Environmental Science

Environment, Ecosystems and Biodiversity

Lecture 11

Recent Issues on Biodiversity

To begin with, what recent issues have developed on Biodiversity. About 75% of the genetic diversity of crop plants have been lost in the past century. Scientists estimate that as many three species per hour are going extinct and 20,000 extinctions occur each year. These species could be across the ecosystem. Not necessarily only in plant life or animal life, it could be insects or anything. Roughly one-third of the world's coral reef systems have been destroyed or highly degraded. About 24% of mammals and 12% of bird species are currently considered to be globally threatened. More than 50% of the world's wetlands have drained and populations of inland water and wetland species have declined by 50% between 1970 and 1999.

If you look at the biodiversity in India, if you look at the mammals, we have about 386 different species in India alone. Percentage of Indian species evaluated is 59 and threatened is a massive 41%. Again, if you look at reptiles, there are 495 species in India alone but the ones threatened account for 46%. If you move to fresh water fish, we have about 700 species in the Indian origin out of which 70% is threatened. You can see what a large percentage is threatened in one country, India. If this were to be done in every country like this, you'd realize the number of species we are discovering, in the same speed are they becoming extinct.

Certain Biodiversity conventions; the first convention on biodiversity was organized at Rio De Janeiro which was the capital of Brazil from 1992 and this was obviously led by the United Nations. It was the United Nations Conference on Environment and Development. It was otherwise also referred to as, the Rio summit to maintain ecological balance and enrich biodiversity. The agreement on biodiversity signed by 150 countries including three programmes - To ensure conservation of biodiversity; Sustainable use of biodiversity; Rational and equitable share of profit to accrue from use of genetic resources. The second convention was in Johannesburg in 2002, nearly a decade later, this was the World summit on Sustainable Development (WSSD) where Biodiversity and Sustainable Ecosystem Management was the issue. Inspite of having a decade's span in between the two conventions, the topics pretty much remain the same. When we want to talk about environmental development, we have later seen that inspite of laws and things that were taken up in around 92. The changes that were developed that had changed in terms of biodiversity conservation laws or let it be the rapid progress of extinction or endangered species, nothing much had changed. The whole shift of the parable was toward the sustainable ecosystem management. The International Conference held on Biodiversity in Relation to Food and Human Security in a warming planet that was in 2010 in our own city. Then, you have the International conference on Wildlife and Biodiversity

which was held in 2010 in Kashmir and then another in Thiruvananthapuram in Kerala. We are obviously going to be dependent on biodiversity, having a life without biodiversity is impossible at the same time, how do we take from biodiversity and at the same time not detracting its value. Let's give back at the same speed we take or at a relatively better speed when taking. 2010, with respect to India was a very active year, where there were constant dialogues and discussions at a global level on how to go about preserving biodiversity and realizing the importance of biodiversity and the importance of it not only in the lifespan of a human being but also in the interrelationships and co-relationships that man has with many other species in the planet.

Biodiversity is our life. If biodiversity got lost at the rate at which it is diminishing now, the very survival of human beings will be threatened. It is very much our moral duty to conserve biodiversity as well as our environment. Long term maintenance of species, their management requires cooperative efforts across entire landscapes. Biodiversity should be dealt with at a scale of habitats or ecosystems rather than at species level. That is the main problem. We end up concentrating on all the small details and wind up losing sight of the big picture. The purpose of the big picture is to encompass the entire biodiversity across the globe. Inspite of us being small minded about other political reasons, other issues, when it comes to biodiversity where we have to globally take a stand because it is only when we look at entire landscapes, we can see how we can conserve biodiversity. If we take species by species, it isn't going to be possible because there is a correlationship as well as interdependency between species, between different levels of the food chain as well as different traffic levels within the food web. All these have to be taken into consideration when we look into biodiversity. Different threats to biodiversity - like we saw, you have each member of an animal or plants species differs widely from other individuals in its genetic makeup. Then you have, Species diversity where the number of plants and animals that are present in one particular region constitutes its species diversity. Then you have the, Ecosystem diversity - there are a variety of different ecosystems on Earth. Each having their own complement of distinctive interlinked species based on the differences in that habitat.

Threats to Biodiversity

If you look at different threats to biodiversity, you have habitat destruction where it's very important to protect one's habitat in order to protect the animals or biodiversity within it. Biodiversity encompasses a number of species, it covers plant life, insect life, microbial life; it covers everything, anything that has a living organic cell falls under the umbrella of biodiversity. There's a huge pressure from the world, rapidly increasing population. We have seen previously on how biodiversity is important to us, how many of our needs are dependent on biodiversity. Then, the next important threat is global climatic change. There is an immense change in biotic

elements of the eco system like global warming and things like that which is causing a huge biotic change. Habitat fragmentation - this is mainly from human activity since we go about cutting trees in forests. Let it be for agricultural purposes or industrial purposes or construction purpose, whatever the purpose; as and when man is getting rid of forests, we are getting rid of huge chunk of biodiversity that area supports. Basically, it reduces the ability of habitat to support certain species. Next important threat is pollution - introduction of pollutants such as nutrient overloading, nitrate fertilizers as well as more immediately felt harmful chemicals that enter the food chain and hence, different levels of food web as well. Over-exploitation - this includes the illegal wildlife trade as well as overfishing, logging of tropical hardwoods, etc. Alien Species - this has been introduced to regions where there are no natural predators. Like even a recent article that came about was with regard to a particular forest where they have realized that because of the poaching of tigers and leopards, there has been increase in the number of species of deers and antlers which is causing an imbalance in the food chain because of which they had to bring species from another area, predators to reduce the number of these deers. Disease - reduction in habitat causing high population densities, encourages spread of diseases. When you look at the natural causes, you have narrow geographical area, no population, no breeding rate natural disasters. Even though these are considered natural causes, there is a certain amount of a human element in all of this, that we influence. Certain natural disasters like landslides or even earthquake could be considered a natural disaster. But because of soil erosion, deforestation and improper drilling and all of those issues cause these natural disasters. Even though natural disaster by itself cannot be categorized as Anthropogenic i.e human causes, there is an intrinsic element where humans are involved in these factors. Then you have Anthropogenic causes; Habitat modification, Overexploitation of selected species, Innovation by exotic species. This happens especially with respect to crops and plants when yield is a major factor to feed our ever increasing population, what happens is, man does a lot of research, trying to introduce genetically modified crops, crops that will grow further, crops that are less prone to diseases and more resistant to certain bacteria or fungi. All of these modified species are always a threat to biodiversity since it hampers the growth of naturally occurring species.

Habitat loss - you can see clearly how forests are getting completely cleared and especially with technology is advancing. The rate at which trees fall is nothing compared to the rate at which trees are being grown or planted. Previously when it was a completely dependent or manmade labour, completely human labour, it used to be a slow tedious process to just get one tree. Few men would be required to do that one job. But now, with technological development, trees can be taken and fall by the minute, by the hour and forests can be cleared in a couple of days. At this rate, more trees have to be replanted or expected to be grown during that period of time. Habitat loss can be described when an animal loses its home. Every animal in the animal

kingdom has one particular niche, one particular place they call their environment in their particular community. Without this habitat, they no longer have that particular niche or home.

Major reasons of loss is agriculture, farming; because of our ever increasing population and the need to feed it, we have to keep increasing the percentage of agricultural land. Harvesting natural resources for personal use. Industrial and urbanization development. Habitat destruction is currently ranked the primary cause of species extinction worldwide. If you look at the examples, we will look at the panda, which is the national animal of Chennai. You find it across the country but now, it is found only in fragmented and isolated regions in the south west of the country as a result of widespread deforestation in the 20th century. There are certain natural causes attached to it too, such as Volcanism, fire and climatic change, is well documented in the fossil record. One study shows that fragmentation of tropical rainforest in euro 3000 million years ago lead to a great loss of amphibian diversity. You can actually see certain natural causes are meant to happen because those species were meant and supposed to be extinct. But when it comes under the control of man and man influenced activities, we obviously have to step in. If it is completely by natural causes, it is probably nature's way of saying that species has to face its end, like how we have lost dinosaurs and other species in the past but now when it is solely because of the carelessness of humans and mankind, a step has to be taken to consider what has to be done. These are forest fires typically seen, then you have volcanic eruptions, you have floods; all of these are natural calamities. But then again, forest fires in some cases are induced by man because he wants to remove that entire forest cover for some particular personal use. This is done by land mafias across the world or even woof mafias who are involved in the wooden trade.

What solutions are there for just this problem? Protecting the remaining intact section of natural habitat. We need to not only trace the different species across the world but also find out the endemic species to that particular area, so that we can go about protecting their natural habitat. When we think of just the species, we might think we can take it to a conservatory lab, you can take it to a natural forest or wildlife sanctuaries; all of these are secondary. First we will have to make an attempt on taking them back to their natural habitat. Reduce human population and expansion of urbanization and industries. Educating the public about the importance of natural habitat and biodiversity. Solutions to habitat loss can include planting trees, planting home gardens so as to reduce the need for man to need large lands for agricultural farms that lead to habitat loss.

Poaching

The next important, crucial reason that reduces biodiversity, is poaching. Poaching could be for a number of reasons. It's actually illegal hunting and harvesting, taking of wild plants or animals, such as through hunting, harvesting, fishing or trapping. Even fish is included, trapping of

certain mammals and other reptiles for their different products. All of these encompass poaching. If you look at history of poaching, the term poaching although it means illegal, if you look back in the stone ages and in history, man has always tried to tame the animal and think that the animals are for his own use. That is true not only when it comes to stone ages but even till date in certain tribal communities. Even tribal communities do it with care, making sure the food chain isn't affected, they do not over exhaust any particular species. It was only during the late middle ages that poaching actually became a punishable offence because man by then was considered civilized and had other methods to feed himself. He had other methods of clothing himself. When it began with a purpose of fun, it became a punishable offence. It was done for tigers, rhinoceros, deers; all of them are hunted for their tusks, their skin, horns; all of these animals are killed for their animal products, all of these do not have medicinal purposes rather killed to create vanity products like handbags, decorative pieces, small items like household items. All of these have not valid purpose as such. The other materials are there to substitute the natural products. Still the poaching habit is a multi billion dollar industry because the entire fashion industry is developing based on the plain source of poaching all across the globe. Its done for large profits, gained by illegal sale or trade of either animal parts, meats and pelts. It exists because there is a demand for these products and there is a still demand because there is lack of education and plain disregard for law amongst the buyers. They know nothing can be done, it cannot be traced back to them. There is a disregard and careless attitude towards this. Many cultures believe that certain animal parts have medicinal value, but that percentage is very small. The rest of it is basically only for commercial purposes. It is not only limited to animals but also plants, these plants create the most poached species; galax, black cohosh and ginseng because they are used in the beverage industry like teas, in medicine as a rejuvenating drug; a lot of these plants have huge medicinal properties that are manufactured across the globe. How does poaching actually affect the environment? Illegal hunting causes animals getting endangered and then becoming extinct. If more number of animals become extinct, then there's a disruption in the food chain, and that will cause major problems in our ecosystem, resulting eventually in new adaptations of animals, and or species beyond human control. Poaching results in animals being hunted too soon for them to have time to reproduce and repopulate.

Man-wild conflicts - this encompasses the different conflicts mankind has with the wildlife. If you think about the man-animal conflict, this is the major problem associated with conservation of wild animals especially the herbivores like elephants in India because they cause severe damage to crops and even manslaughter. Animals such as elephants, gaur, sambar, wild boar and birds like peacock, cause extensive damage to the crops. This phenomenon has registered significant increase in the recent years due to habitat fragmentation and degradation of natural forests and corridors. Instances of many man-animal

conflicts keep coming to limelight from different states across the country. Just few years back, in Sambalpur in Orissa, about 200 humans were killed in the last 5 years by elephants. Again in retaliation, the villagers killed 98 elephants and they badly injured 30. Such kind of conflicts, not only happens in this state but across different states, let it be Kerala or Tamilnadu since we actually use these animals for other purposes. But when we end up going onto their land, let it be forests or any other place, they come around for food because that's their habitat. They don't realize that we have taken over that habitat. Several instances of killing of Elephants in the border regions of Kote - Chamarajanagar belt in Mysore, have also been reported quite recently. You have typical examples, the most felt about are elephants because they destroy crops by the acres, they come in hoards, they cause stampedes and they even hurt a lot of human beings. How do you go about reducing these conflicts? The aim of conflict resolution or management is to reduce the potential for human wildlife conflicts in order to protect life and limb. It's basically important that the habitat is protected, animal population is protected, general biodiversity should also be protected, at the same time any damage caused to the property should be minimal. Preference is obviously for passive, non-intrusive measures but often active intervention is also required to be carried out.

You have two types of management techniques of wildlife. The traditional aim is to stop, reduce or minimize conflict by controlling animal populations. Lethal control has been used in history for the longest time but it has severe drawbacks. Other measures are less costly in terms of life; translocation, regulation and preservation of animal populations. Modern methods depend upon the understanding of ecological and ethological understanding of wildlife. Its environment to prevent or minimize this conflict. Examples being; behavioural modification and measures to reduce interaction between humans and wildlife. Potential solutions to these conflicts include; electric fencing, land use planning, community-based natural resource management (CBNRM), compensation, payment for environmental services, ecotourism, wildlife friendly products, or other field solutions. In effort to reduce the human-wildlife conflict, the worldwide fund for nature has partnered with a number of organizations to provide solutions across the globe. Their solutions are tailored to that community and that species involved. For example in Mozambique, communities started to grow more chili pepper plants after making the discovery that elephants dislike and avoid plants containing capsaicin. This created an effective method to prevent elephants from trampling community farmers's fields as well as protects the species.

Importance of Biodiversity

Now, moving on to the importance of biodiversity. Generation of soil and maintenance of soil quality. Maintenance of air quality, maintenance of water quality, pest control, Detoxification and decomposition of wastes, Pollination and crop production, Climate stabilization, Prevention

and mitigation of natural diseases, Provision of food security. Moving on to biogeographical classification of India. Biogeography is the science that deals with patterns of species distribution and the processes that reside in such patterns. The patterns of species distribution at this level can usually be explained through a combination of historical factors such as speciation, extinction, continental drift, glaciation i.e usually associated with variation in sea level, river routes and so on. River capture in combination with the area and isolation of landmasses and availability of different supplies of energy.

Typical fundamentals in Biogeography are; Evolution i.e change in genetic composition of the population. Extinction - disappearance of a species. Dispersal - movement of populations away from the point of origin, this is usually related to migration and the cause of migration could be natural or manmade. Then you have Range and distribution and Endemic areas. India has different types of climate and topography in different parts of the country and these variations have induced enormous variability in flora and fauna. India has a very rich heritage of biological diversity. It is very important to study the distribution, evolution, dispersal and environmental relationship of plants and animals in time and space. Biogeography comprising of phytogeography and zoogeography deals with these aspects of plants and animals. In order to gain insight about the distribution and environmental interactions of flora and fauna of our country, it has been classified into ten biogeographic zones. Each of these zones has its own characteristic climate, soil, topography and biodiversity.

If you look at the different biogeographic zones, they represent distinctive units of similar ecology, biome representation, community and species. For example, you have Himalaya and the Gangetic plains. Biotic provinces, you have the next level of detail in these zones. The example for this is; Northwestern Himalaya and Western Himalaya. The next category is Biomes - this is major ecosystem groupings found within each province and region. For example - Alpine and Subalpine. These are in stepped hierarchical distinction. Within India, the classification you have are 10 zones divided into 26 provinces. The zones are; Trans-Himalaya with 2 provinces, The Himalaya with 4 provinces, The Indian Desert with 2 provinces, The Semi-Arid zone with 2 provinces, The Western Ghats with 2 provinces, The Deccan peninsula with 5 provinces, the Gangetic plain with 2 provinces, the Coasts with 3 provinces, North East India with 2 provinces and the Islands with 2 provinces. So we have seen the different biogeographic zones within the country and the importance of these provinces and the biogeographic zones.