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Understanding the Concept of Biodiversity and Conservation of Biodiversity as a Strategy for Improving Quality of Life and Human Well-Being

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ABSTRACT: Biodiversity, besides its ecological significance provides a socio-economic and monetary asset to the nation. Human society depends on biological resources, their diversity and the ecosystems that sustain them to provide essential goods and services. It has been estimated that more than 50 million species of plants, animals and micro-organisms are existing in the world. Out of these, about 1.4 million species have been identified so far. Each species is adapted to live in specific environment, from mountain peaks to the depth of seas, from polar ice caps to tropical rain forests and deserts. All this diversity of life is confined to only about one kilometer thick layer of lithosphere hydrosphere and atmosphere which form biosphere. Though the study of environment and ecology is quite old, the term biodiversity has been introduced by Walter Rosen in 1986. Biological diversity or Biodiversity is defined as the variety and variability among the living organisms and the ecological complexes in which they occur. It refers to the variability's among species of plants, animals and microorganisms; ecosystems; ecosystem including terrestrial, aerial, marine and other aquatic system and ecological complexes of which they are part.

KEYWORDS: biodiversity, concept, conservation, strategy, quality of life, human well being

I. INTRODUCTION

In simpler terms, biodiversity is the assemblage of different life forms. It reflects the number of different organisms and their relative frequencies in an ecological system. It includes the organisation of organisms at many levels ranging from complete ecosystems to the chemical components that form the molecular basis of heredity. Thus, biodiversity is sum of all the genes, varieties, species, populations in different ecosystems and their relative abundance. Scientists are aware of the immense potentials of various life-forms existing on the earth. Our planet's requirements and services depend mainly on the biological resources. Biological resources not only provide us nourishment, clothing, housing, fuel and medicine but also meet our several other requirements. [1,2] Therefore the knowledge of biodiversity is of immense utility in planning sustainable livelihood and conserving the natural resources. Biodiversity, besides its ecological significance provides a socio-economic and monetary asset to the nation. Human society depends on biological resources, their diversity and the ecosystems that sustain them to provide essential goods and services.

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Values related to biodiversity can be grouped into three categories as below:

Productive use:

This is assigned to the products that are commercially harvested for exchange in formal markets and is, therefore, the only value of biological resources that is concerned in national income. Biodiversity provides us many products, such as fuel, timber, fish, fodder, skin, fruits, cereals and medicines. In 1994-95 the income from agriculture, forestry and fisheries in India was nearly 30 per cent or 736.88 billion rupees.

Consumptive use:

Consumption value is related to natural products that are consumed directly, i.e., the goods which do not come under normal circulation of trade. For example, a significant number of such non-timber forest products as soft broom grass and cane come under this category.

Indirect use:

Indirect use of biodiversity is of much significance because this value is related primarily with functions of ecosystem and is concerned with national accounting systems. They may provide us indirect benefits as non-consumptive values. Maintenance of ecological balance, conservation of natural resources and prevention of soil erosion may be considered as the examples of indirect use of biodiversity.[3,4]

Types of Biodiversity:

Biodiversity is of three types:

1. **Species diversity**-According to Biological Species Concepts (BSC), species is a basic unit of classification and is defined as a group of similar organisms that interbreed with one another and produce offspring's and share a common lineage. Species diversity refers to biodiversity at the most basic level and is the 'variety and abundance of different types of individuals of a species in a given area'. It includes all the species on Earth, ranging from plants such as bacteria, viruses, fungi, algae, bryophytes, pteridophytes, gymnosperms, angiosperms and all the species of animals including unicellular protozoans to mammals. Certain regions support a more diverse populations than others. Regions that are rich in nutrients and have well balanced climatic factors, such as moderate temperature, proper light and adequate rainfall, show high degree of diversity in their life forms. The tropical areas support more diverse plant and animal communities than the desert and polar areas, as for examples, tropical forest has a higher species diversity as compared to a timber plantation. The regions that are rich in species diversity are called hotspots of biodiversity.
2. **Genetic Diversity**-'Genetic diversity pertains to the range of diversity in the genetic resources of the organisms'. Every individual member of a plant or animal species differs from other individuals in its genetic constitution. Each individual has specific characters, which is due to the genetic makeup or code. The genes present in the organisms can form infinite number of combinations that causes genetic variability. Thus, we find that each human, who is representative of the same species, i.e. Homo sapiens, is distinct from another. Similarly, there are many varieties within the same species such as rice, wheat, apples, mangoes, etc.[5,6] that differ from one another in shape, size, colour of flowers and taste of fruits and seeds due to the variations at the genetic level. The term 'gene pool' has been used to indicate the genetic diversity in the different species. This also includes the diversity in the wild species, which through intermixing in nature over millions of years have given rise to newer varieties. The domesticated varieties of agricultural crops and animals have also evolved from the wild gene pool. The genetic variability is essential for healthy breeding population, the reduction in genetic variability among breeding individuals leads to inbreeding which in turns can lead to extinction of species. In the recent decades, a new science named 'biotechnology' has emerged. It manipulates the genetic materials of different species through various genetic re-combinations to evolve better varieties of crops and domestic animals.

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3. **Ecological/Ecosystem Diversity**-Each ecosystem consists of organisms from many different species, living together in a region connected by the flow of energy and nutrients. The Sun is the ultimate source of energy for all the ecosystems. The Sun's radiant energy is converted to chemical energy by plants. This energy flows through the different systems when animals eat the plants and then are eaten, in turn, by other animals. Fungi and bacteria derive energy from the decomposing dead organisms, releasing nutrients back into the soil as they do so. An ecosystem, therefore, is a collection of living components, like microbes, plants, animals, fungi, etc. and non-living components, like climate, matter and energy that are connected by energy flow. Ecological diversity refers to the 'variability among the species of plants and animals living together and connected by flow of energy and cycling of nutrients in different ecosystems or ecological complexes'. [7,8] It also includes variability within the same species and variability among the different species of plants, animals and microorganisms of an ecosystem. Thus, it pertains to the richness of flora, fauna and microorganisms with in an ecosystem or biotic community. The richness of the biosphere in terms of varied life forms is due to the variations in the ecosystems. The earth has a number of ecosystems like grasslands, forests, semi arid deserts, marine, freshwater, wetland, swamp, marshlands [9,10] etc. each one having its distinct floral, faunal and microbial assemblages. Ecological diversity represents an intricate network of different species present in local ecosystems and the dynamic interaction among them. The ecological diversity is of great significance that has developed and evolved over millions of years through interactions among the various species within an ecosystem.

II. DISCUSSION

Biodiversity refers to the variability of life on earth. Loss of biodiversity occurs when either the habitat essential for the survival of a species is destroyed, or particular species are destroyed. The former is more common as habitat destruction is a fallout of development. The latter reason is encountered when particular species are exploited for economical gain or hunted for sport or food. Extinction of species may also be due to environmental factors like ecological substitutions, biological factors and pathological causes which can be caused by nature or man. Natural causes include floods, earthquakes, landslides, natural competition between species, lack of pollination and diseases.

Man-made causes for the loss of biodiversity

- Destruction of habitat in the wake of developmental activities like housing, agriculture, construction of dams, reservoirs, roads, railway tracks, etc.
- Pollution, a gift of the industrial revolution can be given the pride of place for driving a variety of species in air, water and land towards extinction.
- Motorcars, air-conditioners and refrigerators, the three symbols of a modern, affluent society, have been instrumental in global warming and ozone depletion. They have drastically altered the climate with disastrous effects on the various species. Factories and power stations spewing out poisonous gases and effluents have fouled up the environment bringing death and disease to many species. Oil spills and discharge of sewage have ravaged the oceans and coastal habitats.
- A large number of species are threatened by overhunting, poaching and illegal trade.
- Indiscriminate use of toxic chemicals and pesticides and overexploitation of wildlife resources for commercial purposes are responsible for the rapid decline in the number of some species. The tiger for instance is hunted for its claws and other parts believed to be effective cures for various ailments of man. Snakes and crocodiles are killed in large numbers for their skin and minks, sable, ermine, etc., are in demand for the luxury and warmth of their fur.

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- Genetic erosion arises from the loss (due to commercial and anthropogenic pressures) of habitats rich in biodiversity and from the disappearance of the traditional conservation practices of wild species in their habitats by rural and tribal people[11,12]

It can be conserved in the following ways:

- In-situ Conservation
- Ex-situ Conservation

In-situ Conservation

In-situ conservation of biodiversity is the conservation of species within their natural habitat. In this method, the natural ecosystem is maintained and protected.

The in-situ conservation has several advantages. Following are the important advantages of in-situ conservation:

1. It is a cost-effective and convenient method of conserving biodiversity.
2. A large number of living organisms can be conserved simultaneously.
3. Since the organisms are in a natural ecosystem, they can evolve better and can easily adjust to different environmental conditions.

Certain protected areas where in-situ conservation takes place include national parks, wildlife sanctuaries and biosphere reserves.[13,14]

National Parks

These are small reserves maintained by the government. Its boundaries are well demarcated and human activities such as grazing, forestry, habitat and cultivation are prohibited. For eg., Kanha National Park, and Bandipur National Park.

Wildlife Sanctuaries

These are the regions where only wild animals are found. Human activities such as timber harvesting, cultivation, collection of woods and other forest products are allowed here as long as they do not interfere with the conservation project. Also, tourists visit these places for recreation.

Biosphere Reserves

Biosphere reserves are multi-purpose protected areas where the wildlife, traditional lifestyle of the inhabitants and domesticated plants and animals are protected. Tourist and research activities are permitted here.

Ex-situ Conservation

Ex-situ conservation of biodiversity involves the breeding and maintenance of endangered species in artificial ecosystems such as zoos, nurseries, botanical gardens, gene banks, etc. There is less competition for food, water and space among the organisms.

Ex-situ conservation has the following advantages:

1. The animals are provided with a longer time and breeding activity.

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2. The species bred in captivity can be reintroduced in the wild.
3. Genetic techniques can be used for the preservation of endangered species.[15,16]

Strategies for Biodiversity Conservation

Following are the important strategies for biodiversity conservation:

1. All the varieties of food, timber plants, livestock, microbes and agricultural animals should be conserved.
2. All the economically important organisms should be identified and conserved.
3. Unique ecosystems should be preserved first.
4. The resources should be utilized efficiently.
5. Poaching and hunting of wild animals should be prevented.
6. The reserves and protected areas should be developed carefully.
7. The levels of pollutants should be reduced in the environment.
8. Deforestation should be strictly prohibited.
9. Environmental laws should be followed strictly.
10. The useful and endangered species of plants and animals should be conserved in their nature as well as artificial habitats.
11. Public awareness should be created regarding biodiversity conservation and its importance.

Conserve Biodiversity

It is believed that an area with higher species abundance has a more stable environment compared to an area with lower species abundance. We can further claim the necessity of biodiversity by considering our degree of dependency on the environment. We depend directly on various species of plants for our various needs. Similarly, we depend on various species of animals and microbes for different reasons.[17,18]Biodiversity is being lost due to the loss of habitat, over-exploitation of resources, climatic changes, pollution, invasive exotic species, diseases, hunting, etc. Since it provides us with several economic and ethical benefits and adds aesthetic value, it is very important to conserve biodiversity. Conservation of biological diversity leads to conservation of essential ecological diversity to preserve the continuity of food chains.The genetic diversity of plants and animals is preserved.It ensures the sustainable utilisation of life support systems on earth.It provides a vast knowledge of potential use to the scientific community.A reservoir of wild animals and plants is preserved, thus enabling them to be introduced, if need be, in the surrounding areas.Biological diversity provides immediate benefits to the society such as recreation and tourism.Biodiversity conservation serves as an insurance policy for the future.

Agrobiodiversity conservation

After the introduction of cotton, tobacco, sugarcane, sunflower, soyabean and so on, farmers became victims of monocultures in their greed for money. Therefore many of the indigenous varieties of crops were lost. Moreover, the hybrid varieties of fruits and vegetables (e.g. tomatoes), introduced for pulp are more susceptible to disease and pests. Though hybrid varieties are preferred, traditional wild varieties of the seeds should be conserved for future use in the event of an epidemic which would completely wipe out the hybrids.

Botanical gardens, agricultural departments, seed banks etc., alone should not be given the responsibility of agrobiodiversity conservation. Every farmer, gardener and cultivator should be aware of his role in preserving and conserving agrobiodiversity.[19,20]

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III. RESULTS

Convention of Biological Diversity

The aim of the convention is to save species and plants from extinction and their habitats from destruction. The developed countries are looking for a sustainable supply of biological resources from the developing countries and easy access to them as well. The developing countries lacking the technology to exploit their resources are inviting the developed countries to do so. This has resulted in the developed nations channeling out the benefits of these natural resources. The developing countries are now demanding a higher share of the accrued economic benefits. The developed nations are also concerned by the unsustainable exploitation of natural wealth, particularly rainforests. The aim of the Convention on Biological Diversity is 'the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. [21,22]The convention stipulates that Parties must :

- develop national strategies for the conservation and sustainable use of biological resources;
- establish protected areas, restore degraded ecosystems, control alien species, and establish ex-situ conservation facilities;
- establish training and research programmes for the conservation and sustainable use of biodiversity and support such programmes in developing countries;
- promote public education and awareness of the conservation and sustainable use of biodiversity;
- recognize the right of governments to regulate access to their own genetic resources, and, wherever possible, grant other Parties access to genetic resources for environmentally sound uses;
- encourage technology and biotechnology transfer particularly to developing countries;
- establish an information exchange between the parties on all subjects relevant to biodiversity;
- promote technical and scientific cooperation between parties (particularly to developing countries) to enable them to implement the convention;
- ensure that countries that provide genetic resources have access to the benefits arising from them; and
- provide financial resources to developing countries/parties to enable them to carry out the requirements of the convention.

Projects to save threatened species

Project Tiger

Project Tiger was initiated as a Central Sector Scheme in 1973 with 9 tiger reserves located in different habitat types in 9 different states. There are totally 18 Reserves in 13 states. At present tiger Conservation has been viewed in India not only as an effort to save an endangered species but, with equal importance, also as a means of preserving biotypes of sizeable magnitude.

Crocodile Breeding Project

The project was started in Orissa and then extended to several other states in April 1975 with UNDP assistance. The main objective was to protect the three endangered species of crocodiles namely - *Gavialis gangeticus*, *Crocodylus palustris* and the salt water crocodile, *Crocodylus porosus*.

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Lesser Cats Project

The project was launched in 1976 with the assistance of WWF in India for conservation of four species of lesser cats e.g. *Felis bengalensis* Kerr, *Felis marmota* Martin, *Felis lemnur* Vigors Horsfield and *Felis viverrina* Bennet, found in Sikkim and Northern part of West Bengal.

The Manipur Brow-antlered Deer Project

This was launched in 1981 in Manipur to save the brow-antlered deer (*Cervus eldi eldi*) which is on the verge of extinction. The habitat includes 35 sq.km. of park and sanctuary. The population of the deer has increased from 18 to 27.

Project Elephant

It was launched in 1991 to protect the Asiatic elephant which is also a highly endangered species because of large scale poaching.

Project Rhino

It was launched in 1987 in Kaziranga Wildlife Sanctuary in Assam to save the lesser one horned rhinoceros from extinction. It covers an area of 430 sq.km. and is the natural of the dwindling rhino.

Himalayan musk deer project

This was launched in 1981 to save the endangered musk deer which is facing extinction. Captive breeding has yielded good results.

Project Hangul

This project was launched in 1970 in Kashmir valley to save the highly endangered Kashmir stag (*Cervus elaphus hanglu*) which is facing extinction. As a result their population has increased[23]

IV. CONCLUSIONS

Biodiversity is essential for human health and well-being, economic prosperity, food safety and security, and other areas critical to all humans and all human societies. Organisms, ecosystems and ecological processes supply us with oxygen and clean water, they help cycle carbon and fix nutrients, they enable plants to grow, they keep pests and diseases in check, and they help protect against flooding and to regulate the climate. No one is immune to the adverse impacts of biodiversity loss and degraded ecosystems. Children, in particular, are affected because their bodies are still developing and their behaviour – like playing on the ground or eating dirt – can expose them to more harmful chemicals and organisms. Biodiversity is essential for healthy child nutrition and provides plant, animal and microbial genetic resources necessary for food production and diversified, balanced diets. Biodiversity provides vital ecosystem functions such as soil fertilization, nutrient recycling, pest and disease regulation, erosion control and crop and tree pollination. [19,20] Biodiversity supports ecosystems to provide and purify water. Every two minutes a child dies from a water-borne disease. But through the continuous recycling of water, biodiversity maintains ecosystem services needed to sustain drinking water supplies. Ecosystems also play a significant role in purifying water. Biodiversity is essential

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to increase the resilience of communities and reduce their vulnerability in the face of shocks such as climate change and natural disasters. Biodiversity loss destabilizes ecosystems that can regulate the climate and mitigation of floods. This leads to weakening of community resilience, and their ability to adapt and protect the health and safety of their children. Biodiversity loss can increase the incidence and distribution of certain infectious diseases which are lethal for children. Diseases that spread from animals to humans are a serious threat: studies show that 75 per cent of all emerging diseases come from wildlife. Biodiversity is an important and irreplaceable source for medicines and advances in understanding disease, thereby supporting child health. Plants, fungi, microbes and animals are the sources of unique and innovative molecules that form the basis for new medicines. Biodiversity also provides models with which to study health and disease, contributing to improvements in treatment and survival rates. Experiencing biodiversity positively influences physical and mental health and well-being. Increasingly, research on childhood exposure to nature suggests that early positive experiences may contribute to higher achievement in school, better physical fitness and lower rates of obesity, as well as reduced stress and greater self-confidence.[20,21]

We should conserve biodiversity

Understanding and awareness

Helping people to understand what biodiversity loss means for them, and particularly for the health of their children, can be a very effective incentive for the positive behavioural change required to ensure more sustainable lifestyles and choices in energy, food and water consumption, which will in turn ease threats to biodiversity.

Tools and research on links to human health

In order to provide more evidence on the links with biodiversity and health we should develop tools and methodologies to support the intersection of biodiversity and human health; study more closely environmentally-sensitive diseases in order to support more effective preventive public health strategies; and develop qualitative and quantitative research to explore the root causes of disease emergence and address how anthropogenic drivers of changes in biodiversity affect the transmission of human disease.[22]

Restoring ecosystems while building back better

Habitat protection and restoration are highly beneficial public goods for which government investment is more than justified. According to the OECD, restoring 46 per cent of the world's degraded forests could provide up to US\$30 in benefits for every dollar spent, boosting local employment and increasing community awareness of biodiversity's importance.

Green new deals or stimulus packages provide an opportunity to acknowledge the close connections between people, nature and climate, and translate it into action to reduce nature-related risks. This would lead to increasing protected areas of the planet, restoration of natural habitats, closure of illegal wildlife markets, changing consumption patterns to reduce the strain on nature, and setting targets to halve the impact of everything that the world produces and consumes. In turn, this would help to directly reduce greenhouse gas emissions and increase conservation of carbon sinks which also addresses climate change.[23]

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