

THREATS TO INDIAN BIODIVERSITY

A.J. Thatheyus

P.G. & Research Department of Zoology
The American College, Madurai – 625 002

ABSTRACT

India, being a tropical country harbours a rich biodiversity especially for the coral reefs, mangroves and tropical forests. It is the Vavilovian centre for several crop plants and has a high degree of endemism. Such a rich biodiversity is under threat due to habitat destruction, natural causes, modern agriculture practices, development activities and socio-economic factors. Efforts must be taken in the right direction to conserve the biodiversity so that sustainable development is feasible.

INTRODUCTION

The various biomes ranging from driest desert to the moist rain forests, from the peak mountains to the deepest ocean trenches harbour an astounding variety of life which occurs in a marvelous spectrum of shapes, sizes, colours, life cycles and interrelationships (Cunningham and Cunningham, 2002). Biodiversity, the umbrella term for the degree of nature's variety, including both the number and frequency of ecosystems, species or genes in a given assemblage encompasses all species of plants, animals and microbes and the ecological complexes in which they occur. (McNeely *et al.*, 1990). As a global asset bringing benefits to people in all parts of the globe, biodiversity is the very basis of human survival, providing food, medicine, energy, ecosystem functions, scientific insights, and cultural sustenance to mankind. Moreover, we have to respect that the other organisms have their intrinsic right to life (Kothari, 1947).

The main natural habitat types of India include forests, grasslands, wetlands, mangroves, coral reefs and deserts (Gadgil *et al.*, 1996). India is blessed with 89,451 animal species accounting for 7.31% of the fauna in the world while the 49,219 species of the plants constitute the flora, which accounts for 10.78% of the global total. India figuring with the two hotspots, the Western Ghats and the Eastern Himalayas has 26 recognised endemic centres, two major realms, three kinds of biomes, 10 biogeographic regions, 5 world heritage sites, 12 biosphere reserves, 88 national parks and 490 sanctuaries and occupies a place among the 12 Vavilovian centres of origin of cultivated plants. It is considered to be the centre of origin for about 30,000 to 50,000 varieties of rice, pigeon-pea, mango, turmeric, ginger, sugar-cane, goose berry, etc., along with the richness of marine biodiversity comprising coral reefs and mangroves (MoEF, 2000). Coral reefs are considered as the 'rain forests of the sea', and the mangrove cover of India is around 4,24,400 ha (Gadgil *et al.*, 1996). However, this rich biodiversity of India,

which is the hub of wheel of life, is under severe threat owing to several anthropogenic activities.

THREATENED SPECIES

Over the last 150 years, species are disappearing in a dramatic fashion and between 1,600 and 1,850 anthropogenic activities resulted in the elimination of 2 or 3 species per decade which is double that of the natural extinction rate. But in the recent 150 years, this has increased to thousands per decade (Cunningham and Cunningham, 2002). According to IUCN, the categories of Threat or Extinct (species not definitely located in the wild during the past 50 years), Endangered (Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating), Vulnerable (Taxa believed likely to move in to the 'endangered' category in the near future if the causal factors continue operating), Rare (Taxa with small world populations that are not at present 'endangered' or 'vulnerable' but are at risk) and Indeterminate (Taxa known to be 'endangered', vulnerable or 'rare' but lacking information to be placed appropriately). The threatened animals and plants of India by status and taxonomic group are given in Tables 1 and 2. According to a rough estimate, about one-third of Indian wetlands were already wiped out or severely degraded and out of the 88 Indian wet lands listed by the Asian Directory of wetlands as many as 45 were facing moderate to higher threats. The coral reefs of Gulf of Mannar and Gulf of Kutch were also threatened (Gadgil *et al.*, 1996). In India, the degree of anthropogenic pressure varies in different parts of the country (Paul *et al.*, 2005).

Table 1 : Threatened organisms of India by status category

Status category	Animals	Plants
Extinct	0	7
Extinct in the wild	0	2
Critically Endangered	18	44
Endangered	54	113
Vulnerable	143	87
Lower Risk Conservation Dependent	10	1
Lower Risk Near Threatened	99	72
Data Deficient	31	14

(Source:IUCN, 2000)

Table 2: Threatened species of India by taxonomic group

Taxa	Number of threatened species
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Plants	244
Molluscs	2
Other invertebrates	21
Fish	3
Amphibians	3
Reptiles	25
Birds	70
Mammals	86

(Source: IUCN, 2000)

THREATS

Large scale loss of biodiversity has been mainly caused by anthropogenic activities like hunting, fishing, pollution, and introduction of exotic species, habitat destruction, and a plethora of economic and social factors (Fig.1). Even certain agricultural schemes like surface irrigation, monoculture, introduction of high yielding varieties, domestication, application of chemical fertilizers and pesticides result in the depletion of biodiversity. The various factors which pose a threat to biodiversity are listed in Table 3.

Fig. 1. A break up of Anthropogenic activities that pose threat to biodiversity

Source : Agrawal, 2000

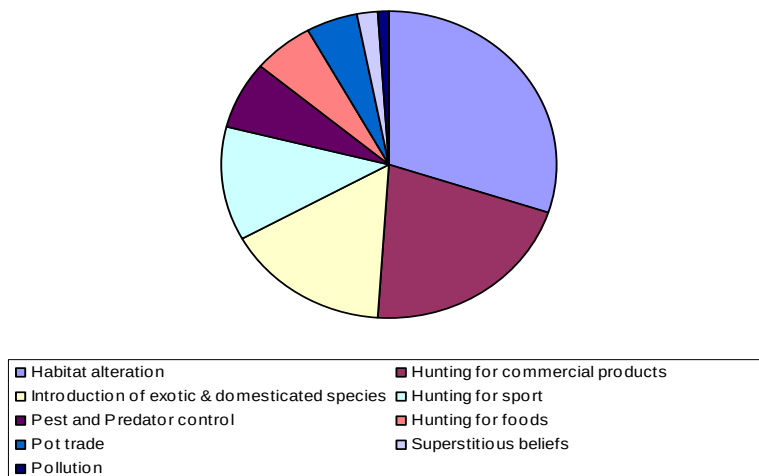


Table 3 : Causes of Threat to Biodiversity

Natural causes	Modern agricultural practices	Habitat destruction	Socio Economic factors	Human activities
Environmental stress	Favouring few species	Human settlements	Free rider principle	Wrong fishing
Limited resources	Manipulating populations	Logging	Wrong land use patterns	Hunting & Collection
Extreme disturbance	Monoculture	Highways	Over exploitation	Climate changes
Geographic isolation	Surface irrigation	Dam construction	Lacking conservation spirit	Mining
Predation	High Yielding Varieties	Deforestation	Inappropriate uses	Fuel wood collection
Fire	Domestication	Desertification	Excluding local communities	Mercantile activities
Grazing	Fertilizers and pesticides	Fragmentation	Poverty	Predator and Pest control
Genetic Assimilation	Shifting cultivation	Inbreeding depression	Consumerism	Exploiting medicinal plants
Catastrophes and Diseases	Uniformity by Biotechnology	Urbanisation & Industries	Throw away society	Pollution

EXTINCTION

It is the elimination of species and a normal process in the natural world as a part of evolution. Though the rate of extinction is low in the undisturbed ecosystem, vast numbers of species are wiped out through mass extinction caused by global climate changes due to the release of green house gases. It is even reported that we are losing 10,000 organisms a year (Cunningham and Cunningham, 2000). No human being can recreate a species once it disappears and it is alarming that a species, which took millions of years to evolve is simply eliminated in a few years due to our own wrong practices.

HABITAT DESTRUCTION

The natural habitats like forests, wetlands and other species rich ecosystems are destroyed for human settlement, grazing grounds, agriculture, mining, industries, highways and dams. In India several species of butterfly are facing extinction and in Western Ghats alone, out of the 370 butterfly species, 70 are at the brink of extinction. In the last few decades, India had lost about half of its forests (Agrawal, 2000). Habitat destruction accounts for 89% of all threatened birds, 83% of mammals and 91% of all threatened plants at the global level (IUCN, 2000). According to UNEP (1986), India originally had about 30,17,01,000 hectares as wildlife habitat, which reduced to 6,15,09,000 hectares amounting to 80% habitat loss.

FRAGMENTATION

Habitat fragmentation is the break up of a large portion of a forested land into several smaller portions and this results in the reduction of total amount of forest area and the isolation of smaller patches (Goparaju *et al.*, 2005). Habitat fragmentation causes the reduction of habitat into smaller, scattered patches with isolated groups, which are vulnerable to inbreeding depression, diseases and catastrophes.

DEFORESTATION

Large areas of forests are cleared due to human settlements, shifting cultivation, development projects, logging, fuel wood and other mercantile activities. During 1951 to 1972, India has lost about 34,02,000 hectares of forest area which represents an annual loss of 1,55,000 hectares (Agrawal, 2000).

HUNTING AND FISHING

Over harvesting in the form of hunting and fishing is responsible for the depletion of species. Wild animals are killed for their products like hides and skin, tusk, antlers, fur, meat, pharmaceuticals, perfumes, cosmetics and ornamental products. In the Indian market the cost of ivory was Rs. 2,000 to 2,500 per kg and in the international market it was about \$150 per kg. In 1987, the Indian Government has banned the trade in Indian ivory. Likewise, one kg of tiger bone is sold for \$90 in India and \$300 in the international market (Agrawal, 2000). According to CITES, nine Indian animal species were depleted due to international trade (Table 4). The various animal species hunted for the different products are given in Table 5.

Table 4 : The Indian animal species depleted due to international trade according to CITES

S. No.	Common name	Zoological name
1	Fin whale	<i>Balenoptera physalus</i>
2	Himalayan Musk Deer	<i>Moschus moschiferus</i>
3	Green Turtle	<i>Chelonia mydas</i>
4	Hawksbill Turtle	<i>Eretmochelya imbricata</i>
5	Olive Ridley Turtle	<i>Dermochelys olivacea</i>
6	Salt water crocodile	<i>Crocodylus porosus</i>
7	Desert Monitor Lizard	<i>Varanus griseus</i>
8	Yellow Monitor Lizard	<i>Varanus flavescens</i>

9	Bengal Monitor Lizard	<i>Varanus bengalensis</i>
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Table 5 : The major animals hunted for their products

S. No.	Animal	Product
1	Rhinoceros	Horns
2	Tiger	Bones and skin
3	Musk deer	Musk
4	Elephant	Ivory
5	Gharial, crocodile	Skin
6	Jackal	Thrivin fur
7	Whale	Whale bone (making combs)
8	Spinytailed Lizard	Oil (aphrodisiac)

Marine ecosystems exhibit a remarkable biodiversity and their coral reefs were compared with tropical forests. More animal phyla are represented with complex food webs in marine systems (Mc Neely *et al.*, 1990). India with an extensive coastline of 8,129 km, 0.5 million km² of continental shelf, 2.02 million km² EEZ and an annual fishery potential of about 3.9 mt, harbours a rich diversity of species (Nair, 2001). Destructive fishing is continued in the estuaries and oceans without any concern to save the juveniles and brood fish. Use of dynamite to obtain more catch, bull trawling to sweep the entire fauna of the sea bottom, purse seining to catch shoals of fish and bag net fishing to catch even migrating juveniles, deplete several species especially the fish species of low fecund groups (Sakthivel, 2001).

COMMERCIAL EXPLOITATION

Though trade of products from endangered species is banned internationally, smuggling of furs, hides, horns, live specimens and folk medicines happens in developing countries like India from where such products are exported to Europe, North America, Japan, Taiwan and Hong Kong. Trading of live animals like *Hippocampus* sp., sea cows, turtles, rare plants, horticultural orchids, insectivorous plants, medical plants, ornamental fishes and birds pose much threat to biodiversity. Animals and plants were collected for zoos and laboratories for study and research in science and medicine, especially the primates like monkeys and chimpanzees and other mammals like rats, mice, guinea pigs, rabbits, etc., for they possess several similarities to human beings.

EXOTIC SPECIES

Bioinvasions of alien species result in the depletion of native species which were suppressed and sometimes eliminated. Introduction of goats and rabbits resulted in the destruction of habitats for several plants, birds and reptiles. Species like water hyacinth and tilapia dominate the aquatic systems and result in the removal of native species. Considered as biopollutants, they behave aggressively due to the absence of predators, parasites, pathogens and competitors that kept them in check in their native home and it is very difficult to eliminate such exotic species (Cunningham and Cunningham, 2002).

PREDATOR AND PEST CONTROL

The toxic pesticides employed in the control of pests and vectors wreak havoc to even non-target organisms. Some predatory species were reduced or deliberately exterminated as they were regarded as dangerous to humans, livestock or crops.

DISEASES

Disease outbreaks cause the mortality of several individuals and epidemics may sweep through the area causing mass mortality. There is widespread occurrence and destructive nature of plant diseases caused by fungi, bacteria, actinomycetes and nematodes. Several serious diseases caused by viruses like sugarcane mosaic, tomato spotted wilt, Bunchy top of banana, Tristeza or Quick, Decline diseases of citrus, Potato blight are devastating diseases killing large number of plants and trees (Rangaswami and Bagyaraj, 2001). Rapid expansion of farming practices and poor managerial practices were identified as the major causes for the incidence of both infectious and non-infectious diseases in shrimp farms. Among the infectious diseases caused by viruses, bacteria, fungi and protozoans, viruses pose the greatest threat to shrimp aquaculture (Sahoo *et al.*, 2005).

POLLUTION

Toxic pollutants discharged from various anthropogenic activities result in disastrous effects on local populations of animals and plants. In addition to their effects on the various systems of organisms, they cause damage to the immune system, which makes them vulnerable to infections. Aquatic life and soil biota are much affected by these contaminants and the organisms at higher trophic levels are damaged by the phenomenon of Biomagnification. Species like fish, birds and mammals are much prone to the various pollutants like pesticides, heavy metals, detergents, agrochemicals, petrochemicals, acid rain, ozone depletion, global warming, noise pollution, etc.

GENETIC ASSIMILATION

Certain rare and endangered species are threatened by genetic assimilation due to their crossbreeding with closely related species, which are more in number or vigour. Hence it introduces foreign genes into an already dangerously small gene pool, which reduces the chances of mating between pure lines.

ECONOMIC FACTORS

Bioresources are not given appropriate prices and hence people gain their benefits without paying for them like a free rider. In cost benefit analysis, the social benefits are not considered especially in land use patterns. Moreover, the persons exploiting biodiversity seldom pay the full costs of their exploitation while the society bears it as a whole. The forests and wildlife are public properties and hence people treat them as free commodities but lack the spirit of conserving them. People mainly look for the present benefits and not the future uses of biodiversity and hence the bioresources are mined for the use of the present generation at the expense of future generations (McNeely *et al.*, 1990)

SOCIAL FACTORS

Biodiversity has to be protected against inappropriate uses and exploitation while the people of the local communities should not be considered as opponents. The inability of the people to live in harmony with the natural environment poses threat to biodiversity.

CONCLUSION

As a nation, we have to understand and recognize the contributions of natural resources and biodiversity towards development. For protecting our wetlands, coral reefs, mangroves, mountains and tropical forests, which harbour a rich diversity, it is imperative to remove the various threats to Indian biodiversity and to proceed with the various measures of conservation. It is mandatory that the individuals, societies, scientists, social and environmental activists, politicians and governments have to contribute for conserving biodiversity. Efforts can be taken to strengthen endangered species management and biodiversity protection through law, recovery programmes, habitat protection, captive breeding programmes, establishing zoos and botanical gardens.

ACKNOWLEDGEMENT

The author thanks the R & D Committee of the American College, Madurai for their encouragement.

REFERENCES:

- Agrawal, K.C. 2000. *Biodiversity, Agrobios (India)*. Jodhpur. 144 pp.
- Cunningham, W.P. and Cunningham, M.A. 2002. *Principles of Environmental Science: inquiry and applications*. McGraw- Hill Companies, New York. 418 pp.

- Gadgil, M., Ghate, U. and Pramod, P. 1996. *Biodiversity Resource Material*, Indian Institute of Science. Bangalore. pp 218-417.
- Goparaju, L., Tripathi, A. and Jha C.S. 2005. *Forest fragmentation impacts on phytodiversity – An analysis using remote sensing and GIS*. *Current Science*. **88** : 1264-1274.
- IUCN. 2000. *Red List of Threatened Species*. The World Conservation Union, Gland, Switzerland.
- Kothari, A. 1997. *Understanding Biodiversity*. Orient Longman Limited. New Delhi. 161 pp.
- McNeely, J.A., Miller, K.R., Reid, W.V., Mittermeier, R.A., and Werner, T.B. 1990. *Conserving The World's Biological Diversity*. IUCN. Gland, Switzerland. 193 pp.
- MOEF. 2000. *Annual Report 2000 – 2001*. Ministry of Environment and Forests. Government of India, New Delhi.
- Nair, N.B. 2001. *Introductory Remarks*. In : *Sustainable Indian Fisheries*. (Ed. T.J. Pandian) National Academy of Agricultural Sciences. New Delhi. pp.1-5.
- Paul, A., Khan, M.L., Arunachalam, A. and Arunachalam K. 2005. *Biodiversity and conservation of rhododendrons in Arunachal Pradesh in the Indo-Burma biodiversity hotspot*. *Current Science*. **89** : 623-634.
- Rangaswami, G. and Bagyaraj, D.J. 2001. *Agricultural Microbiology*. Prentice Hall of India, New Delhi. 422 pp.
- Sahoo, A.K., Patil, P. and Shankar, K.M. 2005. *White spots? A loaded question for shrimp farmers*. *Current Science*. **88** : 1914-1917.
- Sakthivel, M. 2001. *Need for legal Framework for sustainable Aquaculture*. In : *Sustainable Indian Fisheries* (Ed.T.J. Pandian) National Academy of Agricultural Sciences. New Delhi. pp. 225-231.
- UNEP. 1986. *Review of the Protected Areas System in the Indo-Malayan Realm*. IUCN. Gland, Switzerland. 284 pp.