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IN-SITU AND EX-SITU CONSERVATION OF BIODIVERSITY

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ABSTRACT: In-situ and ex-situ conservation of biodiversity are two approaches to the conservation of biodiversity. In-situ conservation mainly focuses on protecting the organism in its natural habitat whereas ex-situ conservation mainly focuses on protecting the organism by relocating it into an ideal protective habitat. In-situ and ex-situ conservation both focus on the protection of an organism however utilizing different means.

KEYWORDS: In-situ, Ex-situ, conservation, biodiversity, protection, habitat

I. INTRODUCTION

Biodiversity refers to the total diversity that exists at all levels of biological organization. The word biodiversity was proposed by Edward Wilson and it can be divided into 'bio' which means life and 'diversity' which means variety. It is considered as there are around 1.7 million species of organisms found on the planet but it is not the exact number of species as a huge number of organisms are yet to be discovered.

Conservation of Biodiversity

Diversity at genetic, species and ecosystem levels are of special significance, and conservation efforts are made at these levels. The three main objectives of biodiversity conservation are:

- Preservation of species diversity.
- Sustainability of species and their ecosystem.
- Maintaining life-supporting and essential ecological processes.

Nowadays, we are losing biodiversity at a fast pace. The various reasons for the loss of biodiversity are:[1,2,3]

- Loss of habitat and fragmentation
- Overexploitation of natural resources
- Invasion of alien/non-native species
- Co-extinction: where the extinction of one species leads to the extinction of the other as they are dependent on each other; for example, plant-pollinator Mutualism

Why should we Conserve Biodiversity?

Biodiversity is vital for the survival of humankind. Apart from the direct benefits (food, fiber, firewood, products of medicinal importance, etc.), we receive many indirect benefits from the ecosystem, such as pollination, pest control, climate moderation, flood control, aesthetic pleasure, etc. We owe to millions of plants, animals, and microbes with whom we share our planet. So, our moral duty is to care for, protect, and preserve them and pass them to our future generations in good order.

II. DISCUSSION

There are two main approaches to conserving our biodiversity- in situ conservation and ex-situ conservation. What is In situ conservation?

When we conserve and protect at all levels of biological organization, that is, the whole ecosystem, the approach is known as in situ conservation. In this, the conservation of species is protected within their natural habitat. For example, to save the tiger, we save the whole forest. The protected areas where in situ conservation takes place are; wildlife sanctuary, national park, biosphere reserve, and sacred groves.

Wild Life Sanctuary

Wildlife sanctuary is a protected area where wild animals and birds are conserved and protected in their natural habitat. The capturing, killing, and poaching of animals are strictly prohibited. However, human activities like the collection of firewood, etc. are allowed up to some extent. Wildlife sanctuaries can be created for particular species—for example, Gir wildlife sanctuary to protect lions.

National Park

The national park protects the entire plants, animals, and landscape of the region. Cultivation of land, forestry, and grazing are not allowed at all. Human activities are strictly prohibited—for example, Corbett National Park.

Biosphere Reserve

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Biosphere Reserve is a large protected area for the conservation of wildlife, plant and animal resources, and traditional tribal life in the area. It contributes to the protection and preservation of the natural ecosystem and culture of the region. It may also contain other protected areas like wildlife sanctuaries or national parks. For example, Pachmarhi Biosphere Reserve contains Satpura National Park and Bori and Pachmarhi Wildlife Sanctuary.[4,5,6]

Sacred Groves

Sacred grooves are tracts of forested land that are protected by the community living around them. The community attaches some religious or cultural significance to the protected forest land. It helps protect many rare, threatened, and endemic plant and animal species found in a region—for example, Khasi and Jantia hills in Meghalaya.

Advantages of In-situ Conservation

The advantages of the in-situ conservation approach are:

- The wildlife species are preserved within their natural habitat. They easily adjust and adapt to their surrounding.
- It conserves the entire ecosystem, not just one particular species.
- It is a more economical and convenient method.
- Useful in conserving large populations of a species
- The chances of recovery are high.

Disadvantages of In-situ Conservation

The disadvantages of the in-situ approaches are:

- Conditions that threaten the survival of the organism will still be present.
- The genetic diversity of the region may already have decreased.
- Endangered habitats may be fragmented and may affect the survival of the species.

What is Ex-situ Conservation?

In ex-situ conservation, threatened animals and plants are taken out of their natural habitat and placed in a unique and ideal setting where they can be protected and given special care. Zoological parks, botanical gardens, gene banks, and cryopreservation serve the above purpose.

Zoological Park

A zoological park is a facility where animals are kept within enclosures for public display and are often bred for conservation purposes. Zoological parks increase the public interest in the understanding of wildlife and are centers for recreation and education like the National Zoological Park, Delhi.

Botanical Gardens

A botanical garden is a garden specially meant for the collection, cultivation, preservation, and display of a wide variety of plants, which are typically labeled with their botanical names. They serve the purpose of scientific research, conservation, display, and education like the National Botanical Garden, Lucknow.

Gene Bank

A gene bank is a biorepository that preserves the genetic material. It is a collection of seeds, plants, tissue cultures, etc., of potentially valuable species. It conserves the genetic diversity of wild and domesticated plants and animals like the National Animal Gene Bank, Karnal.

Cryopreservation

Cryopreservation is the long-term process of keeping live cells, tissues, and other biological samples frozen at sub-zero temperatures for storage and preservation. The sample is commonly kept at −196°C. It preserves the biological material, and the genetic integrity of the material is stored like the one present in IARI, New Delhi.[7,8,9]

Advantages of Ex-situ Conservation

The advantages of ex-situ conservation are:

- It protects endangered species from external threats like predation and poaching.
- Selective breeding programs can be implemented.
- It is a focused approach, as the health of individual animals can be monitored.
- The genetic diversity of the population is preserved
- It is invaluable for research and public education.
- It has the potential to reintroduce organisms back into their natural habitat.

Disadvantages of Ex-situ Conservation

The disadvantages of the above approach are:

- The individual is living outside its natural habitat.
- Animals may not adjust to the new environment.
- Captive animal populations have limited genetic diversity.
- It is expensive to maintain.
- Animals may not survive reintroduction into the wild.

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III. RESULTS

In-situ conservation	Ex-situ conservation
Species are conserved in their natural habitats	Species are conserved in a manmade habitat that resembles their own
As the organisms are protected in their natural habitats, the natural ecosystem sustains.	The organisms are taken out when the organisms can not be protected by the natural ecosystem
The unique biological communities are protected in the wild population	The endangered species are particularly conserved
Example: Wildlife sanctuaries, biosphere reserves, national parks, etc.	Example: Zoological parks, botanical gardens, gene banks, etc.

Conservation of wildlife, both ex-situ and in-situ is important for the ecosystem. Wildlife provides balance to nature and the natural process. It is important to conserve both flora and fauna of a specific area. Biodiversity refers to the difference or diversity of organisms that can be observed within the life that exists on the Earth. The term denotes variety of species or genetic as well as variation in ecosystem level. Some factors are there that are causing problems within the biodiversity. Those are pollution, invasive species, overexploitation and change in climatic conditions. All these things are causing exploitation of both plants and animal species. The number of endangered species is increasing day by day. Here comes the importance of conservation. Conservation of both plants and animals is very important to decrease the number of extinct species in biodiversity. Conservation means taking care of different species and prohibiting them from extinction by providing them special care and protection. Two types of conservation are possible based on the place where the conservation is done- ex-situ and in-situ.

Ex-situ Conservation

Ex-situ conservation is one of the key goals of the Botanical Survey of India is conservation (BSI). It is a type of 'off-site' conservation policy that entails a set of strategies that relate the transfer of an objective species under threat from its natural environment to a considerably safer haven, such as a Botanical Garden, Seed Bank, Zoological Garden, or Gene Bank, among other places. The primary purpose of this strategy is to provide appropriate support for conservation initiatives by ensuring the survival of vanishing and threatened species as well as their associated genetic diversity. [10,11]

In-situ Conservation

In-situ conservation refers to the preservation of animals in its native environment. Using a network of protected areas, such as biosphere reserves, national parks, and animal sanctuaries, this strategy aims to safeguard the natural habitat. These protected areas for the preservation of wildlife occupy 4.7 percent of the Indian landmass.

Examples

The nation's parks : Human activities like forestry, grazing, or gardening are not permitted because the region is set aside for the conservation of animals. India has 104 national parks totaling 40,501 square kilometres.

Ex-situ and in-situ conservation importance

Conservation of wildlife, both ex-situ and in-situ is important for the ecosystem. Wildlife provides balance to nature and the natural process. It is important to conserve both flora and fauna of a specific area. Conservation also saves a huge number of species from extinction of both plants and animals. It also saves a wide range of plants having medicinal properties which would help in the invention of different medicines. Both ex-situ and in-situ conservation have their own importance. Ex-situ conservation is necessary for conservation of species whose natural habitat gets destroyed for some reasons. This also preserves genes, spores and gametes as well which is necessary for performing further studies. In case of in-situ conservation, it is important as both habitats as well as the animals are saved by this type.[12,13]

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IV. CONCLUSION

The number of endangered species is increasing day by day. Here comes the importance of conservation. Conservation of both plants and animals is very important to decrease the number of extinct species in biodiversity. Conservation means taking care of different species and prohibiting them from extinction by providing them special care and protection. Two types of conservation are possible based on the place where the conservation is done- ex-situ and in-situ. Both the conservations have their limitations but are of extreme importance. According to the red data book, the number of endangered species is increasing day by day and a wide range of species, undiscovered, have become extinct as well. [14]

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