Environmental Science

Lecture 12

Different Zones

The different zones within our country and this is just with in India, so you can imagine the number of zones that are there across the globe and the number of provinces that are there across the globe. So if you look into

Trans-Himalayan Region

The Himalayan ranges immediately north of the Great Himalayan range are called the Trans-Himalayas. This region with its sparse vegetation has the riches wild sheep and goat community in the world. The snow leopard is found here.

Himalayas

The Himalayas consist of the youngest and loftiest mountain chains in the world. The Himalayas have attained a unique personality owing to their high altitude, steep gradient and rich temperate flora. The forests are very dense with extensive growth of grass and evergreen tall trees.

Semi-Arid Areas

Adjoining the desert are the semi-arid regions which is a transitional zone between the desert and the denser forests of the Western Ghats. The natural vegetation is thorn forest. This region is characterized by discontinuous vegetation cover with open areas of bare soil and soil-water deficit throughout the year

Western Ghats

The mountains along the west coast of peninsular India are the Western Ghats, which constitute one of the unique biological regions of the world. The mountains rise to average altitudes between 900 and 1500 m above sea level, intercepting monsoon winds from the southwest and creating a rain shadow in the region to their East.

North-West Desert Regions

This region consists of parts of Rajasthan, Kutch, Delhi and parts of Gujarat. The climate here is characterized by very hot and dry summer and then cold winters. Rainfall is less than 70cm. The plants here are mostly xerophytic. So you have Camels, wild asses, foxes and snakes are found in hot and arid deserts.

Deccan Plateau

Beyond the Ghats is Deccan Plateau, a semi-arid region lying in the rain shadow of the Western Ghats. The highlands of the plateau are covered with different types of forests, which provide a large variety of forest products.

The next important zone is the Gangetic Plain

Gangetic Plain

In the North is the Gangetic Plain extending up to the Himalayas foothills. This is the largest unit of the Great Plain of India. The thickness in the alluvial sediments varies considerably with its maximum in the Ganga plains. The physio-geographic scenery varies greatly from arid and semi-arid landscapes of the Rajasthan Plains to the humid and per-humid landscapes of the Delta and Assam valley in the east.

North East India

North East India which is one of the richest flora regions in the country. It has several species of orchids, bamboos, ferns and other plants. Here the wild relatives of cultivated plants such as banana, mango and other citrus and pepper can be found.

The last group is the Island Group.

Islands

The two groups of islands you have the Arabian Sea islands and the Bay of Bengal Islands which differ significantly origin and physical characteristics with a maximum width of 58km the island forest of Lakshadweep in the Arabian Sea have some of the best preserved evergreen forest of the country. Some of the islands are fringed with coral reefs. And many of them are covered with thick forests and some of them are highly dissected.

These are some of the species of the Trans-Himalayan Zone. The Himalayan Pit Viper, the Black necked crane and the chiru, the Himalayan zone you have the ibex, the Red Panda and the Monal Pheasant.

The Indian Desert Zone you have the Black Buck, the Flamingo and Wild Ass.

The Semi-arid zone the tiger

The Western Ghats you have Lion Tailed Macaque, Malabar-civet and the Horn bill

Deccan Peninsula you have the swamp deer, Jerdon’s Courser and the mugger. And the gangetic plains you have the one horn Rhino, otter and the Terrapin.

Biodiversity at Local Level or state level as we will referred to as we look into the Andhra Pradesh as a case study are the sample.

Andhra Pradesh has a rich biological diversity which consists of 4 National parks, you have the Kasu Brahmananda Reddy National Park which was built in the 1994 when the built is pretty much being recognized as a National Park, it's been an existence for also to gather before that and that it's an 1.5 km^2 in area. The next prominent one is MahavirHarinaVanasthali National Park, this is about the 15 km^2 Mrugavani National Park around 3.7 km^2 , Sri Venkateswara national Park in 1989 about 353 km^2

And the Brahmananda Reddy National Park is actually located in the Jubilee hills in Hyderabad, Andhra Pradesh. Is named after the former chief minister is described as the Jungle amidst the concrete jungle, and its one of the most successful example of how inspired of being part of city landscape it is still well preserved and protected, if usually the concept of forest of wildlife sanctuary national park its outskirts surrounded by hills and forest in trees and here its bang in the center of the city. The Park has around 600 species of plant life, 140 species of birds and 30 different varieties of butterflies and reptiles. Animals making their home in the park include the pangolin, small Indian civet, peacock, the jungle cat and porcupines.

Bio-diversity at a Global level

Cellular life has existed on earth probably more than 500 million years, but for more than half of the years is consistent only of prokaryotes thatis unicellular organisms such as bacteria and blue green algae.

Multi cellular that is the metazoans first appeared in the fossil record about 600 million years ago.

During the earlier part of the Cambrian period a wide diversity of multicellular forms appeared with relative suddenness.

The early metazoans inhabited the sea; the land was colonized during the Silurian period.

The Devonian periods years about 340-440 million years ago. In parallel what happened with the land animals, the terrestrial vascular plants also appeared.

But the major problem occurred among the angiosperms that is the flowering plants which diversified enormously during the Cenozoic era which from todays around 65 million years ago.

The present geological era is perhaps the richest in bio-diversity

Current we have about 2.1 million species have been identified while many more species are believed to be in existence.

According to UNEP in 1994 the estimate the total number of species that might exist on earth range between 9.0 to 52 million invertebrate animals and plants which make-up most of the species

About 70% of all known species are invertebrates that is animals without backbones such as insects, sponges, worms etc. while about 15% are plans,

Following the “Earth Summit” in 1992 it became evident that there is a growing need to know and scientifically name the huge number of species which are still unknown on this earth.

The Purpose of Botanical Gardens

4 Ethno-botanical gardens with about 400 species were established in 4 regional research centers in the state at Rajahmundry, Tirupathi, Mulugu near Hyderabad and Achuthapuram in Khammam District to create awareness on Medicinal Plants among the officials as well as staff of the department and the general public.

Sample plots of different Medicinal plants are raised in these gardens. The Ethno-botanical garden at Rajahmundry has Arboretum too with various tree species collected and planted basing on Bentham and Hooker’s classification.

The production of seed and seedlings of different species for utilization as planting material is also achieved in these gardens on a limited scale. There is an enormous scope for increasing this activity not only with in this state also across the country.

INDIA AS A MEGA-DIVERSITY NATION

The country has a rich heritage of biodiversity, encompassing a wide spectrum of habitats from tropical rainforests to alpine vegetation, and from temperate forests to coastal wetlands.

Almost all the bio geographical regions of the world are represented here in India.

1. With a mere 2.4% of the total land area of the world, the known biodiversity of India contributes 9 of the known global biodiversity.
2. India is one of the twelve mega-diversity nations of the world.
3. India is the tenth position in the world and fourth in Asia in terms of diversity in the plant kingdom
4. And in terms of number of mammalian species, the country ranks tenth in the world.
5. And in endemic species of higher vertebrates, it ranks eleventh.
6. In terms of number of species contributed to agriculture and animal husbandry, it ranks seventh.

7. India has two major realms, the Palaearctic realm and the Indo-Malayan realm and you have three biomes namely the tropical humid forests, the tropical dry deciduous forests and the warm desert or the semi deserts.

Now if you look at the different realms across we will be discussing the Palaearcticand the Indo-Malayan because India is involved in border line across both these realms, if you look at the Palaearctic Realm.

Palaearctic Realm

The Palearctic is one of the eight ecozones dividing the Earth surface. Physically, the Palearctic is the largest ecozones. It includes the terrestrial Eco regions of Europe, Asia north of the Himalayan foothills which comes India, northern Africa and central parts of the Arabian Peninsula. This is one of the largest regions includes different continents there occurs a great variety in the number of species of flora in Palearctic realm. The number of fauna is also quite variable. One bird family, the Accentors is endemic to the Palearctic region. The Holarctic has four other endemic bird families; the Divers, Grouse, Auks and the Waxwings. There are no endemic mammal orders in the region, but several families are endemic.

Indomalayan Realm

Indomalaya extends from Afghanistan through the India subcontinent and Southeast Asia to lowland southern China and through Indonesia as far as Java, Bali and Borneo. This realm also includes the Philippines, lowland of Taiwan and Japan's Ryukku Islands

Most of the Indomalayas was originally covered by forest, mostly tropical and subtropical moist broadleaf forests, with tropical and subtropical predominant in these area which is part of India and well as Southeast Asia.

Flora and Fauna

If you look at the distribution here Flora and Fauna, you have plant species from the desert plant to mangrove plant are present

Two orders of mammals that is are you have endemic to this area, then you have many other animals like the Leopard, Tigers, Water buffaloes, Asian Elephant, Indian Rhinoceros, Javan Rhinoceros. All of these are typical to this area.

Indomalaya has three endemic bird families and that's also very important anything with respect to endemic species has to be registered with that realm because that actually states the importance of the realm. If the realm discontinues to exist from some particular reason those species are considered endangered or extinct.

India can be divided into ten biogeographic zones and 26 biotic provinces which represent the major ecosystems of the world.

India figures with two 'hotspots' the Western Ghats and the Eastern Himalayas.

Endemism: Species which are restricted only to a particular area is referred to as endemic

India shows a good number of endemic species. About 62% of amphibians and 50% of lizards are endemic to India

Western Ghats are the site of maximum endemism. It has 26 recognized endemiccenters.

If you look at the protected area. The protected area is define by the world conservation union as an area of land or sea that is dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, managed through either legal or other effective means.

Biosphere reserves: Which protect larger areas of natural habitat that is bigger than the national park or animal sanctuary and often includes one or more National Parks and/or preserves along with buffer zones.

The Buffer Zones could be event part cities or urban areas that are open to certain economic users.

The world network of Biosphere Reserves is the collection of all 482 biosphere reserves in 102 countries. This number is from mid-2005.

India has 5 world heritage sites, 12 biosphere reserves and 6 Ramsar wetlands amongst these protected areas.

If you look at the world heritage sites we have the Kaziranga National Park in Assam, the keoladeo Ghana National Park in Rajasthan, Manas Wildlife Sanctuary in Assam again, Nanda Devi National Park in Uttar Pradesh and the Sundarban National Park in West Bengal.

Conservation of Biodiversity

Now moving onto conservation of Bio-Diversity

BIODIVERSITY

Why do we need to conserve Biodiversity?

- Biodiversity affects us all
- It has direct consumptive value in food, agriculture, medicine and other industries

- It has aesthetic and recreational value
- It maintains ecological balance and continues evolutionary processes
- It provides indirect ecosystems services like chemical cycling, soil management, Climate regulation, water system management, waste treatment and pest control.

CONSERVATION OF BIODIVERSITY

- Biodiversity inventories
- Conserving Biodiversity in protected Habitats
- You have two types In situ conservation and Ex situ conservation
- Certain examples are Seed Bank, Gene Bank, Pollen Bank and DNA Bank
- Restoration of biodiversity
- Imparting Environmental Education
- Enacting, Strengthening and enforcing Environmental Legislation
- Population Control
- Reviewing the agriculture Practice
- Controlling Urbanization
- Conservation through Biotechnology

Now if we look at the different Organism, you have fungi, protists, prokaryotes, plants and animals. So all of these animals is apply a very important role as the part of the ecosystem and therefore in Biodiversity.

So right from yeast, bacteria, protozoans, fungi, plants, reptiles, mammals, birds

The enormous value of biodiversity is due to their genetic, commercial, medical, aesthetic ecological and optional importance emphasizes the need to conserve biodiversity.

If you look at any act or process of conserving, the protection or preservation management or restoration of wildlife and of natural resources such as forest, soil and water. So all of this is encompassed in the conservation of biodiversity its basically define as the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generation while maintain its potential to meet the needs and aspirations of future generations. So obviously conservation is not goanna stoppers from using or utilizing by biodiversity but it's going to tell us how we can give back to it, how it can take it reduce rate and how we can supplement and needs from other sources.

You have two approaches of biodiversity

In situ conservation (within habitat) : This is achieved by protection of wild flora and fauna in nature itself, so the example of this Biosphere Reserves, National Parks, Sanctuaries, Reserve Forests etc.

Ex situ conservation (outside habitats) : This is done by the establishment of certain programs or procedures outside that of the habitat. It could be gene banks, seed banks, zoos, botanical gardens, culture collection centers etc. So even though the influence of man is felt in both In situ and Ex situ. It is completely built from scratch in another location completely different from the habitat. It doesn't have to close to the habitat is Ex situ but In situ even though man is interfering in the environment to create a sustainable environment, it is with in the habitat without distorting and disrupting the life cycle of those particular species.

Conservation Approaches

Here it involves the production within the natural areas, so the biodiversity is protected in the environment itself, what happens in Ex-situ is we are doing it in artificial setting away from the habitat.

So if you look at In situ, you have sacred groves and lakes, you have biosphere reserves. Biosphere reserves could be terrestrial or marine. The next way you can have In situ conservation method is by propagating national park and wildlife sanctuaries. Now if you move onto Ex situ then you have the sacred plant home garden that is within it can be taken from Seed Banks and the other sources it can be taken from the different parts of the country away from it being the source of the organism or that particular species, this is then through seed banks, gene banks and cryo preservations and the other way of Ex situ is Botanical gardens, Zoos and Aquarium.

Moving onto discussing how Ex situ conservation can be done and how it is done here and it is mainly done for conservation of crop varieties with the while varieties of crops and all the local varieties with the main objective of conserving the total genetic variable of the crops species for future crops improvement or forestation programs.

In India we have the following important gene bank or seed bank facilities

- **The National Bureau of Plant Genetic Resources (NBPGR) :** This is located in New Delhi. Here agricultural and horticultural crops and their wild relatives are preserved by cryo-preservation of seeds, pollen etc. By using liquid nitrogen and temperature as low as -190 degree Celsius, varieties of rice, pearl millet, Brassica, tumip, radish, tomato, onions and others have been successfully in liquid nitrogen for several years without using the viability of the seed.

- **National Bureau of Animal Genetic Resources (NBAGR) :** located at Karnal, Haryana. These preserves the semen of domesticated bovine animals, especially could be praised axis, stalians and other animals
- **National Facility for Plant Tissue Culture Repository (NFPTCR) :**This is for development of a facility of conservation of varieties of crop plants/trees by tissue culture. This facility has been created within the Animal genetic resources.

This is a typical seed bank. Seed bank help farmers and also research scientist to come up with genetically modified species.

Endangered animal species are preserved using similar techniques.

The genetic information needed in the future to reproduce endangered animal species can be preserved in gene banks such that future they can be produced in the form of eggs or embryos.

The Zoological society of San Diego has established a “frozen zoo” to store such samples from more than 355 species, including mammals, reptiles and birds.

In-Situ Conservation

- We have around 88 National Parks and 490 Wildlife Sanctuaries.
- Thus the expansion of the protected area network
- Population surveys and assessments and database creation
- Mapping of forest types, protected areas and natural forests
- Improved protection efforts and a landscape approach to conservation
- There should be a regular population habitat viability and risk simulations
- Geographical information systems and remote sensing in planning and monitoring
- Creation of new conservation reserves
- Community reserves
- Joint Forest management
- Voluntary, field based organizations and NGOs

We moving onto specific cases in our country, these are the olive ridley turtles at Orissa coast which are considered severely endangered species, lot of things are being done to protect the species and at the same time this is their fate getting caught in plastic bags in the coast of the sea in fishing nets and dying by the dozen.

Conservation of the Biosphere

Biosphere is a Complex system that has many statistical packages for the social science

It’s an Interlinking in form of a web.

And half the keeping the entire system stable. So individual levels of the biosphere half also need to kept stable. As a conservation method come up with the development & strategies of protecting the diversity that exist in particular biosphere.

Why do we need to conserve?

- Bio-gene Chemical cycles. Nitrogen, Phosphorus, sulphur, Carbon etc
- The gene pool of characters of environmental and human interest
- Food webs and chains providing natural pest and disease control
- And many other such reasons.

Look at the Bio-diversity of India; we have about 10.9% of world Flora. So that's about 45364 plants sapling of species and sub species. Fauna have 7.7% of the world's species that's about 94317 animal species.

If you look at Bio diversity in agriculture, the number of wild relatives in millets of 51, fruits 104, spices and condiments 27, vegetables and pulses 55, fiber crops 24 and medicinal plants as whapping 3000. So the main sources we have are Gulf of Mannar, Great Nicobar, Nilgiri, the Nanda Devi all of these are main sources of Biodiversity.

These are certain National Parks and Sanctuaries, Geographical information throughout the country, and every part of the country even the arid zone of Rajasthan is very important for thani vegetation. We have the thunthra, we have the alpines, sub alpines, deciduous all of that is very important. All of this Geographical information systems (GIS) remote sensing all of this has been used in positive factor and to record what kind of plant species across the country, what kind of endemic species of animals across the country, this is like the vegetation map of India but besides the vegetation of map. Each vegetational area suggest that one kind of particular species is prevalent there and also this gives as an idea of what kind of uses each of these areas will have to mankind as well as what kind of relationship can have with that particular region at the same time not use over using it and at the same time utilizing it resources to the fullest.