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BIODIVERSITY

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ABSTRACT

Biodiversity refers to the variety of different forms of life on Earth, including crops, animals, microorganisms, the genes they contain, and the ecosystems they form. Biodiversity is important in many ways, including enhancing the aesthetic importance of the natural surroundings and making a contribution to our material well-being through utilitarian values such as nutrition, fodder, and gasoline.

Despite the benefits, today's threats to species and ecosystems are increasing at an alarming rate, owing largely to human resource mismanagement. As a result, some biodiversity conservation measures, such as reforestation and zoological gardens, have been implemented.

Biodiversity is the variation in life in this planet. Present paper describes various dimensions of biological diversity including patterns of biodiversity, types of diversity, its importance for the survival of humanity, losses and the measures for conservation.

DEFINING THE TERM "BIODIVERSITY"

The simplest definition of the term biodiversity is "all the variations of the life on the Earth is biodiversity or it is the diversity of all life forms and levels of organizations, which would include ecological structures, functions, and the processes that occur at these levels.

In other words, the occurrence of various types of ecosystems, distinct species of life forms, and their variants such as biotypes, ecotypes, and genes adapted to different climate and

surroundings of different regions, is referred to as biodiversity or biological diversity.[1] As per Edward Wilson the term. Biodiversity refers to the vast cluster of species of microorganisms, algae, fungi, flora, and fauna found on the planet, either in land-based or aquatic habitats, as well as the ecological complexes of which they are a part. The diversity ranges from the terrestrial biomes and various aquatic ecosystems.

HISTORICAL BACKGROUND

Looking back in time, researchers have all at the same time reserved the natural environment, tried to discover a natural order in that globe or implement rational order on the planet, and wanted to know humans' place in the cosmos relying on what they read in the natural world.[2]

Biodiversity is critical for keeping the ecological balance of the ecosystem because each species in a specific region performs a crucial role in the environment. Biodiversity is a significant source of energy and raw materials such as crude oil, lubricants, air fresheners, colouring agents, paper, waxes, jute, and so on.

Each species also contributes to our understanding of how species evolved on the planet. Loss of diversity refers to the extinction of specific species in diversity, which could be permanent or temporary. The natural environment plays a critical role in sustaining ecological equilibrium. Every year, thousands of trees are chopped down to make way for industry sectors, roadways, and settlements, among other things, in order to meet human needs.[3] The species becomes the predicate's focus & ultimately dies. The killing of wild animals for the commercial production of their products has always been a major cause of environmental degradation.

Biodiversity underpins the functioning of ecosystems on which we rely for crucial supporting and regulating services (food, liquid, gasoline, fibers, etc.).

The exploitation of medicinal herbs for a variety of uses has led to the extinction of these life-forms. Several life forms are also hecatomb for scientific and medical research.

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[1] myCBSEguide. (2019, March 1). Biodiversity and conservation class 12 notes biology. myCBSEguide. Retrieved February 27, 2022, from https://mycbseguide.com/blog/biodiversity-conservation-class-12-notes-biology/

[2]David Takacs, Historical Awareness of Biodiversity, Editor(s): Simon Asher Levin, EncyclopediaofBiodiversity,Elsevier,2001,Pages363-369,ISBN 9780122268656 , https://doi.org/10.1016/B0-12-226865-2/00149-

[3] Admin. (2021). Biodiversity- types of biodiversity, importance and causes of loss of biodiversity. read more on biodiversity for UPSC exam. BYJUS. Retrieved February 27, 2022, from https://byjus.com/free-ias-prep/ncert-notes-biodiversity/

Hurricanes, tsunamis, and waves, contribute to biodiversity loss. Air pollution contributes significantly to biodiversity loss. Rapid deforestation has led to an increase in carbon dioxide in the atmosphere, affecting the climate.
The direct consequence of this is that there has been an increase in atmospheric and oceanic temperature, which has had a negative impact on life-forms. The most beautiful aspect of biodiversity is its adaptability.

Scientists were dissatisfied that there actions to protect biodiversity were failing to keep up with the ferocious rate of destruction. Walter G. Rosen, a biologist, and senior programme officer at the National Research Council [USA], assembled scientists from the National Academy of Sciences [NAS] in 1986.

Rosen proposed the word "bio-diversity- diversity" for the event as a suitable abbreviation, a buzzword which would simultaneously encapsulate biologists' understanding of a chaotic, weakening natural world and increase awareness about the challenges to the natural environment.[4] Since then "Biodiversity" has become a popular conservation buzzword as biologists promote the term and the complex world view it represents.

LEVELS OF BIODIVERSITY

The majority of people think of 'biodiversity' as the variety of species inside a system [i.e. species richness]; scientists and researchers usually mean 'biodiversity' in this sense.[5]

Technically, it is a lot more. It is frequently described as having three levels of diversity: genetic, species, and ecosystem.

- Genetic biodiversity refers to the genetic differences that exists among individuals of any particular species of flora and fauna.
- Species biodiversity refers to the total of species found in a given area or ecosystem.
- Ecosystem diversity consists of a large number of distinct ecosystems with different organisms.

[4] David Takacs, Historical Awareness of Biodiversity, Editor(s): Simon A Levin, Encyclopedia of Biodiversity (Second Edition),Academic Press,2013,Pages 121-126,ISBN 9780123847201,https://doi.org/10.1016/B978-0- 12-384719-5.00071-X.(https://www.sciencedirect.com/science/article/pii/B978012384719500071X)

[5] Simberloff, D. (1999). The role of science in the preservation of forest biodiversity. Forest Ecology and Management. Retrieved February 27, 2022, from <https://www.sciencedirect.com/science/article/abs/pii/S0378112798003910?via%3Dihub>

1. Genetic Diversity

Genetic diversity of a species is related to the genetic differences that exists within the species. A specie is a group of individuals who share common physical characteristics. Species are the basic unit of biological classification and, as such, the standard unit of biological diversification measurement. Genes are the fundamental building blocks of all living things.

2. Species Diversity

Species diversity refers to the variability found within a single species.

It is basically the count of species available in a certain habitat. For example, amphibians are more in number in Western Ghats in comparison to those in the Eastern Ghats. Or number of plant species in the Eastern Himalayas is greater than the Western Himalayas.

The abundance, kinds and richness of species can all be used to determine their diversity. Hotspots of diversity are places with a high density of species that is endemic to that area and are on the verge of extinction. Four out of the thirty-six hotspots in the world are in India itself.

Species richness is the count of variety of species available in a particular location. Although the global sum is estimated to be somewhere around 30 million species, as of now nearly 1.7 million of these have been named scientifically.

Coral reefs and rainforests are the habitats to a diverse range of species.

Example, In tropical north and South America there are approximately eighty five thousand flowering plant species , and the tropical and sub-tropical Asia have over fifty thousand specie of plant species and the tropical and subtropical Africa have nearly thirty five thousand .In comparison , there are 11,300 vascular plants in Europe as a whole.

3. Ecosystem Diversity

Ecosystem diversity refers to variability of species at ecosystem level.

What basically is an Ecosystem?

As we know biological community of interacting organisms and their biological and physical environment is referred to as an ecosystem.

SCALES OF DIVERSITY

Whittaker was the first to tell that species diversity can be measured in several ways and at various scales. Species diversity is generally perceived at three scales.[6]

1. Alpha Diversity
2. Beta Diversity
3. Gamma Diversity

What is Alpha Diversity?

Alpha diversity is a measure of the diversity of species in a given location or ecosphere. The variety of species existing in the area of concern is expressed as alpha diversity. It is also known as the diversity within the community or ecosystem. As a result, alpha diversity contributes to species richness in that ecosystem. When compared to beta and gamma diversity, it is a small-scale measure. When compared to species diversity within different ecosystems, species richness is a valuable measure. A transect drawn within the ecosystem or several random quadrats or requisite size can be used to measure species richness. The species seen are counted, and the total number of species present is recorded.

What is Beta Diversity?

The term "beta diversity" indicates a change in species diversity between ecosystems. As a result, beta diversity enables the comparative evaluation of biodiversity across ecosystems. The number of species that are distinct to each system is recorded to estimate the beta diversity.

When there is little interaction among adjacent communities, beta diversity increases. Human land use change is one of the primary factors causing environment fragmentation and preventing species movement between two ecosystems. The free movement of species between communities can be used to control beta diversity.

What is Gamma Diversity?

Gamma diversity is a measure of overall biodiversity of a large geographic region. As a result, it assesses the total diversity of each ecosystem in that area. Cumulative diversity is determined by two factors: mean species diversity in an ecosystem and species diversity differentiation among habitats. Gamma diversity is a type of species diversity at a geographic

[6] Samanthi. (2021). What is the difference between alpha beta and gamma diversity. Compare the Difference Between Similar Terms. Retrieved February 27, 2022, from https://www.differencebetween.com/what-is-the-difference-between-alpha-beta-and-gamma-diversity/

spectrum.

Gamma diversity is a very large scale measure when compared to alpha and beta diversity. Today, we can see a worldwide decline in gamma diversity. One of the primary causes of decreased gamma diversity is the loss of habitat extinction of species in various parts of the globe mainly due to anthropogenic activities.

In summary, Alpha diversity attempts to measure the diversity of species within an ecosystem, whereas beta diversity measures the difference in species diversity between two communities or ecosystems. Gamma diversity, on the other hand, assesses the overall biodiversity of a large geographic region. This is the primary distinction between alpha beta and gamma diversity.

CONCERNS ABOUT BIODIVERSITY PRESERVATION

Maintaining biodiversity means safeguarding our opportunity to discover and develop better medicine, foods, and manufactured goods. It also includes ensuring the stability of our ecosystems and, as a result, the long-term viability of the facilities they provide to our health and well-being.[7] As a result, many nations have made measures to protect their plants and animals while also maintaining the stability of the biosphere.

A large number of scientists throughout the world are working to figure out what causes species extinction, while others are finding, explaining, and retaining new species.

Biodiversity – the diverse range of living things that support and sustain life on Earth – is under threat. One million species are now on the verge of extinction, and species are disappearing at a rate that hasn't been seen in years.

Ecological functions are critical for human survival and well-being. The more diverse an ecosystem, the more likely a species is to survive in the face of adversity and attack, and thus the more productive it is, in general. A high biodiversity-ecosystem, similar to a species with high genetic diversity, may have a better chance of adapting to changes in the environment. In other words, the higher the diversity of species in an area, the more stable it is.

The current level of biodiversity is the result of 2.5-3.5 billion years of evolution. Our planet had more biodiversity before humans than at any other time in history.[8]

[7] Admin.[2019] Gist of XI Class Geography NCERT (Fundamentals of Physical Geography) Web Notes @ abhipedia Powered by ABHIMANU IAS. (n.d.). Retrieved February 27, 2022, from https://abhipedia.abhimanu.com/Article/IAS/MTA2NjQ3/Gist-of-XI-Class-Geography-NCERT--Fundamentals- of-Physical-Geography--Geography-IAS

[8] Admin. (2020). Processes and different types of biodiversity pattern in species. BYJUS. Retrieved February 27, 2022, from https://byjus.com/biology/biodiversity-pattern-species/

However, ever since the appearance of living beings, biodiversity has begun to decrease rapidly, with one species after another facing extinction as a result of overuse.

Biodiversity is a valuable resource that all humans rely on in their everyday lives. Crop diversity, or agro-biodiversity, is an essential element of biodiversity. Biodiversity is regarded as a reservoir of resources from which fruit and veg, medicinal, and beauty products can be obtained.[9]

Human population growth has increased the rate of consumption of natural resources over the last few decades. It has speeded up the extinction of species and the loss of habitat world-wide.

Tropical areas, which protect only around one-fourth of the earth's natural landmass, are roughly three-fourths of the world's population. In order to meet the requirements of a large population, resource over-exploitation and forest degradation have become common. Since these tropical rain forests are habitat to nearly 50 percent of all species on the planet, the degradation of habitats has had far-reaching consequences for the entire biosphere.

Natural disasters such as earthquakes, tsunami , earth -quakes, forest fires, droughts, and so on harm the earth's flora and fauna, causing changes in the biodiversity of the affected areas.

In 1992, 155 countries, including India, signed the Convention on Biological Diversity in Rio de Janeiro, Brazil.

In 1972, the Indian government passed the Wild Life (Protection) Act, which allows the central and state governments to declare any area a wildlife sanctuary, national park, or closed area.

Biodiversity refers to the variation among different species of plants, animals and microorganisms present on the earth. Three-quarters of the terrestrial environment and nearly 66% of the world's oceans have been significantly changed. Crop or Livestock production now occupies more than 1/3 of the world's landmass and nearly a 75percent of freshwater resources. Climate change exacerbates the negative effects of other stressors on hence

[9] U.S, Rawat & Agarwal, N.. (2015). Biodiversity: Concept, Threats and Conservation. Environment Conservation Journal. 16. 19-28. 10.36953/ECJ.2015.16303

our surroundings and our well-being. Humans have overexploited the oceans, deforested forests, contaminated our water supplies, and exacerbated the climate crisis. These actions are having an effect on biodiversity all over the planet, from the most remote locations to our own backyards.

BIODIVERSITY BENEFITS

Biodiversity is critical to the functioning of ecosystems and the service provided by it. Some of such services offered by biodiversity are:

Clean water on which the very survival of humanity depends, Food, timber, and genetic resources and pollination of our crops.

ECOLOGICAL DIVERSIFICATION

The complex network of different species present in an ecological system and their interaction is considered as ecosystem diversity. An ecological system is formed when individuals from different species that share specific habitat are connected through the need of nutrients, energy and also water. The interactions take place when organisms of various distinguished species interact with each other.

Sun is the greatest energy source in every kind of ecological system. Energy is circulated across the system when fauna eats plants and they are eaten by other fauna specie. As a result, the combination of both living organisms and non- living things forms an ecosystem. Example - Fungi is able to get the energy from decomposing organisms which releases the essential nutrients into the soil.

BIODIVERSITY PATTERN

Biodiversity is not uniformly distributed over the world. Two variables that have an impact on biodiversity are:

a. Latitudinal gradient

b. Relationship between species and area

From the perspective of both species and individual organisms, biodiversity is not equally spread across the globe. As we move towards the tropics, biodiversity constantly gets richer. As we move closer to the poles, we notice higher number of fewer species.
Ecologists and evolutionary biologists have presented numerous hypotheses for higher diversity in the tropics, which includes:

1. Promoting niche variety results to the increase in species diversification. This is seen in the case of tropical environments as they are less seasonal.
2. In the past, temperate regions experienced frequent glaciations.

It wiped off most of the species. However, millions of years, tropical latitudes have remained virtually unaltered.

PATTERNS OF BIODIVERSITY [8]

Latitudinal Gradients

The diversity of species reduces towards the poles. There are more species in the tropics than in the temperate and polar regions. This is because of the following factors:

- The tropical regions have remained undisturbed for several years. This resulted in the diversification of species in the tropics.
- The environment in the tropics is more predictable and constant. This is yet another reason for increased species diversity.
- The solar energy adds to higher productivity and helps in increasing biodiversity in the tropics.

Species-Area Relationship

This relationship was given by Alexander Von Humboldt.
A rectangular hyperbola represents the relationship between species richness and area for a variety of taxa. The relationship is a straight line on a logarithmic scale, as described by the equation.
$\log S = \log C + Z \log A$
Where,

S= Richness of a species

A=location

Z = slope [value of z ranges in between 0.1 to 0.2]

C = Y-intercept

IMPORTANCE OF BIODIVERSITY

Biodiversity has immensely contributed towards the betterment of the society as a whole and also towards the upgradation of human culture and in return humans have a crucial role in moulding and the diversification of nature at various different levels:[1]

Following huge roles are played by biodiversity:

a. Ecological;

b. Economic; and

c. Scientific

Feasible utilization of biodiversity and ecosystem services entails much more than conserving particular species or habitats that portray ecosystems, however, these decisions are crucial. Environmental conservation and restoration are essential to the protection and long-term use of biodiversity and must be integrated through all aspects of the economy. Using provisioning services, as an example, we can clearly recognize the significance of biodiversity when we consider the role of therapeutic products directly extracted from shrubs or obtained from natural materials in medical science.

BIODIVERSITY IN INDIA

- In the globe there are twelve mega biodiversity countries. One of which is India.
- After having around 8.1 percent of the global species India only has 2.4 percent of the land area in the planet.
- There are many species which are yet to be named and to be discovered

BIODIVERSITY PRESERVATION

Each and every form of life is inextricably linked, so an imbalance in one causes disturbance in the others too because of the life cycle, as all life forms are inter-related.[2] Biodiversity is

[1] NCERT. (2018). BIODIVERSITY AND CONSERVATION. In Fundamentals of physical geography: Textbook for class xi. essay, National Council of Educational Research and Training.

[2] Cardinale, Bradley & Duffy, J. & Gonzalez, Andrew & Hooper, David & Perrings, Charles & Venail, Patrick & Narwani, Anita & Tilman, David & Wardle, David & Kinzig, Ann & Daily, Gretchen & Loreau, Michel & Grace, James & Larigauderie, Anne & Srivastava, Diane & Naeem, Shahid. (2012). Biodiversity loss and its

critical to human survival. All forms of life are so inextricably linked that a disturbance in one causes an imbalance in the others. When plant and animal species become endangered, they degrade the environment, potentially jeopardising human survival.

When plant and animal species become endangered, they degrade the environment, potentially endangering human survival. It is very crucial to guide people about practises which are environment friendly and reorient their day-in day-out jobs so that our evolution is both harmonious and sustainable with other life forms.

There is an increasing awareness about the goals [environmental goal]. People are being told that the goals would only be met if we actively participate and encourage others to make move towards the betterment of our environment.

The aggregate half-life of a species is approximated to be somewhere between ten to forty lakh years, and ninety-nine per cent of the species which have ever survived on the planet are as of now extinct.

The distribution of Biodiversity on the planet is seen to be uneven. It consistently gets richer in the tropics. As one approaches the poles, one notices that larger population of fewer species is available. The diversity in genes in a species is called genetic biodiversity.

Humans are genetically related to the homosapiens group but are significantly different in terms of their features. Due to genetic diversity, this is the case. This genetic diversity is essential for a healthy breeding of population of species.
Genetic diversity has made a significant contribution in the evolution of human culture. In a similar way human species have also contributed in maintaining natural diversity at genetic, species and ecosystem level.

Different species of ecosystem are busy in one activity or the other. Without activities they can neither survive nor develop.

The ecosystem evolves and sustains itself for no apparent reason. That is, in addition to extracting its own needs, each organism provides something helpful to other creatures.

impact on humanity. Nature. 486. 59-67. 10.1038/nature11148.

Biodiversity is an important resource for all humans in their daily lives. Crop diversity, also known as agro-biodiversity, is an important component of biodiversity. Biodiversity is viewed as a resource reservoir from which food, pharmaceutical, and cosmetic products can be derived.

Biodiversity – the various variety of residing species that help and preserve existence on Earth – is under threat. One million species at the moment are on the verge of extinction.

Each species additionally presents proof approximately how existence advanced on earth. Loss variety refers back to the lack of positive species in a variety that ends in extinction which may be everlasting or temporary. The principal position in keeping ecological stability is performed via means of the herbal habitat. Several bushes are reduced every 12 months for the development of industries, highways, settlements, and so forth to meet human demands.

The species end up with the goal of predicating and in the end dies. Hunting wild animals for the commercialization of their merchandise has been a chief purpose for the lack of biodiversity.

THE IMPORTANCE OF BIODIVERSITY

The living world provides many direct and indirect benefits to humans. Food, medicines, pharmaceutical drugs, fibres, rubber, and timber are all derived from biodiversity. The biological resources may also contain potentially useful resources. The diversity of organisms also provides many free ecological services that are essential to the health of the ecosystem. The significance of biodiversity is summarised below: -

1. Biodiversity's Ecological Value
2. Biodiversity's medicinal value
3. Biodiversity's Existence Value
4. Biodiversity's economic value

Biodiversity's Advantages

Administratively completely manage the environment, floods, sickness, water quality, and fertilization. Sportive, tasteful, and profound advantages are given by social administrations. Soil development and supplement cycling are instances of supporting administrations.

Just 1.75 million species have been found and named by researchers, representing under 20% of those assessed to exist. Just a few of those found have been examined for potential therapeutic, agrarian, or modern worth. A large part of the world's rich biodiversity is quickly disappearing, even before we realize what is absent. Most researchers concur that life on Earth is presently confronting the most extreme eradication occasion since the dinosaurs' elimination 65 million years prior. Plants, creatures, parasites, and infinitesimal life forms, for example, microorganisms, are vanishing at disturbing rates. Therefore, researchers all around the world are zeroing in on their endeavors on indexing and concentrating on worldwide biodiversity to all the more likely get it and slow its decrease.

Conservation of Biodiversity

Biodiversity can be defined as the sum of all the inhabitants of the "entire planet." It is the combination of all species on the planet, to be more specific. The term "biodiversity" refers to the wide range of biological species found on Earth.

The species richness of an area represents its biodiversity, and thus its biodiversity can be efficiently analyzed and compared to any other area. Despite accounting only for 10% of the total world area, the tropics have the richest biodiversity, accounting for more than 90% of all species.

The primary goals of biodiversity conservation are as follows:

(a) To preserve vital ecological processes and life-sustaining systems.

(b) To retain species diversity.

(c) To make long-term use of species and habitats.

Loss of Biodiversity

The loss of biodiversity in an area can result in:

• Degradation in plant production,

• Reduced resistance to environmental issues such as drought, global warming, and so on, and

• High variability in certain ecosystem processes such as plant productivity, water utilization, and pest and disease cycles.

Biodiversity conservation is the preservation, enhancement, and strategic planning regarding

the use of biodiversity in order to provide long-term benefits to upcoming generations.

Biodiversity can be conserved by the following two methods:

- **In situ conservation** – It involves the protection and conservation of a variety of animals and plant species in its natural habitat. It includes biosphere reserves, hot spots, national parks and sanctuaries, wild forests etc.
- **Ex-situ conservation** – It involves protection and conservation of rare species of animals and plants outside their natural habitats. These include zoos, aquariums, botanical gardens, gene banks, etc.[3]

REASONS FOR BIODIVERSITY CONSERVATION

Biodiversity should be conserved for the following reasons:[4]

1. Humans derive a number of economic benefits from nature such as firewood, food, construction material, fibre, and medicines.
2. The Amazon forests provide 20% of the total atmospheric oxygen on earth.
3. These are our biological legacies and should be passed on to future generations.
4. The birds, bees and birds are some of the pollinating agents in the ecosystem.

CONVENTION OF BIOLOGICAL DIVERSITY

The goal of the convention is to save species from extinction and to safeguard their natural habitat from harm.

The developed world wants a consistent supply of biological resources from emerging nations, as well as easy access to them. Growing countries that lack the technological capability to manipulate their reserves invite developed countries to do so. As a result, the developed world has diverted the benefits of these natural resources elsewhere. Nowadays, emerging economies are demanding a larger share of the economic benefits that have accrued. The developed countries are also worried about the uncontrolled extraction of natural resources, especially forests.

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[3] Zegeye, Haileab. (2016). In situ and ex situ conservation: complementary approaches for maintaining biodiversity. International Journal of Research in Environmental Studies. 4. 1-12.

[4] Sood Monika and Chauhan Sakshi [2015] Biodiversity conservation in Himalayan regions, International Journakl of Applied Research 610-615