



Biodiversity: Concept, threats and conservation

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Abstract

Biodiversity is the variety of different forms of life on earth, including the different plants, animals, micro-organisms, the genes they contain and the ecosystem they form. It refers to genetic variation, ecosystem variation, species variation (number of species) within an area, biome or planet. Relative to the range of habitats, biotic communities and ecological processes in the biosphere, biodiversity is vital in a number of ways including promoting the aesthetic value of the natural environment, contribution to our material well-being through utilitarian values by providing food, fodder, fuel, timber and medicine. Biodiversity is the life support system. Organisms depend on it for the air to breathe, the food to eat, and the water to drink. Wetlands filter pollutants from water, trees and plants reduce global warming by absorbing carbon, and bacteria and fungi break down organic material and fertilize the soil. It has been empirically shown that native species richness is linked to the health of ecosystems, as is the quality of life for humans. The ecosystem services of biodiversity is maintained through formation and protection of soil, conservation and purification of water, maintaining hydrological cycles, regulation of biochemical cycles, absorption and breakdown of pollutants and waste materials through decomposition, determination and regulation of the natural world climate. Despite the benefits from biodiversity, today's threats to species and ecosystems are increasing day by day with alarming rate and virtually all of them are caused by human mismanagement of biological resources often stimulated by imprudent economic policies, pollution and faulty institutions in-addition to climate change. To ensure intra and intergenerational equity, it is important to conserve biodiversity. Some of the existing measures of biodiversity conservation include; reforestation, zoological gardens, botanical gardens, national parks, biosphere reserves, germplasm banks and adoption of breeding techniques, tissue culture techniques, social forestry to minimize stress on the exploitation of forest resources.

Key words: Biodiversity, conservation, ecosystem services

Introduction

Biodiversity is a comprehensive umbrella term for the extent of nature's variety or variation within the natural system; both in number and frequency. It is often understood in terms of the wide variety of plants, animals and microorganisms, the genes they contain and the ecosystem they form. The biodiversity we see today is the result of billions of years of evolution, shaped by natural processes and, increasingly, by the influence of humans. It forms the web of life of which we are an integral part and upon which we so fully depend. So far, about 2.1 million species have been identified, mostly small creatures such as insects. Scientists believe that there are actually about 13 million species, though as per UNEP estimates there are 9.0 to 52 million species exist on earth (Mora *et al.*, 2011). Biodiversity

also includes genetic differences within each species - for example, between varieties of crops and breeds of livestock. Chromosomes, genes, and DNA-the building blocks of life-determine the uniqueness of each individual and each species. Yet another feature of biodiversity is the variety of ecosystems such as those that occur in deserts, forests, wetlands, mountains, lakes, rivers, and agricultural landscapes. In each ecosystem, living creatures including human form a community, interacting with one another and with the air, water, and soil around them. Biodiversity is thus considered at 3 major levels:

Genetic diversity: This is the variety of genetic information contained in all of the individual plants, animals and microorganisms occurring within populations of species. Simply it is the variation of genes within species and populations.

Species diversity: This is the variety of species or the living organisms. It is measured in terms of- *Species Richness* - This refers to the total count of species in a defined area. *Species Abundance* - This refers to the

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relative numbers among species. If all the species have the same equal abundance, this means that the variation is high hence high diversity, however if the one species is represented by 96 individuals, whilst the rest are represented by 1 species each, this is low diversity. In nature, not all species of a community are equally different. It is possible to classify species on the basis of their functions-

a) Functional types: Functional types are those species, which perform different ecological functions.

b) Functional analogues: Functional analogues represent distinct taxa performing the same or very similar ecological functions.

Ecosystem diversity: This relates to the variety of habitats, biotic communities and ecological processes in the biosphere.

Biodiversity is not distributed evenly on Earth. It is the richest in the tropics. Terrestrial biodiversity tends to be highest near the equator (Gaston, 2000), which seems to be the result of the warm climate and high primary productivity (Field et al., 2009). Marine biodiversity tends to be highest along coasts in the Western Pacific, where sea surface temperature is highest and in the mid-latitudinal band in all oceans. There are latitudinal gradient in species diversity (Tittensor et al., 2010). Biodiversity generally tends to cluster in hotspots (Myers et al., 2000), and has been increasing through time (McPeck et al., 2007) but will be likely to slow in the future (Robosky, 2009).

BENEFITS OF BIODIVERSITY

Utilitarian benefits

Biodiversity contribute to our material well-being. We obtained various productive materials from biodiversity e.g. agricultural materials or food, medicine, industrial raw materials etc.

- More than 60 wild species have been used to improve the world's 13 major crops by providing genes for pest resistance, improved yield, and enhanced nutrition (IUCN, 2012).
- Since agriculture began about 12,000 years ago, roughly 7,000 plant species have been used for human consumption. While most people depend mainly on domesticated species for their dietary needs, some 200 million depend on wild species for at least part of their food.

- Populations in South and East Asia are dependent on complex rice-fish agro-ecosystems, where fish and other aquatic animals serve as a source of nutrition to local communities, and provide essential services for rice productivity in the flooded fields.
- Fisheries alone account for at least 15% of animal protein directly consumed by humans. Fisheries indirectly support additional food production by providing inputs to the aqua-culture and livestock industries.
- Amphibians play a vital role in ecosystems, are indicators of environmental health, and are 'hopping pharmacies' being used in the search for new medicines. Yet 41% of amphibian species are threatened with extinction.
- In some countries, medicinal plants and animals provide most of the drugs people use, and even in technologically-advanced countries like the USA, half of the 100 most-prescribed drugs originate from wild species. According to world health Organization report nearly 80% of people live in Africa rely on traditional medicines as main source for their health care need.
- More than 70,000 different plant species are used in traditional and modern medicine. Microbes have given us nearly all of our antibiotics such as penicillin, as well as the cholesterol lowering strain. The chemical taxol, derived from the Pacific yew, has been found to kill cancer cells. ACE inhibitors, which are among the most effective medicines known for treating high blood pressure, are derived from the Pit Viper (*Bothrops jararaca*).

Ecosystem services

Ecosystem services are defined as the processes and conditions of natural systems that support human activity (Singh et al. 2006).

- Biodiversity plays an important role in the way ecosystem function and in the services they provide. Biodiversity plays a major role in mitigating climate change by contributing to long-term sequestration of carbon in a number of biomes. It is through biodiversity that sequential balance of CO₂ and O₂ is maintained. Due to the accumulation of CO₂ in the atmosphere and ozone layer depletion, the earth is becoming warmer and more prone to natural calamities. A square kilometre of coastal



ecosystem such as mangroves forests can store up to five times more carbon than the equivalent area of mature tropical forests. But these areas are being destroyed three to four times faster than forests, releasing substantial amounts of carbon dioxide into the atmosphere and the ocean, and contributing to climate change (IUCN: facts and figures on biodiversity, 2012).

- Regulation of biochemical cycles e.g. Oxygen, Nitrogen, hydrological cycles etc. Biological resources are important media in biochemical cycles, without which the cycles are not complete.
- Absorption and breakdown of pollutants and waste materials through decomposition, e.g. in food webs and food chains where the flow of energy goes through production consumption and decomposition without which breakdown and absorption of materials will not be complete. In an ecosystem there is no waste as decomposition will take place to purify our environment by transforming the waste to other forms of biodiversity.
- Determination and regulation of the natural world climate whether local, regional or micro level through influencing temperature, precipitation and air turbulence.
- Biodiversity underpins ecosystem resilience and plays a critical role as part of disaster risk reduction and peace-building strategies. Forests, wetlands and mangroves play a critical role in reducing the impacts of extreme events such as droughts, floods and tsunamis. The value of the ecosystem services provided by coral reefs ranges from more than US\$ 18 million per square kilometer per year for natural hazard management, up to US\$ 100 million for tourism, more than US\$ 5 million for genetic material and bio-prospecting and up to US\$ 331,800 for fisheries (CBD, 2014).
- Protective services of biodiversity provide protection of human beings from harmful weather conditions by acting as wind breaks, flood barriers among others.
- Production of at least one third of the world's food, including 87 of the 113 leading food crops, depends directly or indirectly on pollination carried out by insects (honey bee), bats and birds. This worldwide economic value of the pollinating service provided by insects is worth over US\$ 190 billion per year

for the main crops that feed the world (CBD, 2014). There have been worldwide declines in the diversity of pollinating insects that are essential for the reproduction of many plants.

- Wild species are important in pest regulation. Bats, toads, birds, snakes, and so on consume vast numbers of the major animal pests found on crops or in forests.
- A single colony of Mexican Free-tailed Bat eats more than 9,000 kg of insects per night, targeting especially Corn Earthworms and Fall Armyworms, both major crop predators. Yet 18% of bat species are threatened with extinction.
- A single brood of woodpeckers can eat 8,000-12,000 harmful insect pupae per day, helping to maintain the health of forests, whilst in fruit plantations, insectivorous birds can make the difference between a bumper crop or a costly failure.

Ethical and moral benefits

Every form of life on earth is unique and warrants respect regardless of its worth to human beings; this is the ecosystems right of an organism. Every organism has an inherent right to exist regardless of whether it is valuable to human beings or not. Humankind is part of nature and the natural world has a value for human heritage. The well being of all future generations is a social responsibility of the present generations, hence the existence of an organism warrants conservation of the organism.

Aesthetic value

Human beings derive great enjoyment from natural environment. The shapes, structure and colour stimulate our senses and enrich our culture. This illustrate majorly in the popularity of biodiversity conservation measures and the myriad of the many organizations which fight for the protection of different organisms. A lot of money is paid to conserve wildlife for their value in nature through so many organizations. Wild species enhance our appreciation and enjoyment of the environment through:

- Leisure activities e.g. bird watching and nature trailing;
- Spotting activities e.g. spot hunting, sport fishing, diving and mushroom picking;
- Hearing, touching or just seeing wildlife;
- Enjoyment as seen in art and culture e.g. dolls and teddy bears.



LOSS OF BIODIVERSITY

The loss of biodiversity and the related changes in the environment are now faster than ever before in human history and there is no sign of this process slowing down. Virtually all of Earth's ecosystems have been dramatically distorted and altered by human activities and continuously be converted for agricultural and other uses. Many animal and plant populations have declined in numbers and geographical spread. However, species extinction is a natural part of Earth's history but human activity has increased the extinction rate by at least 100 times compared to the natural rate. Loss of biodiversity is caused by a range of drivers. A driver is any natural or human-induced factor that directly or indirectly causes a change in an ecosystem. A direct driver unequivocally influences ecosystem processes. An indirect driver operates more diffusely by altering one or more direct drivers. Important direct drivers affecting biodiversity are habitat alteration, climate change, invasive species overexploitation and pollution.

Principal threats to biodiversity

A threat by definition refers to any process or event whether natural or human induced that is likely to cause adverse effects upon the status or sustainable use of any component of biological diversity. Biodiversity is declining rapidly due to factors such as habitat alteration and destruction by the land use change, over exploitation of biological resources, climate change, pollution and invasive species. Such natural or human-induced factors tend to interact and amplify each other.

Habitat alteration and destruction

Overall, the main factor directly driving biodiversity loss worldwide is habitat alteration and destruction. Habitat destruction renders entire habitats functionally unable to support the species present in the habitat. Biodiversity reduced in this process when existing organisms in the habitat are displaced or destroyed (Ayoade et al., 2009; Agarwal et al., 2011). Human destruction of habitats has accelerated greatly in the latter half of the twentieth century. Natural habitats are often destroyed through human activity for the purpose of harvesting natural resources for industry production and urbanization. Clearing forest areas for agriculture, changes in the riverine habitat to lacustrine (reservoir) habitat by the construction of hydroelectric projects on the rivers (Agarwal et al., 2014), mining, logging, urban sprawl, construction of highways are some examples of habitat destruction and fragmentation. A five-year estimate of global forest cover loss for the

years 2000–2005 was 3.1 percent. In the humid tropics where forest loss is primarily from timber extraction, 272,000 km² was lost out of a global total of 11,564,000 km² (or 2.4 percent). In the tropics, these losses also represent the extinction of species because of high levels of endemism. Increased greedy demand for resources has resulted into land use changes. Hence loss to genetic diversity, species reduction and increased ecosystem changes such as random population changes, disease outcrop, and habitat fragmentation among others has resulted into biodiversity losses.

Over-exploitation of biological resources

This results when individuals of a particular species are taken at a higher rate than can be sustained by the natural reproductive capacity of the population being harvested. This can be through hunting, fishing, trade, food gathering etc. Overexploitation remains a serious threat to many species, such as marine fish and invertebrates, trees, and animals hunted for meat. The grazing pressure on most of the high altitude grasslands of the Uttarakhand state both from migrant and local communities, is the extensive extraction of medicinal herbs in these areas resulting in their over exploitation (Rawat, 1998). Most industrial fisheries are either fully or overexploited, while destructive fishing techniques harm estuaries and wetlands. Although the true extent of exploitation is poorly known, it is clear that rates of off take are extremely high in tropical forests. The trade in wild plants and animals and their derivatives is poorly documented but is estimated at nearly \$160 billion annually. It ranges from live animals for the food and pet trade to ornamental plants and timber. Because the trade in wild animals and plants crosses national borders, the effort to regulate it requires international cooperation to safeguard certain species from overexploitation.

Pollution

Over the past five decades, inorganic and organic pollutants have emerged as one of the most important factor of biodiversity loss in terrestrial, aquatic- marine as well as freshwater ecosystems. Thermal pollution is another threat to biodiversity. The potential consequences of organic pollutants in a freshwater ecosystem include eutrophication of fresh-water body, hypoxia in coastal marine ecosystems, nitrous oxide emissions contributing to global climate change, and air pollution by NO in urban areas. Occurrence of such problems varies widely in different regions. Species in habitats are increasingly being harmed by industrial



activities and pollution from excessive use of agro-chemicals such as DDT, oil spills, acid precipitation etc. For example pesticide linked decline of fish eating birds and falcons. Lead poisoning is another major cause of mortality of many species such as ducks, swans and cranes as they ingest the spent shotgun pellet that fall into lakes and marshes.

The vulture was once very common in the Gangetic plains of India, and often seen nesting on the avenue trees within large cities in the region. Before the 1990s they were even seen as a nuisance, particularly to aircraft as they were often involved in bird strikes. The vulture has suffered a 99% population decrease in India (Prakash, 2007) and become rare due to poisoning by DDT used as pesticides and also by diclofenac which is used as veterinary non –steroidal anti- inflammatory drug, leaving traces in cattle carcasses which when fed by vultures leads to thinning of egg shells resulting into premature hatching and kidney failure in birds (Green et al., 2004; Muralidharan et al., 2008). Campaigns to ban the use of diclofenac in veterinary practice have been underway in several South Asian countries.

The dramatic decreases in house sparrow population in India is experienced in recent past. It is linked with pollution caused by electromagnetic radiation from mobile phones. Microwave towers (Balmori and Hallberg, 2007); the excessive use of pesticides, a gradual decrease in nesting sites caused by changes in urban building design. To promote the conservation of these birds, in 2012, the then Chief Minister of Delhi, Ms. Sheila Dikshit, declared the house sparrow as the state bird of Delhi.

Species invasions

This can be intentional or accidental. Species introduced in an ecosystem will cause changes in the ecosystem. Introduced species are organisms arising in areas/ habitats in which they were previously not native. Such introduced species are usually referred to as biological pollutants. Some of the ecological impacts of the invasion include hybridization, out competition, disruption of original ecosystem, plant pathogenic influences, disease transmission, disruption of food-webs, and to some situations extinction. Species may be introduced intentionally for ornamental concerns, agriculture, hunting and spotting activities, biotechnology for scientific research and for trade.

Climatic changes

This is of great concern especially when global CO₂ increases in the atmosphere resulting to global

warming. Most species originate within a very narrow physiological limit; hence nature has a range of tolerance maintained for ecosystem stability. Changes may be gradual or abrupt such that if the limit is exceeded the upper or lower, species suffers extinction. Recent changes in climate, such as warmer temperatures in certain regions, have already had significant impacts on biodiversity and ecosystem (Rawat and Semwal, 2014). They have affected species distributions, population sizes, and the timing of reproduction or migration events, as well as the frequency of pest and disease outbreaks. Projected changes in climate by 2050 could lead to the extinction of many species living in certain limited geographical regions. By the end of the century, climate change and its impacts may become the main direct driver of overall biodiversity loss. While the growing season in Europe has lengthened over the last 30 years, in some regions of Africa the combination of regional climate changes and human pressures have led to decreased cereal crop production since 1970. Changes in fish population have also been linked to large-scale climate variations such as "El Nino" have affected fisheries off the coasts of South America and Africa, and decadal oscillations in the Pacific have affected fisheries off the west coast of North America. As climate change will become more severe, the harmful impacts on ecosystem services will outweigh the benefits in most regions of the world. The Intergovernmental Panel on Climate Change (IPCC) project that the average surface temperature will raise by 2 to 6.4⁰C by 2100 compared to pre-industrial levels. This is expected to cause global negative impacts on biodiversity (Millennium Ecosystem Assessment, 2005).

Population

From 1950 to 2011, world population increased from 2.5 billion to 7 billion and is forecast to reach a plateau of more than 9 billion during the 21st century (Population Reference Bureau). As the human population is increasing, there exists insatiable demand for raw materials which is bound to cause changes in biodiversity. The human population has more impact on biodiversity than any other single factor. According to Dumont, (2012) until the middle of the 21st century, worldwide losses of pristine biodiversity will largely depend on the worldwide human birth rate. It is therefore vital to control human population which will result in biodiversity conservation.



Institutional / policy failure

Some institutions are created to manage biological resources. However, the institutions/policy fail to internalize the values of biodiversity within the decision making process of their Nations and individuals. Such institutions/policies in place should have a holistic approach towards biodiversity conservation rather than part conservation.

BIODIVERSITY CONSERVATION

Biodiversity conservation is about saving life on Earth in all its forms and keeping natural ecosystems functioning and healthy. This incorporates the preservation, maintenance, sustainable use, recovery and enhancement of the components of biological diversity. Where - *Conservation* - is the sustainable use of resources and encompasses protection as well as exploitation and, *Preservation* - is an aspect of conservation meaning to keep something without altering or changing it. Sustainable development is another intricate aspect of biodiversity conservation. This refers to development that meets the needs of the current generation without compromising the ability of future generations to meet their needs. It simply refers to intra and intergenerational equity. A balance between the environment, development and society results to sustainable development which ensures biodiversity conservation. This is only possible in the presence of proper enforcement and implementation policies/ conventions and environmental institutions.

Why Conserve Biodiversity?

Biodiversity is the life support system of our planet- we depend on it for the air we breathe, the food we eat, and the water we drink. Medicines originating from wild species, including penicillin, aspirin, taxol, and quinine, have saved millions of lives and alleviated tremendous sufferings. Wetlands filter pollutants from water, trees and plants reduce global warming by absorbing carbon. Bacteria and fungi break down organic material and fertilize the soil. It has been observed that native species richness is linked to the health of ecosystems, as is the quality of life for humans. The connections between biodiversity and our sustainable future appear closer and closer the more we look. We literally need to conserve biodiversity as our lives depend on it.

Conservation measures of biodiversity

Ex-situ conservation:

It refers to conservation of components of biodiversity outside their natural habitats, e.g. zoos, museums, gene banks, botanical gardens/arboretums, used for

threatened and endangered species to avoid their extinction, also known as captive conservation.

A lot of effort is under way to collect and preserve the genetic material of crops, animal, bird and fish species (Agarwal et al., 2009; Agarwal, 2011). This work is being done by institutions such as the National Bureau of Plant Genetic Resources, National Bureau of Fish Genetic Resources, the National Bureau of Animal Genetic Resources, etc. Conservation measures have also included reintroduction, captive-breeding programs and artificial feeding. Reintroduction of an animal or plant into the habitat from where it has become extinct is another form of ex situ conservation. For example, the Gangetic gharial has been reintroduced in the rivers of Uttar Pradesh, Madhya Pradesh and Rajasthan where it had become extinct. Seed banks, botanical, horticultural and recreational gardens are important centers for ex situ conservation. Ex-situ conservation measures complement to in-situ conservation.

In-situ conservation:

It refers to conservation of ecosystems and natural habitats including maintenance and recovery of viable populations of species in their natural habitats. Approximately, 4.2 % of the total geographical area in India has been earmarked for extensive in-situ conservation of habitats and ecosystems. A protected area network of 102 national parks, 18 biosphere reserves and 448 wildlife sanctuaries has been created. The results of this network have been significant in restoring viable population of large mammals such as tiger, lion, rhinoceros, crocodiles and elephants.

Community Participation in Biodiversity Conservation

It is being recognized that no legal provisions can be effective unless local communities are involved in planning, management and monitoring conservation programmes. There are several initiatives to do this, both by government as well as non-governmental organizations. For example, the Joint Forest Management philosophy stresses involvement of village communities in regenerating and protecting degraded forest land in the vicinity of villages. Successful conservation strategies will have to have the confidence and participation of the local communities (Dobhal et al., 2011).

International efforts for biodiversity conservation:

Conserving biodiversity is not an issue confined to any one country or community. It is a crucial global concern. Conservation of biological diversity and



sustainable use of its components came into the limelight in 1972 (United Nations Conference on Human Environment; Stockholm). In 1973, UNEP identified conservation of biodiversity as a priority area, hence there was need to get the legal mandate for conservation of world resources. There were negotiations for a legally binding instrument to address biological diversity and its loss to enhance fairness and equity in sharing of the benefits of biodiversity; this led to the opening of the Convention on Biological Diversity in 1992; (CBD, 2011). The convention was inspired by the growing concern all over the world for sustainable development. The convention objectives were:

- Conservation of the biological diversity
- Sustainable use of its components;
- A fair and equitable sharing of its benefits.

This was the first global comprehensive agreement that addressed all the aspects of biological diversity; genetic resources, species diversity and ecosystem diversity. Several international treaties and agreements are in place in the attempt to strengthen international participation and commitment towards conserving biodiversity. Some of these are:

- Rio-de-Janeiro under the United Nations Conference on Environment and Development (UNCED)/ Earth Summit
- African Convention on Conservation of nature and natural resources.
- The Ramsar Convention on Wetlands of international importance.
- International Union for the Conservation of nature (World Conservation Union).
- Convention on International trade for endangered species (CITES).
- International Convention for the Protection on birds.
- International Board for Plant genetic resources.
- World Resources Institute.
- World Wide Fund for Nature.
- Convention on Conservation of migratory species of wild animals.
- International Convention for the Regulation of whaling.
- UNESCO programme on Man and biosphere.

Indian efforts for biodiversity conservation

In India, protecting and promoting biodiversity has always been an integral part of culture and civilization. This can be seen in the thousands of sacred groves that are found all over the country. The Indian traditional systems of agriculture and medicine depend on plant and animal biodiversity. India is one of the early signatories to the UN Convention on Biological Diversity (CBD). Even prior to CBD, India has already been having legal provisions dealing with aspects relating to biodiversity.

Indian Forest Act 1927 and Forest (Conservation) Act 1980 deal with management of forests and conservation of forest land respectively. Wildlife (Protection) Act 1972 is for the protection of wild animals, birds and plants, and basically aims at protecting, propagating or developing wildlife or its environment through national parks, sanctuaries etc. Besides, the Act has a provision to prohibit picking and uprooting of specified plants.

Despite population pressure on land, India has more than 600 Protected Areas, covering approximately 5% of the total geographical area of the country, in a network of National Parks, Wildlife Sanctuaries, and Conservation Reserves. India has special programmes for some high-profile endangered species like tigers and elephants. In 2010, the country level status assessment for tigers showed an increase in their number to an estimated 1706 from an estimated 1411 in the year 2006. Subsequent to becoming a party to the CBD, India has taken the following steps towards maintenance of biodiversity.

- India has passed and notified the Biological Diversity Act, 2002. The act primarily addresses access to genetic resources and associated knowledge by foreign individuals, institutions or companies, to ensure equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people.
- As per the provision of the Biological Diversity Act 2002, a National Biodiversity Authority has been set up at Chennai on 1st October, 2003 to facilitate implementation of the Act. In compliance with the provisions of the Act, states have formed State Biodiversity Boards and at local level, Biodiversity Management Committees have been formed.
- India chaired the Group of Like Minded Mega diverse Countries (LMMCs) for a period of two years (March, 2004 to March, 2006). India played



an important role in the development of a common position of LMMCs for the negotiations for developing an international regime on access and benefit sharing.

- Subsequent to the approval of the National Environment Policy (NEP) by the Cabinet in 2006, National Biodiversity Action Plan (NBAP) was approved in November 2008 to augment natural resource base and its sustainable utilization.

In the recent past, India has taken the following steps in the direction of biodiversity conservation.

- India has recently ratified the Nagoya Protocol and formalized the commitment to it. The Nagoya Protocol on access and benefit sharing has been negotiated under the aegis of CBD, and adopted by the Tenth Conference of Parties (COP-10) held in Nagoya, Japan in October 2010. The Nagoya Protocol would contribute to fair and equitable sharing of benefits ensuing from utilization of genetic resources would act as incentive to biodiversity-rich countries and their local communities to conserve and sustainably use their biodiversity.
- India has, for the first time, hosted the 11th Conference of Parties (CoP-11) to the Convention on Biological Diversity. This is also the first such Conference since the launch of the United Nations Decade of Biodiversity in 2011.
- At the CoP-11, India has launched the Hyderabad Pledge and announced that our Government will earmark a sum of US\$ 50 million during India's presidency of the Conference of Parties to the Convention on Biological Diversity to strengthen the institutional mechanism for biodiversity conservation in India. India will use these funds to enhance the technical and human capabilities of our national and state-level mechanisms to attain the Convention on Biological Diversity objectives.
- India has also earmarked funds to promote similar capacity building in developing countries.
- In recent years there has been concern that this public knowledge may become restricted in its use because of the application of the modern intellectual property system. India has tried a unique approach to protection of traditional knowledge by establishing a Traditional Knowledge Digital Library. This database has 34 million pages of information in five international languages in

formats easily accessible by patent examiners. This Library promotes the objectives of the Nagoya Protocol on the issue of protection of codified traditional knowledge systems such as the celebrated Ayurveda. India decided to build this knowledge database because of the patent on the use of 'neem' extract in Europe and another on the use of 'turmeric' as a healing agent. Since then, because of this database, over 1000 cases of biopiracy have been identified and over 105 claims withdrawn or cancelled by patent offices.

- Many development schemes have been realigned to provide biodiversity-related benefits. This is vital to protect habitats, including our water bodies, which are beyond our protected areas. The Mahatma Gandhi National Rural Employment Guarantee Scheme, for example, aims to create legally mandated green jobs for every rural household in our country.

Suggested strategic goals for biodiversity conservation

- Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society.
- Reduce the direct pressures on biodiversity and promote sustainable use.
- Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity
- Enhance the benefits to all from biodiversity and ecosystem services.
- Enhance implementation through participatory planning, knowledge management and capacity building.

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