Research Paper

Biodiversity Status and its Conservation in India

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Abstract
India is one of the 12 mega biodiversity countries in the world and divided into 10 biogeography regions. Our country accounts for two hotspots out of the 35 global biodiversity hotspots: the Indo- Malayam which includes the Eastern Himalayas, north-east India and Andaman Islands, and the Western Ghats. Biogeographically, India is situated at the tri- junction of three realms- Afro-tropical, In- do-Malayan and Paleo Arctic realms, and therefore, has character- istic elements from each of them. This assemblage of three distinct realms makes the country rich and unique in biological diversity. It has a great wealth of biological diversity in its forests, wetlands and in its marine areas. Based on this, over 46,000 species of plants and 81,000 species of animals have been described by the Botanical Sur- vey of India (BSI) established in 1890 and Zoological Survey of In- dia (ZSI) established in 1916, respectively. The conservation of this national wealth is of the paramount importance in face of increasing pressure on the biodiversity in the form of land use and land cover change, invasive species, global warming, nutrient deposition and climate change.
Key words: Biodiversity, conservation, climate change.

I.   Introduction:

Biodiversity is derived from two Latin words-*bios* means *life* and *diversitas* means *variety*. Biodiversity is thus defined as the 'Full variety of Life on Earth', in other words it refers to the totality of different kinds of living species, their forms, levels and combinations on earth. The term biodiversity was coined by W.G. Rosen (1985). Since 1986 the term and concept of biodiversity was used by among biologists, environmentalists, political leaders and con- cerned citizens worldwide. This term is generally used to equate to concern for natural environment and its conservation. It includes diversity within species, between species and of ecosystem. How- ever, biodiversity did not became a familiar term to general public until the United Nations Conference on the Environmental and De- velopment (UNCED) held at Rio de Janerio (Brazil) in 1992. The Conference laid immense stress on the biological diversity of our earth planet and the need to preserve it for posterity. It defined the biodiversity: 'Biodiversity means the variability among living or- ganisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.' This is the single legally accepted definition of biodiversity adopted by the UN convention on Biological Diversity. In the simplest sense, biodiversity may be defined as the sum total of species richness, i.e. the number of species of plants, animals and microorganisms occurring in a given region, country, continent of the entire globe. Broadly speaking, the term biodiversity includes genetic diversity (Diversity of genes within a species), species di- versity (Diversity among species), ecosystem diversity (Diversity at the level of community/ecosystem) and habitat diversity.

The earth is home to a diverse array of living organisms, whose genetic diversity and relationships with each other and with their environment constitute our planet's biodiversity. It includes variety and variability among living organisms from all sources including inter alias, terrestrial, marine and other aquatic ecosystem and ecological complexes in which they occur, and it comprises diversity within species and in ecosystems.

Biodiversity is the 'foundation of human life' on earth because each organism plays an important role and helps in producing more productive and stable ecosystem which has the ability to survive in stress conditions. Biodiversity is of our lives and livelihood and constitute the resources upon which families, communities, nations and future generation depend (Elizabeth Dowdeswell, 1995).Human depend on biological resources for food, energy, construction materials and medicine etc. Further, biological resources have the critical character of being renewable, so with proper management they can be used sustainably (McNeely, 1995) ensuring their use for the future generations. Generally three kinds of biodiversities exist –habitat diversity, genetic biodiversity and species diversity. Thus the term biodiversity refers to the totality of genes, species and

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ecosystems of a region.

The distribution and magnitude of the biodiversity that exists today is a product of over 3.5 billion years of evolution, involving speciation, migration, extinction and more recently, human influ- ences. The total number of species in the world is estimated to be around 5 to 30 million out of which about 1.7 to 1.8 million species have been described. There are many more species that have not yet been described. About 61% of these species are insects.

Table *1.: Approximate numbers of species on earth*

Groups	Number of Species
Mammal	4650
Birds	9700
Reptiles	7150
Fish	26959
Amphibians	4780
Insects	1025000
Higher Plants	270000
Algae	40000
Protozoans	40000

Indian context:

India is one of the 12 mega biodiversity countries in the world. India has a great wealth of biological diversity in its forests, wetlands and in its marine areas. The diverse physical features and climatic situation have formed ecological habitats like forests, grasslands, wetlands, coastal and marine ecosystems and desert ecosystems, which harbor and sustain immense biodiversity.

Our country is divided into 10 biogeographic regions including (i) the Trans-Himalayan, (ii) Himalayan, (iii) Desert, (iv) Semi-Arid, (v) Western Ghats, (vi) Deccan Peninsula, (vii) Gangetic plain,

(viii)   Coasts, (ix) Northeast, and (x) Islands (Rodgers and Panwar, 1988). Among these biogeographic zone, Deccan Peninsula has the most extensive coverage of the Indian landmass (42%). The most biodiversity-rich zones, western Ghats and Northeast, account only for 4 and 5.2 % of the geographical area. India has 15 Biosphere Reserves, 44 tiger Reserves, 102 national Parks, and 512 Wildlife Sanctuaries. The total protected area is about 0.20 million km2 (about 4.9 % of the geographical area). Also, it has 5 world heritage sites and 25 Ramsar wetlands.

Biogeographically, India is situated at the tri- junction of three realms- Afro-tropical, Indo-Malayan and PaleoArctic realms, and therefore, has characteristic elements from each of them This as- semblage of three distinct realms makes the country rich and unique in biological diversity. Based on this, over 47,000 species (15,000 flowering plants, 64 Gymnosperms, 2834 Bryophytes, 1012 Pterido- phytes, 1940 lichens and 23000 fungi) of plants and 81,000 species (5000 molluscs 57000 arthropods, 2546 fishes, 204 amphibans, 428 reptiles, 1228 birds and 372 mammmals) of animals have been de- scribed by the Botanical Survey of India (BSI) established in 1890 and Zoological Survey of India (ZSI), respectively. Nearly 4900 of these species are endemic of India out of which, 1500 are highly threatened (MOEF,1999).

With only 2.45% of the land area, India already accounts for 8.10% of the word's biodiversity with a species count of over 1,35,261. The country is also one of the 12 primary centers of ori- gin of cultivated plants and is rich in agricultural biodiversity and domesticated animals. It is considered to be home land of more than 167 species of crops, 320 species of wild crop relatives and 114 breads of domesticated animals. Among the cultivated species of India, the germplasm comprises of 51 species of cereal and millets, 104 species of fruits, 27 species of spices, 24 species of fibre plants and 12 species of oil seeds, besides several wild strains of coffee, tobacco and sugarcane (Kotwal and Banerjee,1988).

Table 2.- Comparative account of recorded number of plant spe-cies in India and the world.

Texa	Species		Percentage ofIndia to the world
	India	**World**	
Bacteria	850	8050	10.56
Viruses	Unknown	4000	-
Algae	6500	40,000	16-25
Fungi	14,500	72,000	20.14
Lichens	2,021	35,000	14.97
Bryophyta	2,825	17,000	16.62
Pteridophyta	1,200	13,025*	9.21
Gymnosperms	48	980*	4.90
Angiosperms	18,000+	2,58,650*	6.96
Total	**45,944**	**4,27,205**	**10.75**

Source : ENVIS, BSI, 2006; IUCN Red List 2007*

Table 3- Comparative account of recorded number of animalspecies in India and the world.

Texa	Species		Percentage of India to the world
	India	**World**	
Protista	2,577	31,290	8.24
Mollusca	5,070	81,000*	6.26
Arthropoda	68,389	9,90,000*	6.91
Other inverte-brates	8,329	1,30,200*	6.40
Protochordata	119	2,106	5.65
Pisces	2,546	30,000*	8.49
Amphibia	209	6,199*	3.37
Reptilia	456	8,240*	5.53
Aves	1,232	9,956*	12.37
Mammalia	390	5,416*	7.20
Total	**89,317**	**12,94,407**	**6.90**

Source : MoEF 1999; IUCN Red List 2007*

In addition, the country is one of the very important Vavilovian Centers of biodiversity In flora, the country can boast of 45,944 species, which accounts for 10.75% of the known world plants. Of the 18,000 species of flowering plants (angiosperms) 36% are endemic and located in 26 endemic centers. Our country is very rich in faunal wealth too. The country has nearly 89,317 animal species, about 75 percent of which are insects, 4,952 vertebrates including protochor- data and about 84,365 are invertebrates, including protista. In ani- mals, the rate of endemism in reptiles is 33%, in amphibians 41%, in mammals 9%, and birds 4%.

India is equally rich in traditional and indigenous knowledge, both coded and informal on the use and importance of the biodiversity in the country. For generations, thousands of human communities have lived in the midst of this rich biodiversity and evolved sustainable lifestyles, of a symbiotic nature with the natural bounty around them. In the last two centuries, these equations have been radically challenged and threatened by various factors. Among them are a social and political mandate that favours maximum extraction of natural resources to achieve a certain paradigm of 'development' and a top-down model of conservation that ignores and threatens the very existence of the first allies of conservation – local people whose lives are deeply entwined with that of their surrounding for their physical, social, emotional and moral sustenance, in fact their very livelihood (Roy and Roy,2015).

Values of Biodiversity:

The estimation of biodiversity is difficult, firstly to estimate the total value of biodiversity due to lack of information and uncertainly, and secondly, due to variation from location to location, ecosystem to ecosystem, country to country and region to region.

Java and Srivastava (1998) have reported that the valuation of biodiversity is based on the premise that it is a biological resource meant to provide:

- The material basis for human life.
- For agricultural and other utilization needs.
- Nutritionally significant edible plants and animal species.
- Medicinal drugs for human and animal health care.
- Costal zone stabilization through mangrove ecosystems.
- Support to fisheries through coral reefs.
- Place for religious practice.
- Aesthetic value.

Loss of Biodiversity:

There are many reasons that disturb the biodiversity. The followingare the major ones.

- Human encroachment upon forest and other lands makes the
biodiversity to loss their natural habitat.
- Construction of big dames submerges biodiversity.
- Replacement of natural forest by monoculture.
- Industrial pollution.
- Chemicals in the form of pesticides and insecticides destroy
the birds and aquatic organisms.
- Irrational and unscientific land use.
- Appreciation in the value of wood and non-timber forest pro-duces (NTEP).
- Problem of land tenures.

Biodiversity Treaty:

The loss of biodiversity is a global problem. Out of the 1.7 million species inhibiting on the Earth, one third to one fourth is likely to extinct within the next few decades. Biological extinction has been a natural phenomenon in geological history. But the rate of extinction was perhaps one species every 1000 years. But man's intervention has speeded up extinction rates all the more. Between 1600 and 1500, the rate of extinction went up to one species every 10 years. But the rate of extinction as estimated today is 10,000 times higher than natural extinction rate of 1-10 species per year dueto human interference.

Arunachalam (1994) has recorded that each day 20 species become extinct from the earth. This is alarming rate. If it continues for a few centuries more, the earth may be devoid of life. Natural habitats such as forests, grasslands, deserts, wetlands, mangroves and coral reefs, etc. are under tremendous pressure due to increas- ing population density and activities of human beings. The major threats to biodiversity are from habitat loss, habitat fragmentation, environmental pollution, introduction of exotic species, genetic pollution, hybridization, genetic anomalies, GMOs, spread of diseases, overexploitation, shifting cultivation, poaching, acid rain, and climate changes etc. However, due to habitat loss and overexploitation owing to burgeoning population, the biodiversity of this country is severely threatened, and some species which used to be found abundantly earlier, have now become rare and some have even become extinct. A changing climate endangers whole ecosystem and entire species. Thus there is urgent need for conserving our biodiversity.

International Union for Conservation of Nature and Natural re- sources (IUCN) Red list is a catalogue of taxa that are facing the riskof extension. The uses of Red list are:

1. Developing awareness about the importance of threatenedbiodiversity.
2. Identification and documentation of endangered species.
3. Providing a global index of the decline of biodiversity.
4. Defining conservation priorities at the local level and guidingconservation action.

World Conservation Union has recognized eight red list categories of species: Extinct, Extinct in the wild, Critically endangered, Endangered, Vulnerable, Lower risk, Data deficient, and not evaluated.

Though IUCN in 1998 listed 23 species of mammals as endan- gered and vulnerable to extinction, 75 species are totally protected as listed under schedule I of the Indian Wildlife Act, 1972. Forests of the Western Ghats are famous for their endemic fauna. The lion-tailed macaque, the Nilgiris Langur, the Malabar large spotted civetand

the Nilgiris thar, etc. are some important endangered species (Agarawal,2009). In India, 44 plant species are critically endan- gered, 113 endangered and 87 vulnerable. Among animals, 18 are critically endangered, 54 endangered and 143 vulnerable.

Table 4. List of few critically endangered and endangered spe-cies of India.

Group	Critically Endangered	Endengered
Animals	Pygmy Hog	Asian Elephant
	Namdapha Squirrel	Lion-tailed macaques
	Malabar large spotted civet	Red panda
		Indian rhinoceros
Plants	*Berberis nighiriensis*	*Capparis pachyhylla*
	Dipterocarpus grandiflorus	*Pterocarpus santalinus*
	Ilex khasiana	*Madhuca diplotemon*

Conservation has been defined as the management of biosphere for the benefit of all life including man so that it may yield sustain-able benefit to the present generation while maintaining its potential to meet the needs and aspirations of the future generations. In brief, conservations is technique of deriving maximum advantage from the biosphere without degrading it. Every species in nature is not only supportive to each other but also cooperative directly or indi- rectly. Thus, biodiversity is the resource on which families, com- munities, nations and future generation depends. It serves as link between all organisms on earth, binding each into an independent ecosystem, in which all biological species interact with each other. In other words-***It is the web of life***.

This can be brought by both *in situ* and *ex situ* conservation. *In situ* conservation includes conservation of species in its natural habitat in protected areas like biosphere reserves, national parks and sanctuaries etc. *Ex situ* conservation involves maintenance and breeding of endangered species under partially or wholly controlled conditions, in botanical gardens, seed banks, gene banks etc. It also includes tissue culture, cryopreservation etc. Rich biodiversity is an indicator of the health of a particular habitat/ biogeography area and it's potential to sustain life. For conservation and protection of biodiversity, biodiversity rich areas are declared as national parks, wildlife sanctuaries, biosphere reserve, ecologically fragile and sensitive areas. Other strategies include offloading pressure from re- serve forest by alternative measures of fuel wood and fodder need by a forestation of degraded areas and wetlands and certain *ex-situ* conservation facilities such as gene bank.

In Indian constitution also provide protection of biodiversity under article 48a and 51a (g). under this article Central as well as State government enforced several laws relevant to biodiversity include Forest Act,1927, Wildlife (Protection) Act, 1972, Forest (con- servation) Act, 1980, and Environment (Protection) Act, 1986. The various central Acts are supported by number of state laws and statutes concerning forests and other natural resources. For the protection and conservation purpose new and aggressive projects will be launched by Government and NGO's.

The following important steps are proposed by various scientists (Agarawal, 2009; and Kotwal & Banerjee,1998) all over the world to save existing wildlife:

• Conservation and protection of existing natural forests and aquatic ecosystems.

• Special attention should be given to conserve the species which fall in the category of endangered, vulnerable or rarespecies.

• Proper planning of land and water utilization should be done to ensure the protection of wildlife in their natural habitats or in the man-made habitats such as zoos and botanical gar-dens.

• Efforts should be made to preserve as many varieties of food crops as possible, including forage plants, timber trees, live-stock, aquaculture animals and domesticated animals

• Wildlife products of wild plants and animals being utilized for international trade should be allowed only at levels which would not endanger the related wildlife.

• Control of diseases particularly of wild animals and plants.

• Strict laws have to be framed and enforced to check poaching, illegal hunting and trade of animal products.

• Protection and improvement of vast ecosystems.

- Restoration of forests, fields, grassland, swamps and water-bodies.
- Natural bamboo breaks/ bamboo forests are excellent habitat

for several wild animals and therefore, need to be conserved.

- Prevention of unnecessary destruction of wildlife by educat-ing human being concerning causes, results and remedial measures of wildlife depletion.
- Key biodiversity areas should be protected from cattle and

anthropogenic activity.

- Intensive research should be carried out in key biodiversity areas to study the habitat, ecology and food requirement of wild animals and biotic pressures etc.
- Preparing wildlife data base and inventories. List of threatened species at the local has to be prepared and updated so that conservation efforts may be focused on these species inthe given area.
- Increased support from state and central government agencies for the conservation of natural resources.
- Prevention of devastating forest fires.
- Regulation and control on fishing, hunting and collection of

wild products from the forest.

- Regularly contact or monthly contact environmental aware- ness and nature education programme should be conducted.It is very useful and major link between people and the Government.
- Biodiversity conservation awareness programme should be conducted at school level which will also gives fruitful effects in due course of time
- Conservation of biodiversity through a network of protected

areas including National Parks, Sanctuaries, Biosphere Re-
serves, Marine reserves, gene Banks, Wetlands, coral Reefs,etc.

- The integrated approach is essential to solve the problem by public awareness and primary education of biodiversity importance, pollution and the effect of global warming on bio-diversity.

II.   Conclusions

The phenomenon of biodiversity is very vast, complex and inter- dependent so there is no single over-arching cause of biodiversity loss or its stability. Proper documentation of biological diversity is essential for conservation and sustainable use of this natural wealth for the benefit of mankind. There is also need to identify the indicators of biodiversity changes through satellite remote sensing monitoring of the changes. There is an urgent need to bring all the information regarding biodiversity available on Zoological Survey of India, Botanical Survey of India, and various Central as well as State Universities and Institutions of India, traditional knowledge mostly unwritten about the medicinal properties and other economic uses of the plants and animals in one common platform. This information helps the planning strategist of biodiversity conservation.

Thus it is necessary for legislators to understand the basic science in order to maintain diversity at its current levels. If present human growth and resource management patterns do not change, it is likely that we will lose many important species, and the ecosystems of the world may never recover. Human is only one more of natural creatures and should not be alien to the other life-forms. We have no moral right to destroy nature and other beings that dwell on earth. We should treat all animals and plants with compassion. Every individual can make a small and yet significant efforts in the race to save our planet and conserve biodiversity. So, there is a need to check the ever-growing human population, which is the root cause of biodiversity decay and erosion. So to control the increasing population laws were made by Central as well as State government and enforced these laws strictly to conserve the biodiversity.

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