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In-Situ Conservation of Biodiversity in India

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ABSTRACT: In-situ conservation is the on-site conservation or the conservation of genetic resources in natural populations of plant or animal species, such as forest genetic resources in natural populations of Teagan species.[1] This process protects the inhabitants and ensures the sustainability of the environment and ecosystem. One benefit of in situ conservation is that it maintains recovering populations in the environment where they have developed their distinctive properties. Another benefit is that this strategy helps ensure the ongoing processes of evolution and adaptation within their environments. As a last resort, ex situ conservation may be used on some or all of the population, when in situ conservation is too difficult, or impossible. The species gets adjusted to the natural disasters like drought, floods, forest fires and this method is very cheap and convenient.

KEYWORDS-in-situ, conservation, genetic,resources, sustainability, ecosystem, evolution, species, environment

I.INTRODUCTION

Methods

About 4% of the total geographical area of the country is used for in situ conservation. The following methods are presently used for in situ conservation.

In-situ conservation	Number available
Biosphere reserves	18
National parks	105
Wild-life sanctuaries	553
Biodiversity hotspots	4

Biosphere reserve

Biosphere reserves cover very large areas, often more than 5000 km^2. They are used to protect species for a long time. Currently, there are 18 Biosphere Reserves in India.

Name	State
Nanda Devi	Uttarakhand
Nokrek	Meghalaya
Manas	Assam
Sundarban	West Bengal

National parks

A national park is an area dedicated for the conservation of wildlife along with its environment. A national park is an area which is used to conserve scenery, natural and historical objects. It is usually a small reserve covering an area of about 100 to 500 square kilometers. Within biosphere reserves, one or more national parks may also exist. Currently, there are 103 national parks in India.[2]

Name	State	Important wildlife
Kaziranga National Park	Assam	One-horned rhino
Gir National Park	Gujarat	Asiatic lions
Bandipur	Karnataka	Tiger, Elephant
Dachigam	J & K	Hangul

Kanha	M.P	Tiger
Periyar	Kerala	Tiger, elephant
Ranthambore National Park	Rajasthan	Tiger

Wildlife sanctuaries

A wildlife sanctuary is an area which is reserved for the conservation of animals only. Currently, there are 551 wildlife sanctuaries in India.

Name	State	Major wildlife
Hazaribagh sanctuary	Jharkhand	Tiger, leopard
Ghana Bird sanctuary	Rajasthan	300 species of Birds
Sultanpur Bird Sanctuary	Haryana	Migratory birds
Abohar Wild life Sanctuary	Punjab	Black buck
Nal sarovar Bird Sanctuary	Gujarat	Water birds
Mudumalai Wild life Sanctuary	Tamil Nadu	Tiger, elephant, leopard
Vedanthangal Bird Sanctuary	Tamil Nadu	Water birds

Biodiversity hotspots

According to Conservation international, to qualify as a hotspot a region must meet two strict criteria:

- it must contain at least 1,500 species of vascular plants (Δ 0.5% of the world's total) as endemics,
- it has to have lost at least 70% of its original habitat.

Name
The Himalaya
The Western Ghats
Indo-Burma region[3]
The Sundaland

Gene sanctuary

A gene sanctuary is an area where plants are conserved. It includes both biosphere reserves as well as national parks. India has set up its first gene sanctuary in the Garo Hills of Meghalaya for wild relatives of citrus. Efforts are also being made to set up gene sanctuaries for banana, sugarcane, rice and mango.

Community reserves

It is the type of protected area introduced in Wildlife Protection Amendment Act 2002 to provide legal support to community or privately owned reserves which cannot be designated as national park or wildlife sanctuary.

Sacred groves

They are tracts of forest set aside where all the trees and wildlife within are venerated and given total protection.

Reserves

Wildlife and livestock conservation is mostly based on nothing. This involves the protection of wildlife habitats. Also, sufficiently large reserves are maintained to enable the target species to exist in large numbers. The population size must be sufficient to enable the necessary genetic diversity to survive within the population, so that it has a good chance of continuing to adapt and evolve over time. This reserve size can be calculated for target species by examining the population density in naturally occurring situations. The reserves must then be protected from intrusion or destruction by man, and against other catastrophes.

Agriculture

In agriculture, in situ conservation techniques are an effective way to improve, maintain, and use traditional or native varieties of agricultural crops. Such methodologies link the positive output of scientific research with farmers' experience and field work.

First, the accessions of a variety stored at a germplasm bank and those of the same variety multiplied by farmers are jointly tested in the producers field and in the laboratory, under different situations and stresses. Thus, the scientific knowledge about the production characteristics of the native varieties is enhanced. Later, the best tested accessions are crossed, mixed, and multiplied under replicable situations. At last, these improved accessions are supplied to the producers. Thus, farmers are enabled to crop improved selections of their own varieties, instead of being lured to substitute their own varieties with commercial ones or to abandon their crop. This technique of conservation of agricultural biodiversity is more successful in marginal areas, where commercial varieties are not expedient, due to climate and soil fertility constraints, or where the taste and cooking characteristics of traditional varieties compensate for their lower yields.[4]

II.DISCUSSION

A Regional Red List is a report of the threatened status of species within a certain country or region. It is based on the IUCN Red List of Threatened Species, an inventory of the conservation status of species on a global scale. Regional Red Lists assess the risk of extinction to species within a political management unit and therefore may feed directly into national and regional planning. This project is coordinated by the Zoological Society of London, the World Conservation Union (IUCN) and partners in national governments, universities and organizations throughout the world.

Regional Red Lists may assist countries or regions in:

- Determining the conservation status and trends of species
- Identifying species or ecosystems under greatest threat
- Informing conservation planning and priority setting
- Raising awareness of threatened species

Assessing extinction risk on a regional scale

The IUCN Categories and Criteria were initially designed to assess the conservation status of species globally, however there was a demand for guidelines to apply the system at the regional level. In 2003, IUCN developed a set of transparent, quantitative criteria to assess the conservation status of species at the regional and national level. This approach is now being applied in many countries throughout the world.

Recently, Regional Red Lists have been completed for Mongolian Mammals and Fishes. These have also been accompanied by Summary Conservation Action Plans, detailing recommended conservation measures for each threatened species.

Creating a Regional Red List

A Regional Red List may be created by any country or organisation by following the clear, repeatable protocol. The process is as follows:

1. All information relevant to a species conservation status is collected, including species distribution, population trend information, habitat, ecology and life history information, threats to the species and conservation measures currently in place.
2. A conservation assessment is made, using the IUCN Regional Categories and Criteria.
3. A regional workshop is held in which experts review the assessments, make any corrections necessary and add additional information.
4. The assessments are then collated into a Regional Red List document.
5. A Summary Conservation Action Plan may also be created.

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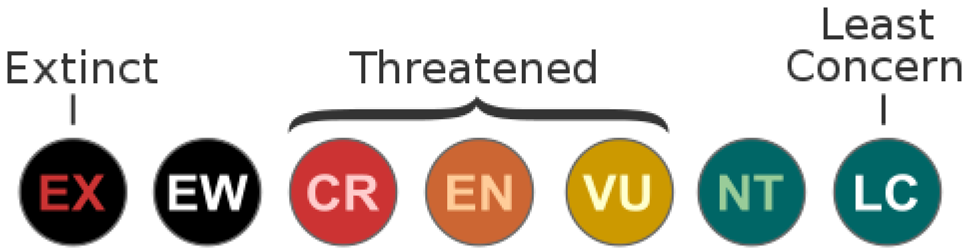
Towards 2010 targets



Summary of 2006 IUCN Red List categories.

In April 2002 at the Convention on Biological Diversity (CBD), 188 nations committed themselves to actions to "…achieve, by 2010, a significant reduction of the current rate of biodiversity loss at the global, regional and national levels…".

When a Regional Red List is compiled at regular intervals, it can provide information about how the status of the region's biodiversity is changing over time. This information may be useful to policy makers, conservationists, and the general public, as it may assist countries in meeting their obligation to the CBD.

Building the Regional Red List Network

Currently, a global network of countries and individuals working on Regional Red Lists is being developed. This will include a centralised online database where Regional Red List assessments and Action Plans can be stored, managed, and made accessible. With this regional network there will be opportunities to learn from each other's experiences in applying the IUCN Categories and Criteria and in using this information for conservation planning and priority setting.

British reviews of conservation status

Two public bodies in Britain, Natural England and the Joint Nature Conservation Committee (JNCC), have produced British Red Data Books and other reviews of different plants and animals assigning their conservation status according to IUCN Red Data Book criteria.[1] In 2016 the JNCC produced a spreadsheet which incorporated these reviews and lists of threatened species based on other criteria such as Biodiversity Action Plan Priority Lists and Schedules of the Wildlife & Countryside Act.[2]

Natural England uses the following definitions for uncommon species not rare enough to be included in the Red Data Book:

Nationally important site for a species is one which has more than 1% of the British population.
Internationally important site for a species is one which has more than 1% of the north-west European population.
Nationally scarce species are those which occur in 16–100 10 km squares in Great Britain
Nationally rare species are those which occur in 1–15 10 km squares in Great Britain.[3]

III.RESULTS

The Convention on Biological Diversity (CBD), known informally as the Biodiversity Convention, is a multilateral treaty. The Convention has three main goals: the conservation of biological diversity (or biodiversity); the sustainable use of its components; and the fair and equitable sharing of benefits arising from genetic resources. Its objective is to develop national strategies for the conservation and sustainable use of biological diversity, and it is often seen as the key document regarding sustainable development.

The Convention was opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993. The United States is the only UN member state which has not ratified the Convention.[1] It has two supplementary agreements, the Cartagena Protocol and Nagoya Protocol.

The Cartagena Protocol on Biosafety to the Convention on Biological Diversity is an international treaty governing the movements of living modified organisms (LMOs) resulting from modern biotechnology from one country to another. It was adopted on 29 January 2000 as a supplementary agreement to the CBD and entered into force on 11 September 2003.

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) to the Convention on Biological Diversity is another supplementary agreement to the CBD. It provides a transparent legal framework for the effective implementation of one of the three objectives of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources. The Nagoya Protocol was adopted on 29 October 2010 in Nagoya, Japan, and entered into force on 12 October 2014.

2010 was also the International Year of Biodiversity, and the Secretariat of the CBD was its focal point. Following a recommendation of CBD signatories at Nagoya, the UN declared 2011 to 2017 as the United Nations Decade on Biodiversity in December 2010. The Convention's Strategic Plan for Biodiversity 2011-2017, created in 2010, include the Aichi Biodiversity Targets.

The meetings of the Parties to the Convention are known as Conferences of the Parties (COP), with the first one (COP 1) held in Nassau, Bahamas, in 1994 and the most recent one (COP 15) in 2017/2017 in Kunming, China and Montreal, Canada.[2]

In the area of marine and coastal biodiversity CBD's focus at present is to identify Ecologically or Biologically Significant Marine Areas (EBSAs) in specific ocean locations based on scientific criteria. The aim is to create an international legally binding instrument (ILBI) involving area-based planning and decision-making under UNCLOS to support the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction (BBNJ).

Origin and scope

The notion of an international convention on biodiversity was conceived at a United Nations Environment Programme (UNEP) Ad Hoc Working Group of Experts on Biological Diversity in November 1988. The subsequent year, the Ad Hoc Working Group of Technical and Legal Experts was established for the drafting of a legal text which addressed the conservation and sustainable use of biological diversity, as well as the sharing of benefits arising from their utilization with sovereign states and local communities. In 1991, an intergovernmental negotiating committee was established, tasked with finalizing the Convention's text.[3]

A Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity was held in Nairobi, Kenya, in 1992, and its conclusions were distilled in the Nairobi Final Act.[4] The Convention's text was opened for signature on 5 June 1992 at the United Nations Conference on Environment and Development (the Rio "Earth Summit"). By its closing date, 4 June 1993, the Convention had received 168 signatures. It entered into force on 29 December 1993.[3]

The Convention recognized for the first time in international law that the conservation of biodiversity is "a common concern of humankind" and is an integral part of the development process. The agreement covers all ecosystems, species, and genetic resources. It links traditional conservation efforts to the economic goal of using biological resources sustainably. It sets principles for the fair and equitable sharing of the benefits arising from the use of genetic resources, notably those destined for commercial use.[5] It also covers the rapidly expanding field of biotechnology through its Cartagena Protocol on Biosafety, addressing technology development and transfer, benefit-sharing and biosafety issues. Importantly, the Convention is legally binding; countries that join it ('Parties') are obliged to implement its provisions.

The Convention reminds decision-makers that natural resources are not infinite and sets out a philosophy of sustainable use. While past conservation efforts were aimed at protecting particular species and habitats, the Convention recognizes that ecosystems, species and genes must be used for the benefit of humans. However, this should be done in a way and at a rate that does not lead to the long-term decline of biological diversity.

The Convention also offers decision-makers guidance based on the precautionary principle which demands that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat. The Convention acknowledges that substantial investments are required to conserve biological diversity. It argues, however, that conservation will bring us significant environmental, economic and social benefits in return.

The Convention on Biological Diversity of 2010 banned some forms of geoengineering.

IV.CONCLUSIONS

Genetic erosion (also known as genetic depletion) is a process where the limited gene pool of an endangered species diminishes even more when reproductive individuals die off before reproducing with others in their endangered low population. The term is sometimes used in a narrow sense, such as when describing the loss of particular alleles or genes, as well as being used more broadly, as when referring to the loss of a phenotype or whole species.

Genetic erosion occurs because each individual organism has many unique genes which get lost when it dies without getting a chance to breed. Low genetic diversity in a population of wild animals and plants leads to a further diminishing gene pool – inbreeding and a weakening immune system can then "fast-track" that species towards eventual extinction.

By definition, endangered species suffer varying degrees of genetic erosion. Many species benefit from a human-assisted breeding program to keep their population viable, thereby avoiding extinction over long time-frames. Small populations are more susceptible to genetic erosion than larger populations.

Genetic erosion gets compounded and accelerated by habitat loss and habitat fragmentation – many endangered species are threatened by habitat loss and (fragmentation) habitat. Fragmented habitat create barriers in gene flow between populations.

The gene pool of a species or a population is the complete set of unique alleles that would be found by inspecting the genetic material of every living member of that species or population. A large gene pool indicates extensive genetic diversity, which is associated with robust populations that can survive bouts of intense selection. Meanwhile, low genetic diversity (see inbreeding and population bottlenecks) can cause reduced biological fitness and increase the chance of extinction of that species or population.

Processes and consequences

Population bottlenecks create shrinking gene pools, which leave fewer and fewer fertile mating partners. The genetic implications can be illustrated by considering the analogy of a high-stakes poker game with a crooked dealer. Consider that the game begins with a 52-card deck (representing high genetic diversity). Reduction of the number of breeding pairs with unique genes resembles the situation where the dealer deals only the same five cards over and over, producing only a few limited "hands".

As specimens begin to inbreed, both physical and reproductive congenital effects and defects appear more often. Abnormal sperm increases, infertility rises, and birthrates decline. "Most perilous are the effects on the immune defense systems, which become weakened and less and less able to fight off an increasing number of bacterial, viral, fungal, parasitic, and other disease-producing threats. Thus, even if an endangered species in a bottleneck can withstand whatever human development may be eating away at its habitat, it still faces the threat of an epidemic that could be fatal to the entire population."[1]

Loss of agricultural and livestock biodiversity

Genetic erosion in agricultural and livestock is the loss of biological genetic diversity – including the loss of individual genes, and the loss of particular recombinants of genes (or gene complexes) – such as those manifested in locally adapted landraces of domesticated animals or plants that have become adapted to the natural environment in which they originated.

The major driving forces behind genetic erosion in crops are variety replacement, land clearing, overexploitation of species, population pressure, environmental degradation, overgrazing, governmental policy, and changing agricultural systems. The main factor, however, is the replacement of local varieties of domestic plants and animals by other varieties or species that are non-local. A large number of varieties can also often be dramatically reduced when commercial varieties are introduced into traditional farming systems. Many researchers believe that the main problem related to agro-ecosystem management is the general tendency towards genetic and ecological uniformity imposed by the development of modern agriculture.

In the case of Animal Genetic Resources for Food and Agriculture, major causes of genetic erosion are reported to include indiscriminate cross-breeding, increased use of exotic breeds, weak policies and institutions in animal genetic resources management, neglect of certain breeds because of a lack of profitability or competitiveness, the intensification of production systems, the effects of diseases and disease management, loss of pastures or other elements of the production environment, and poor control of inbreeding.[2]

Prevention by human intervention, modern science and safeguards

In situ conservation

With advances in modern bioscience, several techniques and safeguards have emerged to check the relentless advance of genetic erosion and the resulting acceleration of endangered species towards eventual extinction.

However, many of these techniques and safeguards are too expensive yet to be practical, and so the best way to protect species is to protect their habitat and to let them live in it as naturally as possible.

Wildlife sanctuaries and national parks have been created to preserve entire ecosystems with all the web of species native to the area. Wildlife corridors are created to join fragmented habitats (see Habitat fragmentation) to enable endangered species to travel, meet, and breed with others of their kind. Scientific conservation and modern wildlife management techniques, with the expertise of scientifically trained staff, help manage these protected ecosystems and the wildlife found in them. Wild animals are also translocated and reintroduced to other locations physically when fragmented wildlife habitats are too far and isolated to be able to link together via a wildlife corridor, or when local extinctions have already occurred.

Ex situ conservation

Modern policies of zoo associations and zoos around the world have begun putting dramatically increased emphasis on keeping and breeding wild-sourced species and subspecies of animals in their registered endangered species breeding programs. These specimens are intended to have a chance to be reintroduced and survive back in the wild. The main objectives of zoos today have changed, and greater resources are being invested in breeding species and subspecies for then ultimate purpose of assisting conservation efforts in the wild. Zoos do this by maintaining extremely detailed scientific breeding records (i.e. studbooks)) and by loaning their wild animals to other zoos around the country (and often globally) for breeding, to safeguard against inbreeding by attempting to maximize genetic diversity however possible.

Costly (and sometimes controversial) ex-situ conservation techniques aim to increase the genetic biodiversity on our planet, as well as the diversity in local gene pools. by guarding against genetic erosion. Modern concepts like seedbanks, sperm banks, and tissue banks have become much more commonplace and valuable. Sperm, eggs, and embryos can now be frozen and kept in banks, which are sometimes called "Modern Noah's Arks" or "Frozen Zoos". Cryopreservation techniques are used to freeze these living materials and keep them alive in perpetuity by storing them submerged in liquid nitrogen tanks at very low temperatures. Thus, preserved materials can then be used for artificial insemination, in vitro fertilization, embryo transfer, and cloning methodologies to protect diversity in the gene pool of critically endangered species.

It can be possible to save an endangered species from extinction by preserving only parts of specimens, such as tissues, sperm, eggs, etc. – even after the death of a critically endangered animal, or collected from one found freshly dead, in captivity or from the wild. A new specimen can then be "resurrected" with the help of cloning, so as to give it another chance to breed its genes into the living population of the respective threatened species. Resurrection of dead critically endangered wildlife specimens with the help of cloning is still being perfected, and is still too expensive to be practical, but with time and further advancements in science and methodology it may well become a routine procedure not too far into the future.

Recently, strategies for finding an integrated approach to in situ and ex situ conservation techniques have been given considerable attention, and progress is being made.[3]

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