
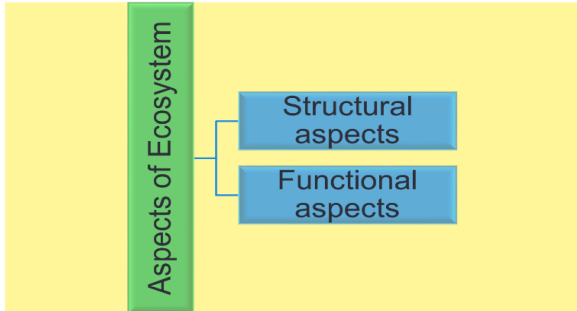


Study Material: UO 3 a

Course Code CE: Subject Code 22447: Subject Name Environmental Studies: Topic Name: Ecosystem - Aspects & Divisions: UO 3a State the aspects and divisions of ecosystem: Study Material		
Anant J Fulzele	Coordinator: Dr. B R Ambade ; 03 July, 2020	Dr D K Parbat
Key words Ecosystem Aspects of ecosystem Divisions of ecosystem	Learning Objective: State the aspects and divisions of ecosystem.	Diagram/ Picture 
Key Questions Define ecosystem? State the aspects of ecosystem? Describe the divisions of ecosystem?	<p>Concept Map</p>  <p>Explanation of Concept ECO-SYSTEM The eco-system can be defined as any spatial or organizational unit including living organisms and non-living substances interacting to produce an exchange of materials between the living and non-living parts. The eco-system can be studied from either structural or functional aspects.</p> <p>ASPECT OF AN ECOSYSTEM –</p> <ul style="list-style-type: none"> ➤ Structural aspect ➤ Functional aspect <p>Components that make up the structural aspects of an ecosystem include:</p> <ol style="list-style-type: none"> 1) Inorganic aspects – C, N, CO₂, H₂O. 2) Organic compounds – Protein, Carbohydrates, Lipids – link abiotic to biotic aspects. 3) Climatic regimes – Temperature, Moisture, Light & Topography. 4) Producers – Plants. 	<p>Key Definitions/ Formulas Definition: The living community of plants and animals in any area together with the non-living components of the environment such as soil, air and water, constitute the ecosystem.</p> <p>A.G. Tansley (in 1935) defined the Eco-system as 'the system resulting from the integrations of all the living and non-living actors of the environment'. Thus he regarded the Eco-systems as including not only the organism complex but also the whole complex of physical factors forming the environment.</p>

Solved word Problem

Describe the functional aspects of ecosystem?

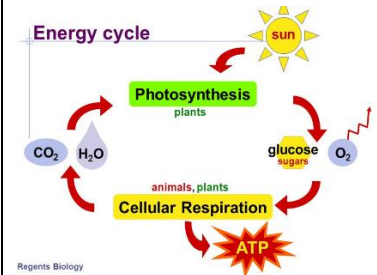
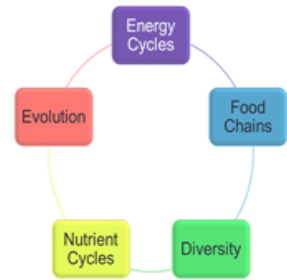
- 5) Macro consumers – Phagotrophs – Large animals.
- 6) Micro consumers – Saprotrophs, absorbers – fungi.

Components that make up the Functional aspects of an ecosystem include:

- 1) **Energy cycles.**
- 2) **Food chains**
- 3) **Diversity- inter linkages between organisms**
- 4) **Nutrient cycles- biogeochemical cycles**
- 5) **Evolution**

1) Energy cycles

- ☐ The energy cycle is based on the flow of energy through the ecosystem.
- ☐ Energy from sunlight is converted by plants themselves into growing new plant material which includes leaves, flowers, fruit, branches, trunks and roots of plants.
- ☐ During photosynthesis carbon dioxide is taken up by plants and oxygen is released.
- ☐ Animals depend on this oxygen for their respiration.



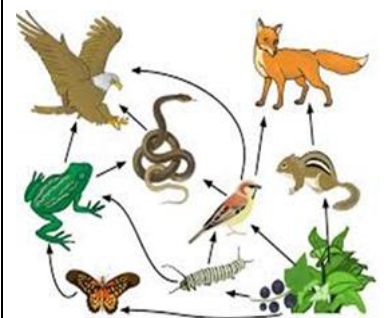
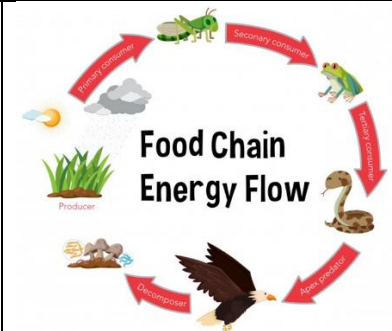
2) Food chains

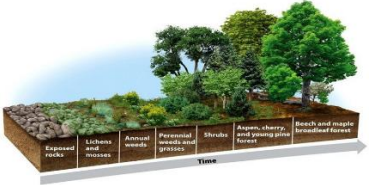
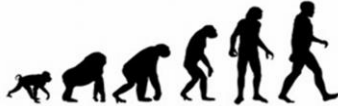
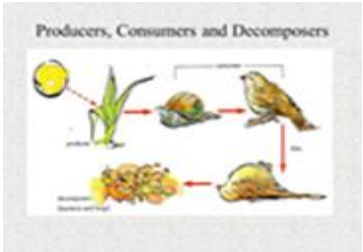
- ☐ Plants can grow by converting the sun's energy directly into their tissues, they are known as producers in the ecosystem.
- ☐ The plants are used by herbivorous animals as food, which gives them energy.
- ☐ The carnivores in turn depend on herbivorous animals on which they feed.
- ☐ Thus the different plant and animal species are linked to one another through food chains
- ☐ Each food chain has three or four links.

3) Diversity-

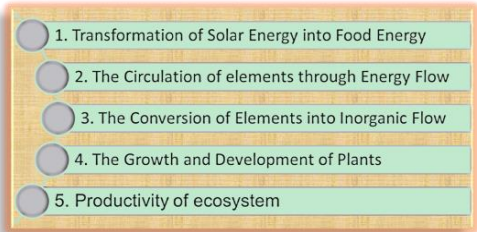
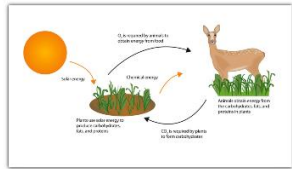
Inter linkages between organisms

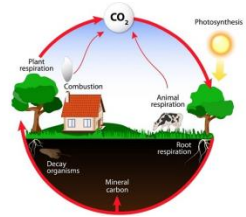
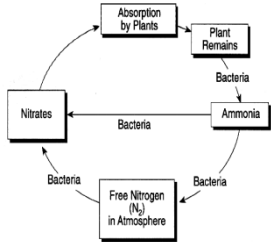
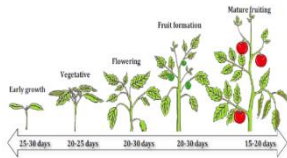
- ☐ The different plant and animal species are linked to one another through food chains.
- ☐ Each food chain has three or four links. However as each plant or animal can be linked to several other plants or animals through many different linkages.
- ☐ These inter-linked chains can be depicted as a complex food web.
- ☐ This is thus called the 'web of life' that shows that there are thousands of interrelationships in nature.



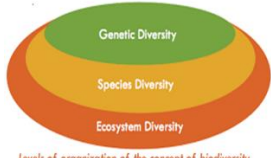
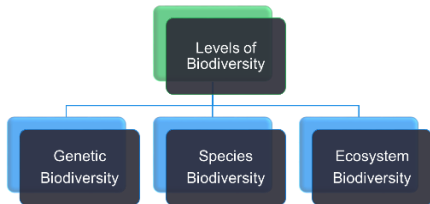
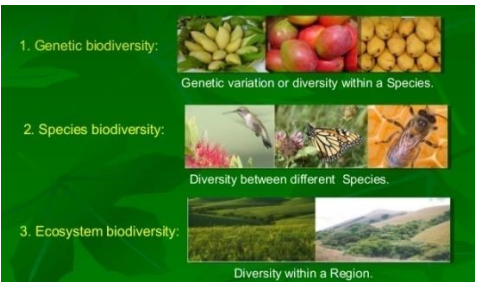

	<p>5) Evolution -</p> <ul style="list-style-type: none"> ❑ Ecological succession is a process through which ecosystems tend to change over a period of time. ❑ If a forest is cleared, it is initially colonized by a certain group of species of plants and animals, which gradually change through an orderly process of community development. ❑ One can predict that an opened up area will gradually be converted into a grassland, a shrub land and finally a woodland & a forest ❑ Evolution of man from Monkeys is the result of ecological succession. <p>Division of Ecosystem</p> <p>The ecosystem can be divided, from the energetic view point into three types of organisms: producers, consumers, and reducers. These can be explained as under:</p> <p>(1) Producer Photosynthetic algae, plants and bacteria are the producers of the ecosystem; all other organisms depend upon them directly or indirectly for food</p> <p>(2) Consumers Consumers are herbivorous, carnivorous, and omnivorous animals; they eat the organic matter produced by other organisms.</p> <p>(3) Reducers Reducers are heterotrophic organisms like animals; they are fungi and bacterial that decompose dead organic matter.</p> <p>References:</p> <ol style="list-style-type: none"> 1. Dr. J. P. Sharma, 2009. Environmental Studies, 2nd Edition, Laxmi publications, New Delhi, India. 2. M.P. Singh, 2005, Environment and Natural Resources Hardcover, Satish Serial Publishing House, Delhi India. 3. Prof. Erach Bharucha, 2004. Textbook for Environmental Studies. University Grants Commission, New Delhi, India. 4. Dr. Y. K. Singh, 2006. Environmental Science. NEW AGE INTERNATIONAL (P) LIMITED, PUBLISHERS, New Delhi, India. 5. R. Rajgopalan, 2011. Environmental Studies: From crisis to cure, Oxford University Press, New Delhi, India. 6 Images & pictures from Google web sites. 	  
	<p>Application of Concept/ Examples in real life</p> <p>The study of structural & functional aspect of ecosystem is important in the protection of environment.</p> <p>Producer – All types of plants</p> <p>Consumer – All herbivorous & carnivorous animals</p> <p>Decomposers - Bacteria, Fungi, scavengers etc.</p>	<p>Link to YouTube/ OER/ video</p> <p>https://youtu.be/Q_KTkMJTx1M</p> <p>https://youtu.be/V7qegBoNje0</p>
<p>Key Take away from this LO:</p> <p>Definition of ecosystem</p> <p>Aspects of ecosystem : Structural & Functional</p> <p>Divisions of ecosystem: Producers, Consumers & Decomposers</p>		



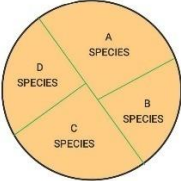
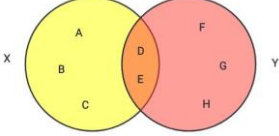
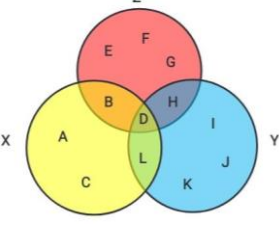
Study Material: UO 3a and 3b

Course Code CE: Subject Code 22447: Subject Name Environmental Studies: Topic Name ecosystem and biodiversity: UO 3a and 3b State the general characteristics and functions of ecosystem: Study Material		
Anant J Fulzele	Coordinator: Dr. B RAMbade ; 05 July,2020	Dr D K Parbat
Key words General characteristics of ecosystem Functionsof ecosystem	Learning Objective: State the general characteristics and functions of ecosystem	Diagram/ Picture If relevant to UO else, put another solved example or trivia related to this concept
Key Questions State the general characteristics of ecosystem? Describe the functions of ecosystem?	Concept Map  Explanation of Concept GENERAL CHARACTERISTICS OF AN ECO-SYSTEM According to Smith following are the general characteristics of eco-system. (1) The ecosystem is a major structural and functional unit of ecology. (2) The structure of an eco-system is related to its species diversity; as such the more complex ecosystem has high species diversity. (3) The relative amount of energy required to maintain an ecosystem depends on its structure. The more complex the structure, the lesser the energy it requires to maintain itself. (4) The function of the ecosystem is related to energy flow in material cycling, through and within the system. (5) Ecosystems mature by passing from less complex to more complex states. Early stages of such succession have an excess of potential energy. Later (mature) stages have less energy accumulation. (6) Both the environment and the energy fixation in any given ecosystem are limited. They cannot be exceeded in any way without causing serious undesirable effect. (7) Alterations in the environments represent selective pressures upon the population to which it must adjust. Organisms, which fail to adjust to the changed environment, must vanish. Functions of Eco-system 1.Transformation of Solar Energy into Food Energy (Photosynthesis) <input type="checkbox"/> The solar radiation is the basic input of energy entering the ecosystem. <input type="checkbox"/> The green plants receive it. And is converted into heat energy. <input type="checkbox"/> It is only a small proportion of radiant solar energy that is used by plant to make food through the process of photosynthesis.	Key Definitions/ Formulas 
Solved word Problem		

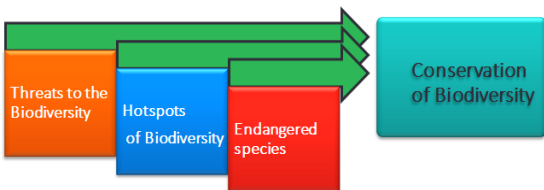

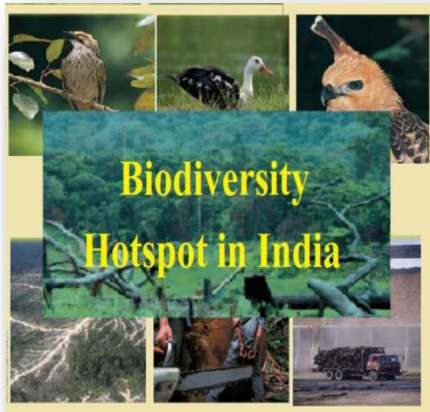

	<ul style="list-style-type: none"> Green plants transform a part of solar energy into food energy or chemical energy. The chemical energy becomes the source of energy to the herbivorous animals of the food chain. <p>2. The Circulation of elements through Energy Flow (e.g Carbon Cycle)</p> <ul style="list-style-type: none"> In the various biotic components of the ecosystem the energy flow is the main driving force of nutrient circulation. The organic and inorganic substances are moved reversibly through various closed system of cycles in the biosphere, atmosphere, hydrosphere and lithosphere. This activity is done in such a way that total mass of these substances remains almost the same and is always available to biotic communities. <p>3. The Conversion of Elements into Inorganic Flow (e.g Nitrogen Cycle)</p> <p>The organic elements of plants and animals are released in the under mentioned ways:</p> <ol style="list-style-type: none"> Decomposition of leaf fallen from the plants ,dead plants and animals by decomposers and their conversion into soluble inorganic form. Burning of vegetation by lighting, accidental forest fire or deliberate action of man. When burnt, the portions of organic matter are released to the atmosphere and these again fall down, under the impact of precipitation, on the ground. Then they become soluble inorganic form of element to join soil storage. The waste materials released by animals are decomposed by bacteria. They find their way in soluble inorganic form to soil storage. <p>4. The Growth and Development of Plants</p> <ul style="list-style-type: none"> In the biogeochemical cycles are included the uptake of nutrients of inorganic elements by the plants through their roots. The nutrients are derived from the soil where these inorganic elements are stored. The decomposition of leaves, plants and animals and their conversion into soluble inorganic form are stored into soil contributing to the growth and development of plants. 	   <p>Productivity of ecosystem</p> <p>The productivity of an ecosystem refers to the rate of production i.e. the amount of organic matter, which is accumulated in any unit time.</p> <div data-bbox="1114 1294 1417 1460" style="background-color: #0056b3; color: white; padding: 10px;"> <p>Ecosystem Productivity</p> <ul style="list-style-type: none"> Gross primary productivity (GPP) – the total amount of solar energy that the producers in an ecosystem capture via photosynthesis over a given amount of time Net primary productivity (NPP) – the energy captured (GPP) minus the energy respired by producers <ul style="list-style-type: none"> NPP = GPP – energy used by producers Measured in kg C/m²/year </div>
	<p>Application of Concept/ Examples in real life</p> <p>General characteristics and Functions of ecosystem help us to know our environment better so that it can be safeguarded.</p>	<p>Link to YouTube/ OER/ video</p> <p>https://youtu.be/n-3X0UBgtIA</p> <p>https://youtu.be/NkHVUa_faCI</p>
<p>Key Take away from this LO: General characteristics of ecosystem Functions of ecosystem</p>		

Study Material: UO 3c

Course Code CE: Subject Code 22447: Subject Name Environmental Studies: Topic Ecosystem and biodiversity: UO 3c List the levels of biodiversity: Study Material		
Anant J Fulzele	Coordinator: Dr. B R Ambade ; 09 July,2020	Dr D K Parbat
Key words levels of biodiversity Genetic biodiversity Species biodiversity Ecosystem biodiversity	Learning Objective: List the levels of biodiversity.	Diagram/ Picture 
Key Questions List the levels of biodiversity? Describe Ecosystem biodiversity? Describe Species biodiversity? Describe Genetic biodiversity?	Concept Map  Explanation of Concept Biodiversity Biological diversity' or biodiversity is that part of nature which includes the differences in genes among the individuals of a species, the variety and richness of all the plant and animal species at different scales in space, locally, in a region, in the country and the world, and various types of ecosystems, both terrestrial and aquatic, within a defined area. Levels of biodiversity : Biodiversity is generally described in terms of its 3 fundamental and hierarchically related levels of biological organisms. These are –  Genetic diversity <ul style="list-style-type: none"><input type="checkbox"/> It includes the genetic variations within species, both among geographically separated populations and among individuals within single population. e.g. variety of rice, teak wood ,dog etc.<input type="checkbox"/> Each member of any animal or plant species differs widely from other individuals in its genetic makeup because of the large number of combinations possible in the genes that give every individual specific characteristics.<input type="checkbox"/> Thus, for example, each human being is very different from all others. This genetic variability is essential for a healthy breeding population of a species 	Key Definitions/ Formulas Biodiversity Bio - Life Diversity- Variety Biodiversity is the variety and variability among all group of living organisms and the ecosystem in which they occur
Solved word Problem		

	<p>Species diversity</p> <ul style="list-style-type: none"> It includes full range of species from micro organisms to giants and mammoth varieties of plants and animals, e.g. single celled viruses and bacteria etc. and multi-cellular plants, animals and fungi. Plant species - e.g. Apple, mango, grapes etc. Animal species- e.g. Lion, tiger, elephant etc. Natural undisturbed tropical forests have a much greater species richness than plantations developed by the Forest Department for timber At present conservation scientists have been able to identify and categorise about 1.8 million species on earth <p>Ecosystems diversity</p> <ul style="list-style-type: none"> It provides variation in the biological communities in which species live, exist and interact. <p>Eg River ecosystem, Forest ecosystem, Desert ecosystem etc.</p> <ul style="list-style-type: none"> There are a large variety of different ecosystems on earth, which have their own complement of distinctive inter linked species based on the differences in the habitat. India is exceptionally rich in its ecosystem diversity. <p>Alpha diversity</p> <ul style="list-style-type: none"> Alpha diversity – It refers to a group of organisms interacting & competing for the same resources or sharing the same environment. For example, <p>In Ecosystem X, α = Variety of species in one ecosystem $\alpha = 4$</p> <p>Beta diversity</p> <ul style="list-style-type: none"> Beta diversity – It refers to the expression of diversity between habitats. For example, <p>In Ecosystem X and Y, β = Only uncommon species variety in two adjacent ecosystem $\beta = 6$</p> <p>Gamma diversity</p> <ul style="list-style-type: none"> Gamma diversity – It refers to the landscape diversity or Diversity of habitats within a landscape or region. For example, <p>In Ecosystem X, Y and Z γ = All uncommon species and Common species are considered only once $\gamma = 13$</p>	    
	<p>Application of Concept/ Examples in real life The knowledge of different levels of biodiversity helps us to maintain the ecological balance.</p> <p>Genetic biodiversity – Different breed of dogs Species biodiversity – Tiger, Rat, Mango Tree, Rose Plant etc. Ecosystem biodiversity – Grassland, Lake, Desert, Rain Forest etc.</p>	<p>Link to YouTube/ OER/ video https://youtu.be/uMDxp-M9b2Q https://youtu.be/3SYnDDe6FcE</p>
<p>Key Take away from this LO: levels of biodiversity Genetic biodiversity Species biodiversity Ecosystem biodiversity</p>		

Study Material: UO 3 d

Course Code CE: Subject Code 22447: Subject Name Environmental Studies: Topic Name: 3.4, Threats and Hotspots to the Biodiversity : UO 3d, Enlist the endangered species : Study Material		
Mrs. Swati Ingale	Coordinator: Dr. B R Ambade ; 25 July,2020	Dr D K Parbat
Key words Ecosystem Aspects of ecosystem Divisions of ecosystem	Learning Objective: Students will able to understand importance of Biodiversity	
Key Questions Describe threats to biodiversity? State the endangered species? Describe hotspots of biodiversity?	<p>Concept Map</p> 	<p>Diagram/ Picture</p> 
	<p>Threats to the Biodiversity</p> <ul style="list-style-type: none"> ▶ Biodiversity is under serious threat as a result of human activities. ▶ CAUSES OF BIODIVERSITY LOSSES <p>There are four major causes (called “The Evil Quartet”) of biodiversity losses:</p> <ol style="list-style-type: none"> 1. Habitat loss and fragmentation, 2. Over exploitation, 3. Alien species invasions 4. Co-extinction <p>1. Habitat loss and fragmentation:</p> <ul style="list-style-type: none"> ▶ The tropical rain forests, once covering 14 per cent of the land surface of Earth, but now they cover only 6 per cent of the land area. ▶ The Amazon rain forests (called the ‘lungs of the planet’) are cleared for cultivation of soybeans or are converted into grasslands for raising beef-cattle. ▶ The loss of a habitat deprives many animals and plants their homes and they face extinction. ▶ Degradation of many habitats by pollution threatens the survival of many species. <p>2. over exploitation:</p> <ul style="list-style-type: none"> ▶ e.g.: Steller’s sea cow, passenger pigeon, many marine fishes became extinct due to over-exploitation by humans. 	 

3. Alien species invasions:

- ▶ When alien species are introduced in an area, some of them become invasive and may cause extinction of indigenous species,
- ▶ e.g.: Introduction of **Nile Perch** into Lake Victoria (East Africa) caused extinction of many species of **cichlid fish** in lake.
- ▶ Invasive weed species such as **Parthenium (carrot grass)**

4. Co-extinction:

- ▶ When a species becomes extinct, the plant and animal species associated with it also become extinct, e.g.
- ▶ When a host fish becomes extinct, its unique parasites also become extinct.
- ▶ Similarly, when one partner of a co-evolved pollinator mutualism becomes extinct, the other partner also have the same fate.

Hotspots of Biodiversity

- ▶ A **biodiversity hotspot** is a biogeographic region that is both a significant reservoir of biodiversity and is threatened with destruction.
- ▶ Large regions containing exceptional concentrations of plants and animals and experiencing high rates of habitat loss.
- ▶ **Important hot spots in India,**

1. Western Ghats and Sri Lanka

2. Himalaya

3. Indo-Burma

1. Western Ghats And Sri Lanka

- ▶ The western Ghats, known locally as the Sahyadri hills run parallel to India's western coast, about 30 to 50 Km inland.
- ▶ They cover an area about 1,60,000 Sq Km and stretch for 1,600 Km from Gujarat to south tip.
- ▶ It is habitat for variety of mammals, reptiles, birds and plants.

2. Himalayan

- ▶ Includes the entire Indian Himalayan region (and that falling in Pakistan, Tibet, Nepal, Bhutan, China and Myanmar).
- ▶ The hotspot is home to important populations of numerous large birds and mammals, including vultures, tigers, elephants, rhinos and wild water buffalo.



3. Indo-burma

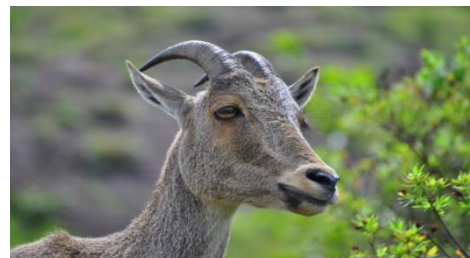
- ▶ Encompassing more than 2 million km² of tropical Asia. Indo-Burma is still revealing its biological treasures.



Purple Moor Hen



Bison



Nilgiri Tahr



Tiger



Rhino



Vultures

- Six large mammal species have been discovered in the last 12 years. This hotspot also holds remarkable endemism in freshwater turtle species. Bird life in Indo-Burma is also incredibly diverse, holding almost 1,300 different bird species

INDO-BURMA



Endangered species

- Organisms whose number have declined rapidly and species might be wiped off from the earth in near future are called Endangered Species
- World Wildlife Federation (WWF) published a book containing the details of endangered and threatened species of Flora and Fauna called as RED DATA BOOK or RED LIST BOOK
- The RED DATA BOOK symbolizes a warning signal for those species which are endangered and have to be protected. Otherwise they are likely to become extinct in the near future.

Animals

Asiatic Lion, Bengal Tiger, Snow Leopard, Blackbuck, Red Panda, One Horned Rhinoceros, The Nilgiri Tahr, Kashmir Red Stag (Hangul), Lion Tailed Macaque, Indian Bison (Gaur).

Birds

Great Indian Bustard, Red Headed Vulture, Forest Owlet, Spoon Billed Sandpiper, Jerdon's Courser, Bengal Florican, White Bellied Heron, Himalayan Quail, Sociable Lapwing, Siberian Crane.

Plants

Assam Catkin Yew, Ilex Khasiana, Red Sandalwood, Ebony, Musli, Actinodaphne Lawsoni, Malabar Mahagony.



Spot billed pelican



Saola

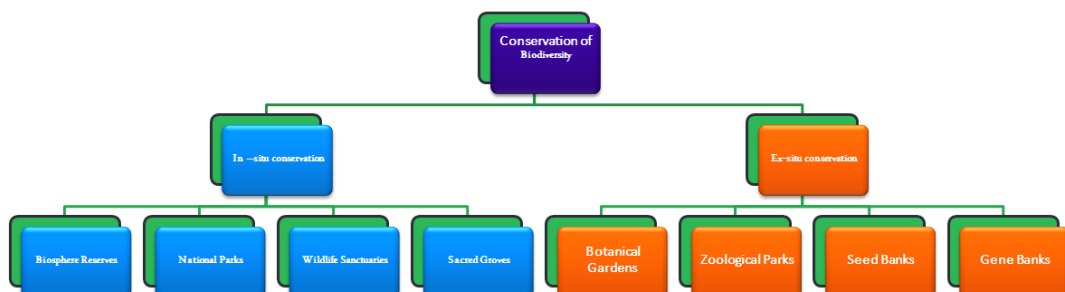


Pangolins

- **There are two approaches for conservation of biodiversity:**

1. In -situ conservation (on site conservation)
2. Ex-situ conservation (off site conservation)

Conservation of Biodiversity



In -situ conservation (on site conservation)

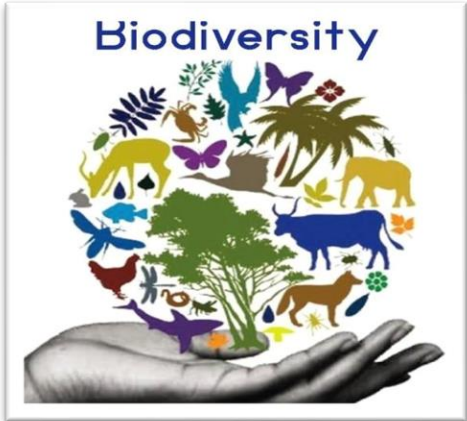
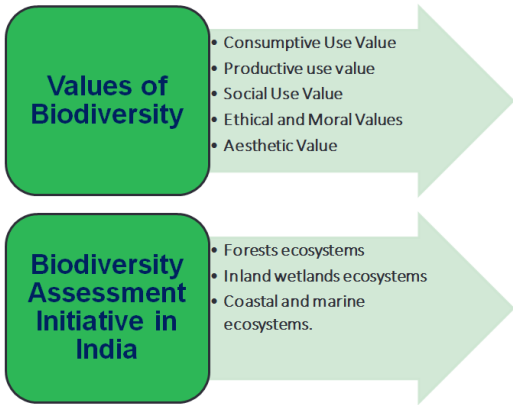


1. Biosphere Reserves

Various Laws for conservation of biodiversity

- The concept of **conservation of biodiversity** is

	<ul style="list-style-type: none"> ▶ These are large tracts of protected land with multiple use preserving the genetic diversity of representative ecosystem by protecting wildlife, traditional life styles of the tribals and varied plant and animal genetic resources. <p>2. National Parks</p> <ul style="list-style-type: none"> ▶ These are areas reserved for wildlife where they are able to obtain all the required natural resources and proper habitats. <p>3. Wildlife Sanctuaries</p> <ul style="list-style-type: none"> ▶ These Are Tracts Of Land With Or Without lake where animals are protected from all types of exploitation and habitat disturbance. <p>4. Sacred Groves</p> <ul style="list-style-type: none"> ▶ These are tracts of forest set aside where all the trees and wildlife within are venerated and given total protection. ▶ Such sacred groves are found in Khasi and Jaintia Hills in Meghalaya; Aravali Hills of Rajasthan; Western Ghat regions of Karnataka and Maharashtra and the Sarguja; Chanda and Bastar area of Madhya Pradesh. <p>Ex-situ conservation (off site conservation)</p> <p>1. Botanical Gardens: Botanical garden is a place where plants, especially ferns, conifers and flowering plants, are grown and displayed for the purposes of research and education.</p> <p>2. Zoological Parks: The place where wild animals and, in some instances, domesticated animals are exhibited in captivity. In such an establishment, animals can generally be given more intensive care than is possible in nature reserves or sanctuaries.</p> <p>3. Seed Banks: A seed bank is a bank where seeds of different crops and rare plant species are stored for future use. Seed banks are created to maintain and protect biodiversity, where samples of all species are collected and stored.</p> <p>4. Gene Banks: Gene banks are a type of bio repository which preserve genetic material. For plants, this is done by in vitro storage, freezing cuttings from the plant, or stocking the seeds. For animals, this is done by the freezing of sperm and eggs in zoological freezers until further need.</p>	<p>enshrined in the Indian Constitution in Article 48(A) and 51A (g). Major Central Acts relevant to biodiversity are:</p> <ul style="list-style-type: none"> ▶ The Indian Forest Act, 1927; ▶ The Wildlife (Protection) Act, 1972; ▶ The Forest (Conservation) Act, 1980; ▶ The Environment (Protection) Act, 1986; ▶ The Biological Diversity Act, 2002; ▶ The Scheduled Tribes and Other Forest Dwellers (Recognition of Forest Rights) Act, 2006. <p>International Efforts For Biodiversity Conservation</p> <ul style="list-style-type: none"> ▶ THE EARTH SUMMIT <ul style="list-style-type: none"> ▶ It was the historic convention on Biological diversity, held in Rio de Janeiro in 1992. ▶ It called upon all the nations to take appropriate measures for Conservation of biodiversity, and (ii) Sustainable utilization of the benefits of biodiversity. ▶ THE WORLD SUMMIT <ul style="list-style-type: none"> ▶ It was held in 2002 in Johannesburg, South Africa. ▶ 190 countries pledged their commitment to achieve a significant reduction in the current rate of biodiversity loss at global, regional and local levels by 2010. <p>Biodiversity adds a flavor in healthy Environment hence its Conservation is a Global Need.</p>
	<p>Application of Concept/ Examples in real life</p> <p>The study of threats and hotspots of biodiversity is important for the conservation of biodiversity and protection of environment.</p>	<p>Link to YouTube/ OER/ video https://youtu.be/rzhLBylwYjs</p>
<p>Key Take away from this UO: threats and hotspots of biodiversity, list of endangered species and conservation of biodiversity.</p>		

Study Material: UO 3 e

Course Code CE: Subject Code 22447: Subject Name Environmental Studies: Topic Name: 3.4, Ecosystem and Biodiversity : UO 3e, Values of Biodiversity: Study Material		
Mrs. Swati Ingale	Coordinator: Dr. B R Ambade ; 25 July, 2020	Dr D K Parbat
Key words Values, assessment, biodiversity	Learning Objective: Students will able to describe value of biodiversity	Diagram/ Picture 
Key Questions Define Biodiversity? Describe the values of biodiversity? Describe the assessment of biodiversity?	<p>Concept Map</p>  <p>Values of Biodiversity</p> <ul style="list-style-type: none"> • Consumptive Use Value • Productive use value • Social Use Value • Ethical and Moral Values • Aesthetic Value <p>Biodiversity Assessment Initiative in India</p> <ul style="list-style-type: none"> • Forests ecosystems • Inland wetlands ecosystems • Coastal and marine ecosystems. 	 
	<p>Biodiversity</p> <ul style="list-style-type: none"> ▶ Biodiversity is the term used to describe the variety of life found on Earth and all of the natural processes. ▶ This includes ecosystem, different species and their connections with each other. <p>Values of Biodiversity</p> <ul style="list-style-type: none"> ▶ Consumptive Use Value ▶ Productive use value ▶ Social Use Value ▶ Ethical and Moral Values ▶ Aesthetic Value <p>Consumptive Use Value</p> <ul style="list-style-type: none"> ▶ It is the direct utilization of biodiversity by local communities. ▶ The biodiversity contained in the ecosystem provides forest dwellers with all their daily needs like food, building material, fodder, medicines and a variety of other products. ▶ They are well-known about the qualities and different uses of wood, fruits, flowers, seeds etc from different species of trees. ▶ Fisher folks are completely dependent on fish and know where and how to catch fish and other edible aquatic animals and plants. <p>Productive use value</p> <ul style="list-style-type: none"> ▶ New species of plants and animals are being constantly discovered by biotechnologist These wild species are the building blocks for the betterment of human life. ▶ Biological diversity is the raw material from which new drugs can be identified from plant or animal products. 	

- ▶ Genetic diversity enables scientists and farmers to selectively develop better crops and domestic animals through careful breeding programs.
- ▶ This category also comprises of marketable products such as animal skins, ivory, medicinal plants, honey, beeswax., fibers, gums ect.....,

Social Use Value

- ▶ 'Ecosystem people' value biodiversity as a part of their livelihood as well as through cultural and religious sentiments.
- ▶ Biodiversity in INDIA is important for its religious, spiritual and other cultural uses.
- ▶ Many plants and animals have ritual significance.

Ethical and Moral Values

- ▶ Ethical values of biodiversity are based on the importance of protecting all form of life.
- ▶ Man is only a small part of the Earth's great family of species; plants and animals have an equal right to live and exist on our planet.
- ▶ Indian civilizations has preserved nature through local traditions over several generations.



Aesthetic Value

- ▶ Biodiversity is a beautiful and wonderful aspect of nature. For Example- Sitting in a forest and listening to the birds, Watching a spider weaving its complex web, Observing a fish, It is just magnificent and fascinating.
- ▶ Biodiversity is a source of imagination and creativity for Writers and poets
- ▶ it is important for tourist attraction.
- ▶ In many countries, history and culture is reflected throgh plant and animal image.
- ▶ In India, The Basil or the 'Tulsi' has spirital importance for centuries.


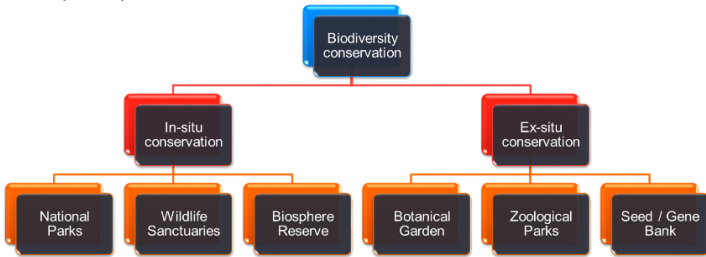
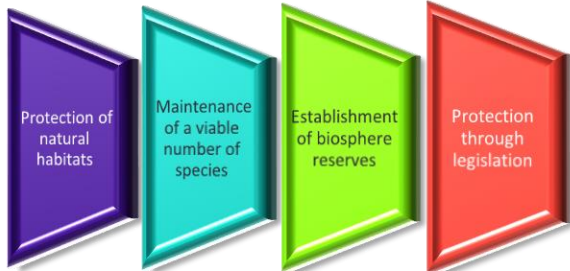
Biodiversity Assessment Initiative in India

- ▶ India is one of the 17 mega-diverse countries on the planet, with only 2.4% of the world's land area, yet accounts for 7-8% of all recorded species. India has 10 biogeographic zones and is home to 8.58% of the mammalian species documented so far, 13.66% avian species, 7.91% reptiles, 4.66% amphibians, 11.72% fishes and 11.80% for plants.
- ▶ India's growing population, rapid economic growth and industrialization have increased the pressure on biodiversity and ecosystem services.
- ▶ The conservation of biodiversity and ecosystems is vital national priority as they are linked to the country's economic, ecological and social well-being.
- ▶ Economic valuations of ecosystem services and biodiversity are used to improve the conservation and management of ecosystems
- ▶ The initiative focuses on three ecosystem types:
 1. Forests ecosystems
 2. Inland wetlands ecosystems
 3. Coastal and marine ecosystems.



	<p>Forest Ecosystems</p> <ul style="list-style-type: none"> ➤ Forest is an area with a high density of trees, together with other plants, covering a large area of land. ➤ India's successful endeavour in expanding forest cover is widely acknowledged. An effective Forest (Conservation) Act, 1980, further strengthened by the National Forest Policy, 1988, a massive afforestation programme, establishment of biosphere reserves, and re-vegetation of degraded lands through Joint Forest Management and people's participation, account for the success in forest and biodiversity conservation. <p>Inland Wetlands Ecosystem</p> <ul style="list-style-type: none"> ▶ Wetlands are ecosystems located at the interface of land and water. Inland wetlands refer to those wetlands which don't have a direct connection with the sea. ▶ The floral diversity supported by these ecosystems range from unicellular algae, bryophytes, mosses and ferns to woody angiosperms. The number of plant species within Indian wetlands is nearly 1,200. ▶ The Government of India has been implementing the National Wetlands Conservation Program (NWCP) since the year 1985-86. Aim of the Program is Conservation of wetlands in the country so as to prevent their further degradation and ensuring their wise use for the benefit of local communities and overall conservation of biodiversity. <p>Coastal and Marine Ecosystems</p> <ul style="list-style-type: none"> ▶ Coastal and marine ecosystems provide many services to human society and are of great economic value like food and water resources, and raw materials like sand, and other high-value heavy minerals like ilmenite, zircon, monazite etc., which are collected from beach sand. ▶ The number of species in the coastal and marine ecosystems is suggested to be more than 13,000. It is also known for high biological productivity, which provide a wide range of habitat for many aquatic flora and fauna. ▶ India has established 31 Coastal and Marine Protected Areas (CMPAs) and several species have been listed under Wildlife (Protection) Act 1972. 	 
	<p>Application of Concept/ Examples in real life</p> <p>The study of values and assessment of biodiversity is important for the conservation of biodiversity and protection of environment.</p>	<p>Link to YouTube/ OER/ video https://youtu.be/HqZVKiolUnc</p>
<p>Key Take away from this UO: values and assessments of biodiversity.</p>		

Study Material: UO 3f

Course Code CE: Subject Code 22447: Subject Name Environmental Studies: Topic Ecosystem and biodiversity: LO3f - Suggest the methods of biodiversity conservation:Study Material		
Anant J Fulzele	Coordinator: Dr. B R Ambade ; 09 July,2020	Dr D K Parbat
Key words Biodiversity conservation In-situ conservation Ex-situ	Learning Objective: Suggest the methods of biodiversity conservation.	Diagram/ Picture 
Key Questions Suggest the methods of biodiversity conservation. Describe In-situ and Ex-situ biodiversity conservation. List the objectives of biodiversity conservation.	<p>Concept Map</p>  <p>Explanation of Concept</p> <h3 style="text-align: center;">Biodiversity Conservation</h3> <ul style="list-style-type: none"> <input type="checkbox"/> The hope for conservation of natural biodiversity rests on preservation of selected ecosystems and representative areas of different vegetation types in the country. as well as on saving some of the extinction-prone species. <input type="checkbox"/> The number of endangered species of plants and animals is on the rise, which has prompted government and non-governmental organizations to take certain steps <input type="checkbox"/> In this direction. Forestry and wildlife were primarily under the control of state governments but later on looking to the gravity of the situation a separate Ministry of Environment and Forests was established. <p>The aims and objectives of wildlife management in India includes the following –</p> 	Key Definitions/ Formulas
Solved word Problem State various laws existing for conservation of biodiversity in India.		

Laws Governing Biodiversity Conservation in India :

- ❑ The Madras Wild Elephant Preservation Act, 1873.
- ❑ All India Elephant Preservation Act, 1879.
- ❑ The Indian Fisheries Act, 1897.
- ❑ Wild Birds and Wild Animals Protection Act, 1912.
- ❑ The Indian Forest Act, 1927.
- ❑ Bengal Rhinoceros Act, 1932.
- ❑ Haily National Park Act.. 1936.
- ❑ Bombay Wild, Animals and Wild Birds Protection Act, 1951.
- ❑ Assam Rhinoceros Protection Act, 1954.
- ❑ The Cruelty Against Animals Act, 1960.
- ❑ The Wildlife (Protection) Act, 1972.
- ❑ The Forest (Conservation) Act, 1980. (xiii) Wildlife (Protection) Amendment Act; 1991.
- ❑ Conservation of Forests and National Ecosystems Act, 1994.

IN-SITU AND EX-SITU CONSERVATION OF BIODIVERSITY :

The goal of biodiversity conservation can be attained in a number of ways. The concept of gene banks regulates all these methods.

In-situ conservation :

- ❑ It can be defined as the conservation of plants and animals in their native ecosystem (natural habitats) or even man made ecosystem, where they naturally occur.
- ❑ This type of conservation is applicable to wild flora and fauna as conservation is achieved through protection of populations in their natural ecosystems.
- ❑ The concept of protected areas falls under this category e.g. **National Parks, Sanctuaries and Biosphere reserves** etc.

Ex-situ conservation :

- ❑ It can be defined as the conservation of plants and animals away from their natural habitats.
- ❑ It includes collection of samples of genetic diversity and their treatment in the laboratory, where they are cultured.
- ❑ The concept of 'gene banks' has primarily become the talk for ex-situ conservation as it is important for conservation of agricultural crops and forestry based afforestation programmes.
- ❑ Genetic resource centres fall under this category and include **botanical gardens, zoological parks , seed banks , gene banks** etc.

for In-situ conservation :

National Park:

- ❑ According to the Indian Board for Wild Life (IBWL), "a National Park is an area dedicated by statute for all time to conserve the scenery, natural and historical objects, to conserve the wild life there in and to provide for enjoyment of the same in such manner and by such means, that will leave them unimpaired for the enjoyment of future generations with such modification as local conditions may demand".
- ❑ The history of National parks in India begins in 1936 when the Hailey (now Corbett) national parks of United Provinces (now Uttar Pradesh) was created.
- ❑ The area is declared for the protection and preservation for all time of wild animal life and wild vegetation for the benefit and advantage and enjoyment of the general public.
- ❑ In this area hunting of fauna or collection of flora is prohibited except under the direction of park authority.
- ❑ There are 104 existing **national parks in India** covering an area of 40501.13 km², which is 1.23% of the geographical area of the country (**National Wildlife Database, May, 2019**)



Botanical Gardens
Kirstenbosch (South Africa)



Seed Banks
Svalbard (Norway)



Captive Breeding
Great Plains Zoo (America)

Distribution between National Park, Sanctuary and Biosphere Reserve

Sanctuary :

- ☐ The Indian Board for Wild Life has defined a sanctuary as, 'An area where killing, hunting, shooting or capturing of any species of bird or animal is prohibited except by or under the control of highest authority in the department responsible for the management of the sanctuary and whose boundaries and character should be sacrosanct as far as possible.
- ☐ By June 1992 India had 416 sanctuaries.
- ☐ The Board has further clarified the position by stating that while the management of sanctuaries does not involve suspension or restriction of normal forest operation, it is desirable to aside a completely sacrosanct area within a sanctuary to be known as 'Abhyaranya'.
- ☐ It has also indicated that sanctuaries should be made accessible to the public.
- ☐ **Wildlife sanctuaries of India** are classified as IUCN Category IV protected areas. Between 1936 and 2016, 543 **wildlife sanctuaries** were established in the country that cover 118,918 km² (45,914 sq mi) as of 2017.

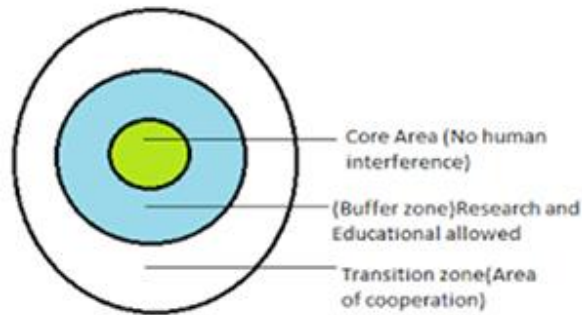
Important Wildlife Reserve / Sanctuaries in India

State	Wildlife Reserve
Maharashtra	Pench, Nawegaon, Dhakna-Kolkaz
Manipur	Keibul
Meghalaya	Balapakrani
Mizoram	Dampa
Nagaland	Intangki
Orissa	Simplipal, Chilka lake
Punjab	Abohar
Rajasthan	Ranthambore, Ghana
Sikkim	Kanchenjunga
Tamil Nadu	Guindy, Mundumalai, Annamalai
Uttar Pradesh	Corbett, Dudwa
West Bengal	Mahanandi, Jaldapara, Deer Parks, Sunderban

State	Wildlife Reserve
Andhra Pradesh	Kawal, Pocharam, Neelapattu
Arunachal Pradesh	Namidapha
Assam	Kaziranga, Manas
Bihar	Hazaribagh, Belta
Goa	Mollen
Gujarat	Gir, Wild Ass, Nal Sarovar
Haryana	Sultanapur lake
Himachal Pradesh	Gobin-sagar
Jammu & Kashmir	Dachingam
Karnataka	Bandipur, Nagarhole
Kerala	Periyar, Neyyar
Madhya Pradesh	Kanha

Biosphere Reserve:

- ❑ Biosphere Reserves have been described as undisturbed natural areas for scientific study as well as areas in which conditions of disturbance are under control.
- ❑ These serve as the centres for ecological research and habitat protection, The “Biosphere consists of two main zones as :
Core area & Buffer zone.
- ❑ Presently, there are 18 notified **biosphere reserves** in India.

**Important Biosphere Reserves in India**

S.No.	Biosphere Reserve	State
1.	Nilgiris	Tamil Nadu, Kerala and Karanataka
2.	Namdapha	Arunachal Pradesh
3.	Nanda Devi, Uttarakhand	Uttar Pradesh
4.	(Valley of flowers)	Uttar Pradesh
5.	Andamans	Andamans & Nicobar
6.	Gulf of Mannar	Tamil Nadu
7.	Kaziranga	Assam
8.	Sunderbans	West Bengal
9.	Thar desert	Rajasthan
10.	Manas	Assam
11.	Kanha	Madhya Padesh
12.	Nokrek	Meghalaya
13.	Little Rann of Kutch	Gujrat
14.	Great Nicobar Island	Andamans & Nicobar

	<p>Special projects :</p> <ul style="list-style-type: none"> ➤ Project Tiger : <ul style="list-style-type: none"> ❑ A fast decline of the tiger population lead to the set up of a special task force in 1970 by the Indian Board for Wildlife ❑ It prepared an action plan to conserve the tiger population in India. As a result 'Project Tiger' was launched on 1 April 1973 ➤ Gir Lion Project : <ul style="list-style-type: none"> ❑ The Asiatic lion is now confined to the Gir Forest of Gujarat. The sanctuary harbored nearly 200 of them. The great reduction in the number was due to the increased threat from overgrazing, depletion of prey species, etc. ❑ The Asiatic lion was in danger of being wiped out either due to starvation, epidemics or human interference. In 1972 the State government prepared a scheme for the management of the Gir Lion Sanctuary with proper guidelines for conservation. The Centre provided assistance for the protection and improvement of the habitat. <p>Special projects :</p> <ul style="list-style-type: none"> ➤ Himalayan Musk Deer Project : <p>The musk deer (<i>Moschus moschiferus</i>) which was once found throughout the Himalayan tract has terribly suffered due to its musk been used in the preparation of perfumes and medicine. Secondly the habitat destruction brought about a sharp decline in their population. A conservation project was therefore launched at the Kedarnath sanctuary in U.P.</p> ➤ Crocodile Breeding Project : <p>The three varieties of crocodile population viz., gharial (<i>Cavialis gangeticus</i>), the mugger (<i>Crocodylus palustris</i>) and the salt-water crocodile (<i>Crocodylus porosus</i>) witnessed a sharp decline by the early 1970s. With the assistance of the UNDP, the Government of India launched a crocodile breeding and management project.</p> ➤ The Project Elephant : <p>It was launched with a view to protect and conserve the elephant population of the country. Project Elephant aimed at restoring degraded habitats of elephants. Creation of migration corridors, elimination of human interference and establishment of a data base on the migration and population dynamics of elephants e.g. elephant habitat restoration work was done in Rajaji National Park.</p> 	
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	<p>References:</p> <ol style="list-style-type: none"> 1. Dr. J. P. Sharma, 2009. Environmental Studies, 2nd Edition, Laxmi publications, New Delhi, India. 2. M.P. Singh, 2005, Environment and Natural Resources Hardcover, Satish Serial Publishing House, Delhi India. 3. Prof. ErachBharucha, 2004. Textbook for Environmental Studies. University Grants Commission, New Delhi, India. 4. Dr. Y. K. Singh, 2006. Environmental Science. NEW AGE INTERNATIONAL (P) LIMITED, PUBLISHERS, New Delhi, India. 5. R. Rajgopalan, 2011. Environmental Studies: From crisis to cure, Oxford University Press, New Delhi, India. 6 Images & pictures from Google web sites. 	
	<p>Application of Concept/ Examples in real life With the knowledge of various methods of biodiversity conservation .we can suggest suitable method applicable for any given condition. Examples - In-situ conservation – National Parks,Wildlife sanctuaries,Biosphere Parks etc. Ex-situ conservation – Botanical Gardens ,Zoological Parks, Gene/Seed Banks etc.</p>	<p>Link to YouTube/ OER/ video https://youtu.be/fH9DXc7D3yA https://youtu.be/z7UQPAvyHbQ</p>
Key Take away from this LO: Biodiversity conservation In-situ conservation Ex-situ conservation		