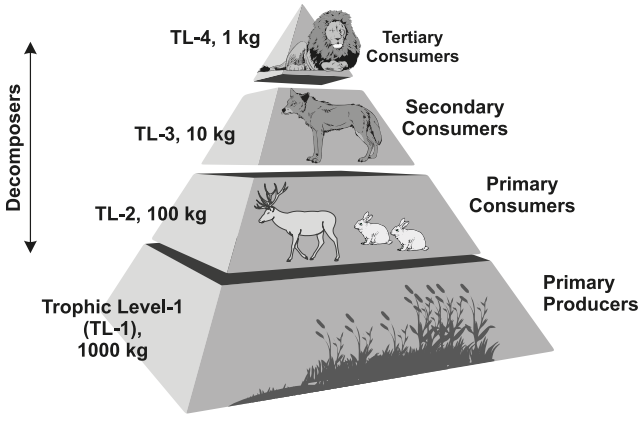
Types of Ecosystem



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

Productivity

Solar Energy is necessary for any ecosystem to function. Primary production is defined as the amount of biomass or organic matter produced per unit area over a time-period by plants during photosynthesis. The rate of biomass production is called productivity.

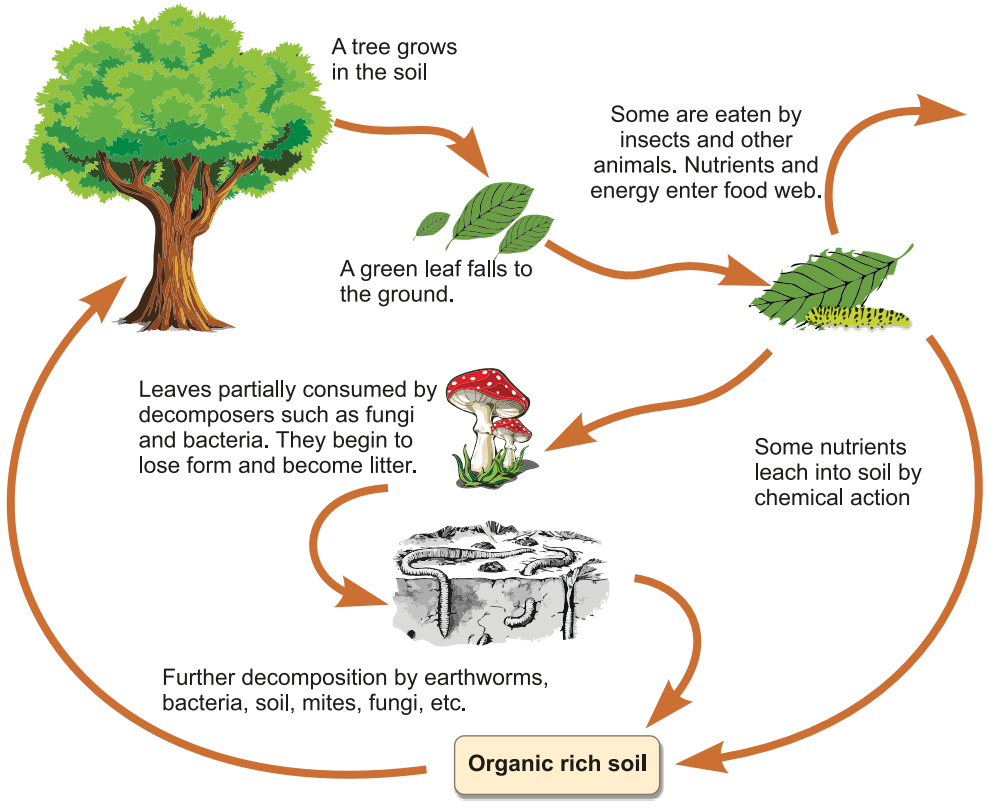
Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis. A considerable amount of GPP is utilised by plants in respiration. Gross primary productivity minus respiration losses (R), is the net primary productivity (NPP).

Net primary productivity is the available biomass for the consumption to heterotrophs (herbivores and decomposers). Consumers define secondary productivity as the rate of formation of new organic matter.

Primary productivity depends on the plant species inhabiting a particular area. It also depends on a variety of environmental factors including availability of nutrients and photosynthetic capacity of plants. Therefore, it varies in different types of ecosystems. The annual net primary productivity of the whole biosphere is approximately 170 billion tons (dry weight) of organic matter. Of this, despite occupying about 70 per cent of the surface, the productivity of the oceans are only 55 billion tons. Rest of course, is on land.

Decomposition

Earthworms help in the breakdown of complex organic matter as well as in loosening of the soil. Similarly, decomposers break down complex organic matter into inorganic substances like carbon dioxide, water and nutrients. The process is called decomposition. Dead plant remains such as leaves, bark, flowers and dead remains of animals, including faecal matter, constitute detritus, which is the raw material for decomposition.



Decomposition cycle in a terrestrial ecosystem

Humification and mineralisation occur during decomposition in the soil. It leads to accumulation of a dark coloured amorphous substance called humus that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate. Being colloidal in nature, it serves as a reservoir of nutrients. Some microbes further degrade the humus and release of inorganic nutrients occur by the process known as mineralisation. Decomposition is largely an oxygen-requiring process.

Energy Flow

All the components of an ecosystem are constantly interacting with each other. These interactions lead to the growth and regeneration of its plants and animal species for which energy is required. Sun is the ultimate source of energy for all the ecosystems in the world, except for the deep sea hydrothermal ecosystems.

Only 50 percent of the solar radiation is Photosynthetically Active Radiation (PAR). The producers capture only 2-10 percent of this PAR and this small amount of energy sustains the entire living world. This energy goes through different organisms occupying trophic levels in an ecosystem.

> Photosynthetically Active Radiation (PAR) is the amount of light available for photosynthesis, which is light in the 400 to 700 nanometer wavelength range. PAR changes seasonally and varies depending on the latitude and time of day.
>
> It is needed for photosynthesis and plant growth. Higher PAR promotes plant growth. Monitoring PAR is important to ensure plants are receiving adequate amount of light for this process.

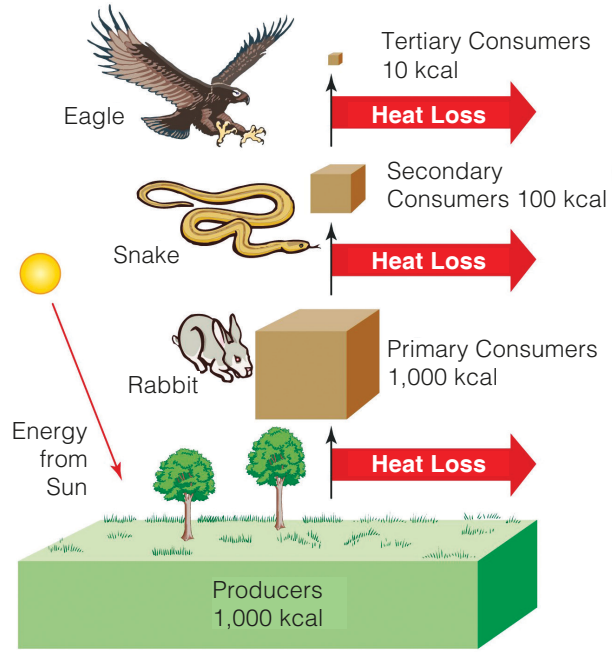
Trophic Levels

A trophic level is a step in a food chain of an ecosystem. Based on the feeding behavior, the organisms are classified into different trophic levels. Thus, trophic levels are the feeding positions of all organisms in a specific ecosystem.

At the first trophic level, primary producers like green plants, algae, and some bacterias use solar energy to produce organic plant material through photosynthesis. The second trophic level is occupied by Herbivores, animals that feed solely on plants.. Similarly, the third trophic level is occupied by Predators who eat herbivores.

The highest amount of energy is concentrated in the first trophic level, subsequently dispersing into organisms of different trophic levels. The amount of energy decreases as one moves higher up in the trophic level in an ecosystem.

Energy Flow and Trophic Levels



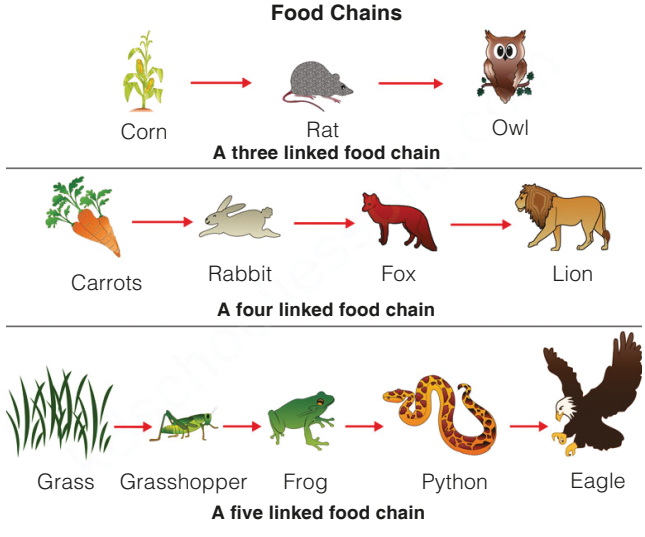
On an average, about 10 percent of net energy production at one trophic level is passed on to the next level. Processes that reduce the energy transferred between trophic levels include respiration, growth and reproduction, defecation, and non-predatory death (organisms that die but are not eaten by consumers).

> As there is high energy loss at subsequent trophic levels, most terrestrial ecosystems have no more than five trophic levels and marine ecosystems generally have no more than seven. This difference between terrestrial and marine ecosystems is likely due to differences in the fundamental characteristics of land and marine primary organisms. In marine ecosystems, microscopic phytoplankton carries out most of the photosynthesis that occurs, while plants do most of this work on land.

Phytoplankton are small organisms with extremely simple structures, so most of their primary production is consumed and used for energy by grazing organisms that feed on them. In contrast, a large fraction of the the land plants produce, such as roots, trunks, and branches, cannot be used by herbivores for food, so proportionately less of the energy fixed through primary production travels up the food chain

Food Chains

All the organisms need energy to grow, move and reproduce. For this purpose, smaller insects eat plants, bigger animals eat smaller insects and so on. This feeding relationship forms a food chain in an ecosystem. Thus, food chain is a linear sequence of organisms through which transfer of energy and nutrients takes place. The energy and nutrients flow in the form of food from organism to organism by eating and being eaten.



Each step of the food chain is known as Trophic level. As we know that at each transfer, a large amount of energy is lost in the form of heat and used up in respiration or metabolism. Each chain has only four to five such trophic levels as after that very little energy is left to support any life form.

As we move from the first level to the next, there is a progressive decrease in numbers of organisms occupying that particular trophic level and a progressive increase in the size of predators. As one moves higher up the trophic level, less energy is available. This requires an organism to eat more to get the same amount of energy as compared to the lower trophic level organism.

Also, a particular organism need not occupy a unique trophic level in a food chain. Many Omnivores can be at the second trophic level surviving directly by eating the plants or higher up the order, eating other animals. Example: Man.

Also, in an ecosystem, there may be more than one food chain

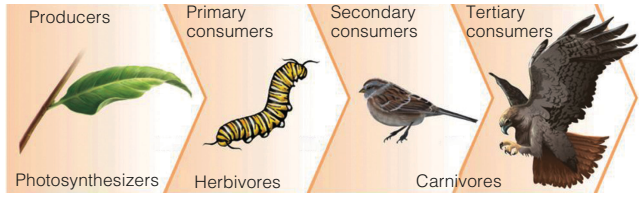
Grass → Rabbit → Fox-Wolf → Tiger

Grass → Grasshopper → Frog → Snake →Hawk

There are two types of food chains:

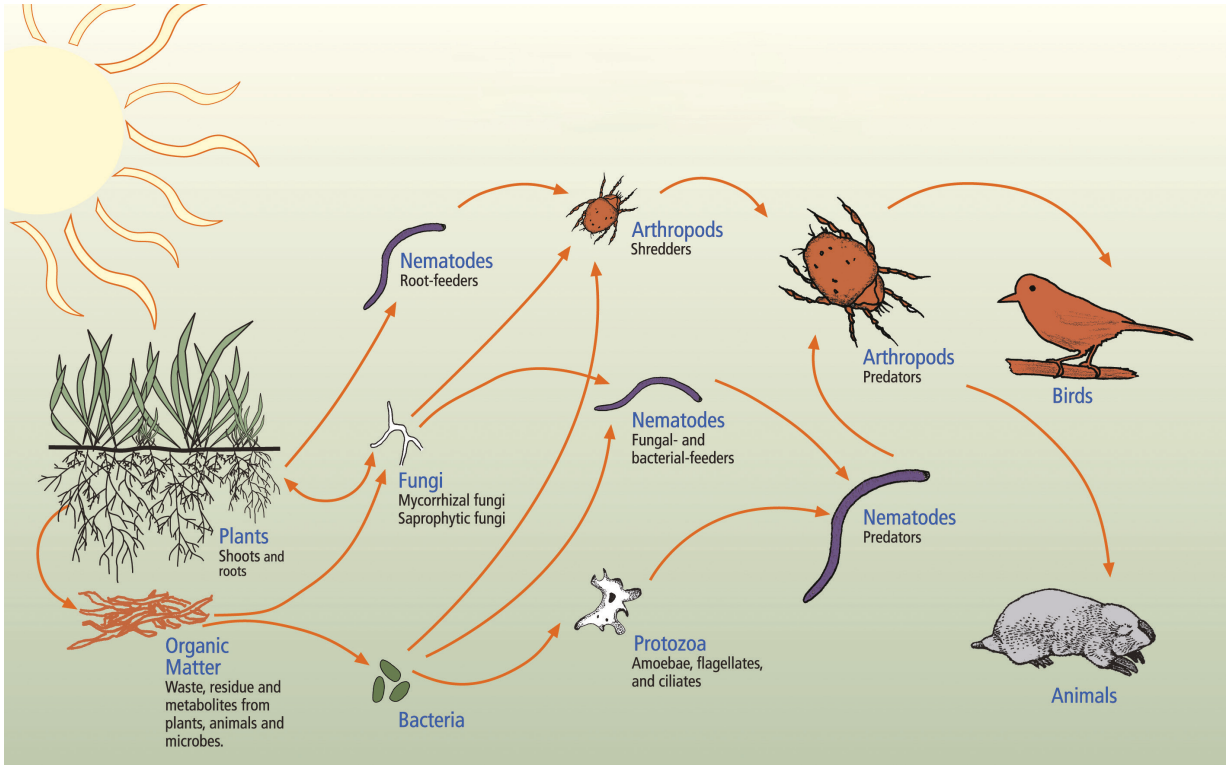
Grazing Food Chains

This type of food chain is more prevalent in those ecosystems where a substantial part of the net primary production is grazed on by herbivores. Thus, there is enough energy to support the higher trophic level and in turn a food chain. It starts from a green plant base, goes to grazing herbivores and on to carnivores.



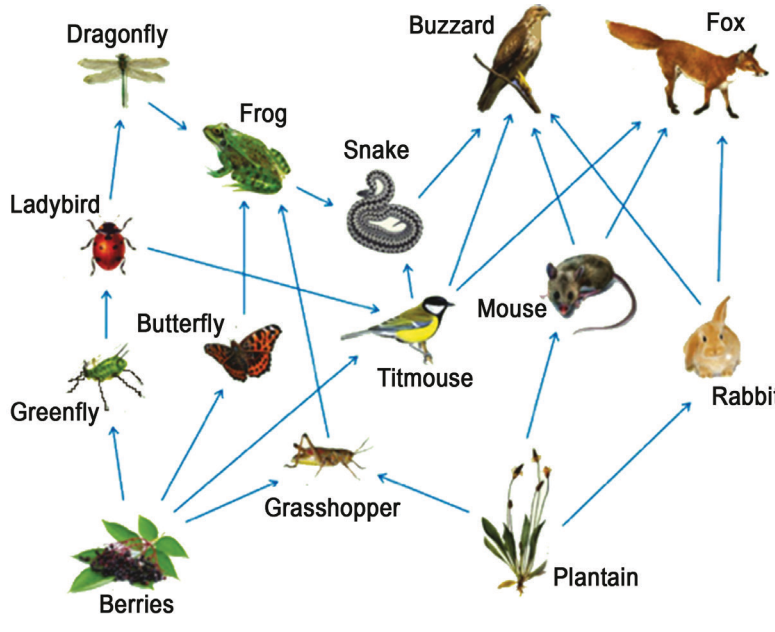
Detritus Food Chains

This type of food chain starts with a dead organic matter which is decomposed by microorganisms, which in turn are eaten by other organisms. Clearly, it is less dependent on direct solar energy and more on the supply of organic matter produced by another ecosystem.



Food Web

Food chain follows a single path as animals eat each other. In natural environment or an ecosystem, the relationships between the food chains are inter-connected. These relationships are very complex, as one organism may be a part of multiple food chains. Hence, a web like structure is formed in place of a linear food chain. The web like structure if formed with the interlinked food chain and such matrix that is interconnected is known as a food web.



Food web as interconnected Food chains

Although it looks complex, it is just several food chains joined together. Here are some of the food chains in this food web:

Berries → Butterfly → Frog → Snake

Berries → Greenfly → Ladybird → Dragonfly → Frog → Snake → Buzzard

Plantain → Rabbit → Fox

Plantain → Mouse → Buzzard

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) Pairs 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) H_2S and oxides of Nitrogen
(b) SO_2 and oxides of Nitrogen
(c) CO_2 and H_2S
(d) CH_4 and H_2S

[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)