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Biodiversity Evaluation

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Abstract

Biodiversity or biological diversity includes all living organisms such as plants, animals and microbes etc. and the genetic differences among them. It exists at species, community ecosystem and landscape scales. It is important for four basic reasons such as morality, aesthetics economics and the service that is provided to society. Biodiversity is considered at three main levels including species biodiversity, genetic biodiversity, functional biodiversity and ecosystem biodiversity. Relative to the variety of habitats, biotic communities and ecological processes in the biosphere, biodiversity is important in no. of ways such as promoting the aesthetic value of the natural environment, contribution to our material well being through utilitarian values, maintaining the integrity of the environment. There are many direct benefits to people and our economy from biodiversity such as foods, fibers, forage for grazing animals, medicines, fuels, building material and industrial product. Biodiversity is nature's insurance policy against disasters. Loss of biodiversity not only reduces the availability of ecosystem services but also decreases the ability of species communities and ecosystem to adapt the changing environment conditions. India is one of the 12 mega diversity countries of the world. In biodiversity, each species no matter how big or small has an important role to play in ecosystem. Various plants and animal species depend on each other for what each offers and these diverse species ensures natural sustainability for all life forms. A healthy and solid biodiversity can recover itself from variety of disasters.

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Biodiversity, Biological diversity, Mega diversity, Disasters, Natural sustainability, Benefits.

Introduction

The term biodiversity encompasses a broad spectrum of biotic scales, from genetic variation within species to biome distribution on the planet (Wilson, 1992; Gaston, 1996; Purvis and Hector, 2000; Mooney, 2002). Biodiversity conservation was first defined as a science less than three decades ago (Meine, 2010), but is now well developed, multidisciplinary research endeavor (Sodhi and Ehrlich, 2010). The interest of quantification and valuation from natural scientists that biodiversity is imperiled by human activities (Wilson, 1992), especially the destruction of natural habitats (Primack, 2000).

India occupies only 2.4%of the world's land area but its contribution to the worlds biodiversity is approximately 8% of the total no. of species (Khoshoo, 1996), which is estimated to the 1.75million. Myer's and Colleagues (2000) 'hotspots' concept has already become part of the classic conservation lexicon, defining areas with high

species endemism and severe degradation by humans. These are places where at current rates of habitat loss and exploitation, we are about to lose far more irreplaceable species than in similar habitats elsewhere, this concept was originally applied to terrestrial environments but later extended to the marine realm (Roberts *et al*., 2002).

Global change triggered by human activities is all around us. The pervasive effects of climate change habitat loss and fragmentation, overharvesting pollution, altered nutrient cycling, invasive species and interaction thereof affect virtually all earth's ecosystem (Rockstrom *et al*., 2009). A recent study has compiled indicators on the state of biodiversity and reported overall decline with no significant recent reduction in the decline rate. This strongly suggests that the rate of biodiversity loss is not slowing down (Butcharet *et al*., 2010).

The freshwater biodiversity is the over-riding conservation priority during the 'water for life' decade and beyond after all water is the fundamental resource on which our life support system depends (Jackson *et al*., 2001; Postel and Richter, 2003; Clark and King, 2004). It is currently generally accepted that biodiversity plays an important role in the extent and stability of the services provided by ecosystem (Naeem *et al*., 2009). Degradation of natural forests is a global problem (Guppy, 1984; Sayer and Whitmore, 1991). People have been destroying forests for millennia ever since agriculture was started (William, 1989).

Levels of Biodiversity

The manifestation of biodiversity is the biological and ecological processes of which they are part. Therefore biodiversity is considered at three major levels.

Genetic diversity: It is the clay of evolution, the base material on which adaptation and speciation depend. For more than 80 yrs the study of genetic diversity has principally been the domain of evolutionary biologists (Wright, 1920; and Fisher, 1930). Genetic diversity provides the raw material for evolution of natural selection (Fisher, 1930). Early interest in the ecological effects of genetic diversity occurred in several fields in addition to evolutionary biology. For instance, in agronomy there have long been efforts to increase crop yield by planting genetically diverse varieties within a single field (Wolfe, 1985; Smithson and Lenne, 1996). There is a delicate interdependence between biological and genetic diversity. Changes in biodiversity result in changes in the environment require subsequent adaptation of the remaining species. If there are changes in the genetic diversity, particularly loss of diversity through the loss of species, it results in a loss of biological diversity. The field of biotechnology manipulates genes for developing better types of medicines and a variety of industrial products.

Species diversity: It refers to the variety of species within a habitat or a region. The world total is estimated at five to ten million species though only 1.75 million have been named scientifically so far. Ecologists have found species diversity difficult to define and this may in fact reflect the possibility that it is a 'non concept' (Hurlbert, 1971). The study of species diversity or at least species richness gives ecologists insights into the stability of communities (Walker, 1988). Species diversity or other forms of diversity can be partitioned across spatial scales. Whittaker (1960, 1977) defined a hierarchical system whereby point diversity within a microhabitat. Though the global biodiversity crisis is typically measured at the species level, the effects of species loss occur first at the population level (Ceballos and Ehrlich, 2002).

Ecosystem diversity: Ecological diversity relates to the different forms of life which are present in a particular site; in a more precise sense, it concerns the different species of a particular genus which are present in an ecological community. Global change has four interacting components climate, atmospheric composition, land use and ecological diversity (Walker *et al*., 1999). Pielou was one of the first to attempt rigorous measurement of ecological diversity as the level of uncertainty in the community (Pielou, 1977). In an ecological framework the diversity concept relies on the apportionment of abundance into a no. of animal or plant categories forming the ecological community. In particular it has been hypothesized that ecological diversity may contribute importantly to various aspects of ecosystem stability (Walker, 1995; Hobbs *et al*., 1995; Peterson, Allen and Holling, 1998).

Mega diversity of India

India is one of the 12 Mega biodiversity countries in the world. The country is also one of the 12 primary centers of origin of cultivated plants and domesticated animals. The large species richness and abundance are due to immense variety of climatic and altitudinal condition in country. There are 10 biogeography zones and 26

biogeography provinces which are representatives of all the major ecosystem of the world.

The country constitutes only 2.4% of the world's land area, but having 11% of flora and 6.5% of fauna of the world (Sinha *et al*., 2010). Among the biologically rich nations, India stands among the top 10 or 15 countries for its great variety of plants and animals, which are not elsewhere. India has 350 different mammals, 1,200 species of birds, 453 species of reptiles and 45,000 plant species which are almost angiosperms.

Based on the survey of about two-third of the geographical area of the country, the ministry has at present 89,317 species of fauna and 45,364 species of flora. To preserve our rich biodiversity nine biosphere reserves are set up in the specific biogeography zones. India also occupies ninth position in terms of freshwater Mega biodiversity (Mittermeier and Mittemeier, 1997). The Indian fish population represents 11.72% of species, 23.96% of genera, 57% of families and 80% of the global fishes (Chaudhuri, 2010). Biodiversity is therefore, essential for stabilization of ecosystem and protection of overall environmental quality for understanding intrinsic work of all species on the earth (Sumitra *et al*., 2007).

Importance of Biodiversity

Ecosystem provides many goods and services that are crucial to human survival. These goods and services include food, fiber, fuel and energy, fodder, medicines, clean water, clean air, flood/storm control, pollination aesthetic and recreational values etc. Ecosystem also plays an important role in biogeo chemical processes that underline the functioning of the earth ecosystem.

Biodiversity provides an important safety- net during times of food insecurity, particularly during times of low agricultural production (Anglesen and Wunder, 2003; Karjalainen *et al*., 2010), during other seasonal or cyclic food gaps (Arnold, 2008 and Vinceti *et al*., 2008) or during periods of climate induced vulnerability (Cotter and Tirado, 2008).

In many rural locations, particularly areas that lack basic infrastructure and market access, the collection of wild resources provides considerable subsistence support to local livelihoods (Delang, 2006). Freshwater biodiversity provides a broad variety of valuable goods and services for human societies some of which are irreplaceable (Covich *et al*., 2004).

Loss of Biodiversity

The diversity of life on earth is dramatically affected by human attractions of ecosystems (Baillie *et al*., 2004). Many activities indispensable for human subsistence lead to biodiversity loss, and this trend is likely to continue in the future. Extinctions of species are a part of an evolutionary process. However, during recent times, extinction rates are ten to hundred times higher than during pre- human times (Sinclair, 2000).

In Europe only 15% of the continent is classified as undisturbed which is the lowest percentage tropical forest is the most highly published aspect of this (Sinclair, 2000) either rivers are impounded, coral reefs destroyed by dynamite and natural grasslands are ploughed. Pollution and global environmental change also threaten the world's biodiversity. Over harvesting by illegal hunting and the systematic cutting of wood for heating purposes or charcoal production are other reasons for biodiversity loss.

The theory of Island biogeography states that when natural communities have been reduced to less than 10% of their original area, loss of the original species are at risk (Mac Arthur and Wilson, 1967). Increase in algal blooms may cause the increased frequency and duration of the sea sonal anoxia in the Bay. These changes probably have reduced no. of benthic organisms and thereby contributed to reducing the productivity of the Bay (Officer *et al*., 1984). In Germany agriculture is the main sector responsible for endangering species. Agriculture has been identified as the source of a threat to 513 species, 72% of species are on the red list of threatened and endangered species (OECD, 1991).

The current loss of biota has several causes. One is the destruction, conversion or degradation of entire ecosystem with the consequent loss of entire assemblages of species. There is an ongoing unprecedented loss of variety as well as absolute no. of organism from the smallest micro organisms to the largest mammal. The decline in biological diversity is important not only for reasons of aesthetics or scientific curiosity but because human existence depend on the biological resources of the earth.

Conservation of Biodiversity

Biodiversity at all its levels, genetic species and as intact ecosystems can be best preserved by both In-situ and ex-situ conservation method.

Fig.1 Hierarchical organization of genetic diversity

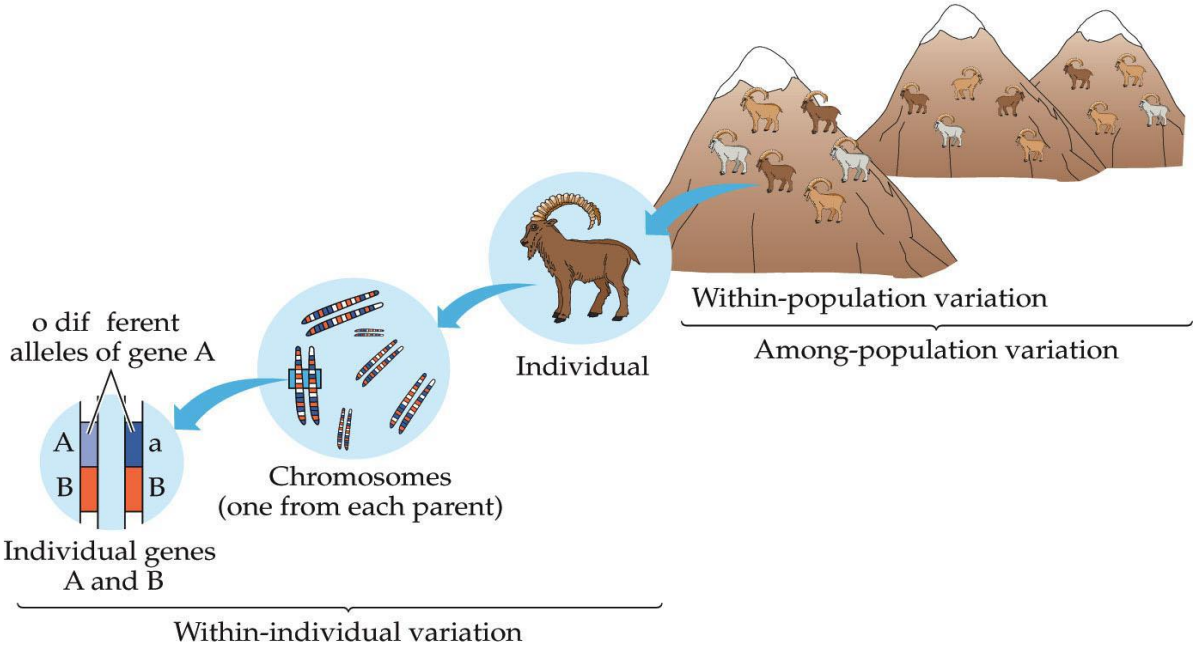

Fig.2 Species diversity of Earth

Fig.3 Biological diversity in different ecosystem (Desert, Forest, Grassland and Marine Ecosystem)

In In-situ conservation of crop genetic resources sometimes not been given importance. In Himalayan region a no. of protected areas – biosphere reserves, national parks and wildlife sanctuaries are in existence and are proposed. Rawat (1994) has proposed potential areas for plant conservation in various Biogeography zones of Himalayas.

For ex-situ conservation in Himalayas region, Khoshoo (1993) emphasized the need of seed, organ, tissue or gene banks, although these can be established at minimal cost because of the proximity of glaciers in the region.

The traditional farming systems have a key role in in-situ conservation of plant diversity. The traditional farming systems were developed by farmers over years of experience to suit specific ecological conditions with a view attaining stability and diversification in production (Singh and Misri, 1995). Gadgil and Berkes (1991) refer that various traditional ecosystem approaches require a belief system which includes a no. of prescription for restrained.

People's participation is very important to integrate ecosystem conservation and rural development as it is necessary to know the needs for they depend on a particular ecosystem (Khoshoo, 1993). Thus folklore surveys are necessary in remote tribal areas to assess the potential of traditional conservation values such as sacred plants, traditional restraints, religious beliefs about certain plants etc. and this background information with obviously help in biodiversity conservation programs.

The working linkages between the centers such as Wildlife Ministry of Environment & Forests, Botanical India, Zoological Survey of India, National Bureau of Plant Genetic Resources, Wildlife Institute of India, Forest Research Institute, G.B. Pant Institute of Himalayan Environment and Development etc. are being established under the programmes and the well established institutions engaged in the participating country are important for exchanging the information they have. Therefore, such linkages may be used for collecting information of biodiversity including the extinct and endangered plants as well as sites for their conservation.

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