

## Unit 2.4: Conservation Biology

- Concept, HIPPCO, Extinction crisis
- In-situ and ex situ conservation strategies.

### 2.4.1: Concept of conservation

Conservation involves maintenance of the natural environment of man including the infinite resources of air, water, soil and life forms. Conservation also involves the collective responsibility of governments, private organizations, industries and individuals and the setting aside of funds, finances for ecological research and execution of conservation projects.

**Primary focus** is upon maintaining the health of the **natural world**, its fisheries, habitats, and biological diversity. To ensure the preservation of a quality environment that considers aesthetics and recreational as well as product needs. To ensure a continuous yield of useful plants and animals by establishing a balanced cycle of harvesting and renewal.

**Secondary focus** is on **material** conservation, including non-renewable resources such as metals, minerals and fossil fuels, and energy conservation, which is important to protect the natural world.

#### Definition:

**Conservation is an ethic of resource use, allocation, and protection. Conservation is a broad concept which involves not only the scientific but ethical, moral, economic, technological and political aspects as well. Conservation can also be defined as follows:**

**Political:** In all cases, conservation deals with judicious development and manner of use of natural resources of all kinds.

**Economically:** Conservation for the petroleum engineer is largely minimizing of waste from incomplete extraction and for a forester it may be sustained yield of products.

**Technologically:** The maximization overtime of the net social benefits in goods and services from resource.

**Socially:** Conservation may also be defined as the achievement of the highest sustainable quality of living for mankind by the rational utilization of the environment, protection of nature to enrich the life of man and the control or elimination of environmental pollution in its many manifestations.

**Ecologically:** Conservation supports practices that will maintain the resources of the earth on which man depends. Conservation is the science concerned with interrelationship between living things and their environment.

**The reasons for the prerequisite of conservation are:**

- a) World population is increasing at an alarming rate,
- b) World resources are being used up at an increasing rate due to increase in population,
- c) Pollutions is increasing with the passage of time, and
- d) Damage caused by human activities is sometimes irreversible.

➤ **Principles of Conservation**

Conservation is achieved through measures adopted in favor of a natural resource in order to increase its longevity and improve usage patterns. Some such measures are as follows:

**a) Rational use of the resources:**

Rational use involves conservation and preservation of environment and resources. It implies the direct use of resources for their commodity or recreational value. Thus, harvesting of forest crops, livestock grazing of grassland, catching fish and hunting wild animals can be considered a legitimate part of the rational use of natural resources, if they are carried out in such a way that the resource is perpetuated and not endangered. Preservation of a few resources may also maintain the function of the rest of the environment, for example, protection of forests assures a sustained yield of water into urban reservoirs, and protection of estuaries maintains ocean fishery.

**b) Sustained yield:**

Concept of sustained yield is involved in these activities. This means cropping the annual surplus of individuals so as not to endanger the breeding stock of game animals or fish. Similarly, tree cutting or grazing of grass should remove only the annual increment and no more.

**c) Restoration:**

Restoration is another important aspect of conservation. It is essentially the correction of past careless activities that have impaired the productivity of the resources. Deforested, mined and barren lands can be re-vegetated with some effort. Depleted animal and plant populations can recover if they are accorded protection. This measure is familiar **in modern soil and water conservation practices** applied to agricultural land.

**d) Protection:**

Protection of natural resources from commercial exploitation is needed to prolong their use for recreation, watershed and scientific study. When species become extinct, the restoration of past conditions becomes impossible. In such condition the establishment and protection of parks and reserves in favour of endangered and vulnerable species is needed.

**e) Re-utilisation:**

Re-utilisation is the reuse of waste materials, as in the use of industrial water after it has been purified and cooled. The same process becomes **recycling** if the water material requires minor treatment before it can be used, as in the use of scrap iron in steel manufacture.

**f) Substitution:**

Substitution, an important conservation measure, has two aspects: (i) the use of a common resource instead of a rare one when it is for the same purpose, (ii) the use of a renewable rather than a non-renewable resource when conditions permit.

**g) Allocation:**

Allocation concerns the strategy of the best use of a resource. The allocation of resources may be controlled by government through the use of quotas, rationing and outright permits. e.g. categories of schedule I to VI allocated by Wildlife Protection Act 1972, India and Appendices by CITES towards the animals and plants protection.

**h) Integration:**

Integration is a central objective of planning. Integration in resource management is preferable to maximize certain benefits from a single resource at the expense of other benefits or other resources.

**2.4.2: HIPPCO**

Acronym used by conservation biologists for the six most important secondary causes of premature extinction of various species world over.

**H**abitat destruction, degradation, and fragmentation;

- Competition for land has led to deforestation, agriculture, transportation; electrifications exploiting and fragmenting the available forest which are important not only to protect natural resources and species but also to maintain clean and oxygen rich environment.

**I**nvasive (non-native) species;

- Many nonnative species provide us with food, medicine, and other benefits but a few can wipe out native species, disrupt ecosystems, and cause large economic losses.
- Many invasive species have been introduced intentionally or unintentionally.

**P**opulation growth (too many people consuming too many resources)

- More the population more is the amount of natural resources required to sustain it.

#### **P**ollution;

- With the advent of industrialization, urbanization and agriculture lots of pollution through effluents, sewage generation along with non-biodegradable substances, bio-accumulation and bio-magnification of toxic chemicals are resulted.

#### **C**limate change; and

- Pollution and certain anthropogenic activities cause climate change like global warming due to 'green house effect' high carbon foot print.

#### **O**verexploitation

- Killing predators and pests that bother us or cause economic losses threatens some species with premature extinction.
- Some protected species are killed for their valuable parts or are sold live to collectors. Legal and illegal trade in wildlife species used as pets or for decorative purposes threatens some species with extinction i.e. Rhinoceros are often killed for their horns and sold illegally on the black market for decorative and medicinal purposes.

### **2.4.3: Extinction crisis**

The difference with past extinctions, which were caused by catastrophic natural phenomena like volcanic eruptions, asteroid strikes, and violent climate changes, is that the current crisis is caused almost entirely by humans. As a matter of fact, as many as 99% of the species at the threshold of extinction are there due to human activities, particularly the ones that drive the introduction of exotic species, loss of habitat, and global warming. Granted, extinction is a phenomenon that occurs naturally, however it normally happens at a rate of 1 to 5 species every year. But, as scientists estimate, we are currently losing species 1,000-10,000 times faster than that, which means that literally tens of species are vanishing from the face of the Earth every day. We could be looking at a frightening future. By this rate, almost one third to one-half of all species could become extinct by 2050.

Over the last 500 years, as many as one thousand species vanished, without even accounting for many thousands more that went extinct before science discovered and described them. Almost 38% of all known species on a global scale are on the verge of extinction. This puts many thousands of unique species in the dire position of being gone forever.

Toads, frogs, and salamanders are vanishing due to animal agriculture, habitat loss, air and water pollution, global warming, UV light exposure, disease, and the introduction of exotic species.

Diminishing bird populations in the majority of habitats are the sad confirmation that major changes are taking place on Earth because of our activities. More than 12% of currently known species of birds are at the threshold of extinction. Fishing, rising water demand, river dams, water pollution and invasive species place aquatic ecosystems among the most endangered on Earth. One-third of the known invertebrate species are now threatened with extinction. Water pollution, water projects, and groundwater withdrawal threaten freshwater invertebrates, while deforestation and animal agriculture has caused extinction. About half of all the primate species on Earth are at the brink of extinction. 50 percent of all known mammals see rapidly decreasing populations, and almost 20 percent are close to extinction. This has been particularly pronounced for island reptile species, counting at least 28 island reptiles having disappeared so far. Reptiles are especially threatened by non-native species that compete for resources or feed on them, and habitat loss.

#### 2.4.4: *In-situ* conservation strategies

It means the conservation of species in their natural habitats either by protecting or cleaning up the habitat itself. It is achieved by formation of national parks and sanctuaries. Around 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 India.

In-situ conservation	Number available
Biosphere reserves	18
National parks	104
Wild-life sanctuaries	537
Biodiversity hotspots	4

**Biospheres:** Nandadevi of Uttarakhand, Nokrek of Meghalaya and Manas of Assam.

**National parks:** Kaziranga for One-horned Rhino [Indian Rhino Vision (IRV2020)], Dachigam for Hangul and Knha for Tiger (Project Tiger).

**Wild-life sanctuaries:** Ghana (Bharatpur) Bird sanctuary, Rajasthan for 300 bird species; Mudumalai Wild life Sanctuary, Tamil Nadu for Tiger, elephant, leopard; Sultanpur Bird Sanctuary, Haryana for migratory birds.

**Biodiversity hot-spots** are Himalaya, Western Ghats and the Nicobar Islands.

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.

**Community or privately owned reserves** which cannot be designated as national park or wildlife sanctuary are protected under Wildlife Protection Amendment Act 2002 to provide legal support to them.

**Sacred groves** are tracts of forest where all the trees and wildlife within are respected and given total protection.

#### **2.4.5: Ex-situ conservation strategies**

Ex-situ conservation is the preservation of components of biological diversity outside their natural habitats. This involves conservation of genetic resources, as well as wild and cultivated or species, and draws on a diverse body of techniques and facilities. Ex situ conservation measures should support in-situ conservation measures (in-situ conservation should be the primary objective).

Some of these include: Gene banks, e.g. seed banks, sperm and ova banks, field banks, In vitro plant tissue and microbial culture collections, Cryopreservation, Long Term Captive breeding of animals and artificial propagation of plants, with possible reintroduction into the wild; and Collecting living organisms for zoos, aquaria, and botanic gardens for research and public awareness, Animal translocation, Botanical garden and Zoological garden.

##### **i. Seed gene bank:**

These are cold storages where seeds are kept under controlled temperature and humidity for storage and this is easiest way to store the germ plasma of plants at low temperature. Seeds preserved under controlled conditions (minus temperature) remain viable for long durations of time. The Kew Seed Bank in England has 1.5 per cent of the world's flora - about 4,000 species - on deposit.

##### **ii. Gene bank:**

Genetic variability also is preserved by gene bank under normal growing conditions. These are cold storages where germ plasm are kept under controlled temperature and humidity for storage; this is an important way of preserving the genetic resources.

##### **iii. Cryopreservation:**

This is the newest application of technology for preservation of biotic parts. This type of conservation is done at very low temperature (196°C) in liquid nitrogen. The metabolic activities of the organisms are suspended under low temperature, which are later used for research purposes.

##### **iv. Tissue culture bank:**

Cryopreservation of disease free meristems is very helpful. Long term culture of excised roots and shoots are maintained. Meristem culture is very popular in plant propagation as it's a virus and disease free method of multiplication.

**v. Long term captive breeding:**

The method involves capture, maintenance and captive breeding on long term basis of individuals of the endangered species which have lost their habitat permanently or certain highly unfavorable conditions are present in their habitat.

**vi. Botanical gardens:**

A botanical garden is a place where flowers, fruits and vegetables are grown. The botanical gardens provide beauty and calm environment. Most of them have started keeping exotic plants for educational and research purposes.

**vii. Animal Translocation:**

Habitats are unstable; many times they are depleted or altered due to natural or human activities. Therefore their carrying capacity is reduced to hold the inhabitant species. On other hand sometimes the inhabitant species may become overcrowded in their original habitats. In such conditions some important species are transferred to an alternative habitat is known as translocation.

**viii. Agriculture** is an *ex-situ* conservation measures to maintain domesticated plants which cannot survive in nature unaided.

**ix. Botanical garden and Zoological garden:**

Some of these institutions also play a central role in public education and awareness raising by bringing members of the public into contact with plants and animals they may not normally come in contact with. It is estimated that worldwide, over 600 million people visit zoos every year.

**Advantages of *ex-situ* preservation:**

1. It is useful for declining population of species. These measures also have a valuable role to play in recovery programmes for endangered species.
2. Endangered animals on the verge of extinction are successfully bred.
3. Threatened species are bred in captivity and then released in the natural habitats.
4. *Ex-situ* centres offer the possibilities of observing wild animals, which is otherwise not possible.
5. It is extremely useful for conducting research and scientific work on different species. *Ex-situ* conservation provides excellent research opportunities on the components of biological diversity.

## **Unit 2.5: Case Study: Community Conservancies**

- Snow Leopard Conservancy in India
- Community-based Nature Conservancy (CNC) in Tadoba
- Community Wildlife Conservancies in Namibia
- Lewa and Maasai Mara Wildlife Conservancies in Kenya

### **2.5.1: Snow Leopard Conservancy in India (SLC-India Trust)**

The snow leopard is an endangered large cat inhabiting the high mountains of Central and South Asia. It has an extremely patchy and fragmented distribution throughout its range. Snow leopards are found in 12 central Asian countries, including India, China and Mongolia. The estimated global population of the species is 4500 to 7500 individuals. Within India, 200 to 600 individuals are thought to occur in the higher reaches of the Himalayas encompassing the northern areas of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh. Snow leopard is highly threatened due to poaching for its pelt and other body parts, a decline in its natural prey base, increasing competition between its natural prey and domestic livestock. More recent threats include hydroelectric projects, mining and climate change.



The India program grew from our activities in Ladakh and through our partnership with the Mountain Institute. Working closely with Rinchen Wangchuk and NGO associates, it was tested and refined innovative techniques for engaging local people in community based conservation of snow leopards and their prey.

In 2003, SLC-India Trust was registered as an environmental and social NGO under Indian law. In 2010, SLC-IT began working independently of Snow Leopard Conservancy.

#### **Highlights of Accomplishments**

It was initiated a corral predator-proofing program to prevent retributive killing of snow leopards by livestock owners. For every community's winter corral predator-proofed, and believed that up to five or more snow leopards were effectively removed from risk of being trapped or poisoned by angry herders.

Working with the Mountain Institute and a grant from UNESCO trust launched the award-winning Himalayan Homestays program. The J&K Wildlife Department assumed control of this program in 2010.



In 2004 trust was able to transfer many of these ideas to community-based tourism initiatives in Spiti under a partnership with MUSE.

Due to the incredible protection efforts of the local people, government, and SLC-IT, snow leopards were being seen regularly in Hemis National Park.

Between 2002 and 2005, working in collaboration with the J&K Wildlife Department in Hemis National Park, trust pioneered the use of noninvasive camera traps to assess snow leopard abundance and better estimate the population size of this shy, rarely seen cat.

In 2005, the Snow Leopard Conservancy established a partnership with the Pune-based nonprofit, Kalpavriksh, to develop a community-based environmental education program for rural Ladakh, focused on conservation of snow leopards and other wildlife of the local trans-Himalayan region. For this program, Kalpavriksh developed an educator's handbook and locally relevant educational material (posters and games) for classes 4 to 8. In 2007,

### **2.5.2: Community-based Nature Conservancy (CNC) in Tadoba**

The community-based Nature Conservancy (CNC) that encourages people owning land alongside government-owned parks and reserves to pool their land parcels together for hosting and protecting wildlife population, and earning a regular income from it. About 39 land owners from Gothangaon village in Vidharbha, which is sandwiched between the Umred Karhandla Wildlife Sanctuary and the backwaters of the Goshikhurd irrigation project, have consented to pool together 105 acre farm lands, mostly used for grazing livestock, to set up the first such CNC. The programme envisages involvement of communities around national parks and sanctuaries in re-wilding of farmlands rendered uneconomic due to various factors such as crop depredation by wildlife, limited space, less agriculture yield, human encroachment in forests, increased conflict, injuries and loss of life. It also aims to involve private enterprises to invest in the areas to help communities develop the CNC into a remunerative source of alternative income. The CNC is expected to usher in a win-win situation for humans, forests and wildlife by ending the mutual conflict. "The whole concept is to create a sustainable future for animals, local communities, the environment and visitors alike. It is also the best way to reduce man-animal conflict and ensure livelihood based on wildlife conservation for locals.

### **2.5.3: Community Wildlife Conservancies in Namibia**

In the mid-1980s a Namibian NGO and local leaders introduced an innovative community game guard system to curb poaching in northwest Namibia.

Building from the community game guard experience, in 1996, the new Namibian government granted communities the right to create conservancies - areas with defined borders and governance and management structures outside of parks - where communities have the right to manage and benefit from their wildlife.

### WWF's Role

WWF has been in Namibia since those early days, working alongside the government and local NGO partners to give birth to the conservancy program. Hand-in-hand with our Namibia partners, we assist communities to set up conservancies and help to foster the knowledge, skills and capacity required to successfully govern their conservancies and manage their wildlife resources. WWF also supports maximizing benefits to communities by facilitating the creation of partnerships between their conservancies and the tourism sector.



### A Success for People and Wildlife

Across Namibia and globally, communal conservancies have become a recognized conservation success story. While many challenges remain, conservancies have contributed to strengthening communities' rights, voice and stewardship of the wildlife on which they depend for their livelihoods and cultures.

Since 1998, Namibia has created 82 communal conservancies, covering nearly 20 percent of the country (62,550 mi<sup>2</sup>), and encompassing approximately 189,000 community members (9% of Namibia's population). Formed and run by local people, these conservancies offer protected space for wildlife outside of official protected areas and generate more than \$7 million a year in cash income and in-kind benefits for local people. The money goes directly back to communities to support anti-poaching operations, wildlife management, and education and health initiatives.

The model has produced impressive gains for wildlife; Namibia's elephant population has more than tripled, black rhinos, once near extinction, have rebounded, and free-roaming desert lions—reduced to less than 25 by the mid-1990s—now number over 150 and cover vast expanses of northwest Namibia.

Both wildlife and communities stand to benefit. Initial capital investment from the government treasury and partnerships with private sector actors has led to the establishment of more than fifty conservancies in Namibia, many of which have become financially self-sufficient. The involvement of communities across large areas facilitates the scaling-up of conservation efforts. In their study of Namibia, De Jager and Barnes show empirically that private landowners who group together to form large-scale conservancies can achieve greater financial returns through non-extractive industries than if they were to remain as small-scale ranchers. To date, 50% of elephant range-land in Namibia has been incorporated into the conservancy network, leading to a marked increase in their population. Between 2001 and 2008 in the Caprivi region alone, elephant numbers increased from about 100 to

over 1,000. Much of this success is attributed to CBNRMs (community-based natural resource management programs).

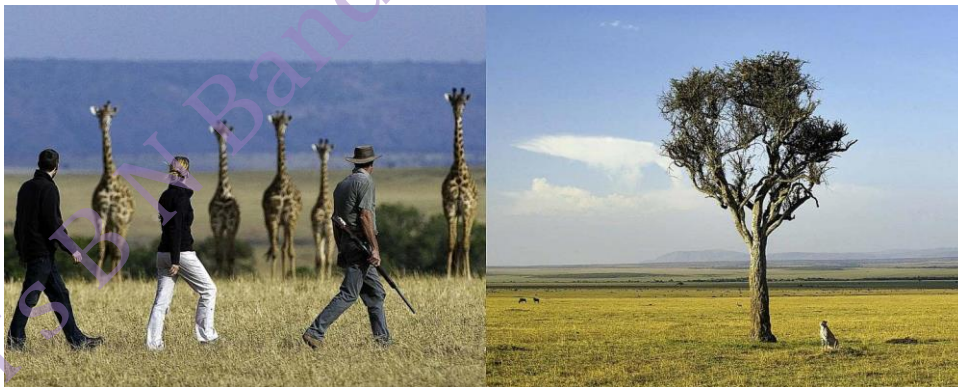
#### 2.5.4: Lewa and Maasai Mara Wildlife Conservancies in Kenya

The Lewa Wildlife Conservancy, or Lewa Downs, is a 20,000ha private reserve in north-eastern Kenya's Laikipia Plateau, a short distance from Mount Kenya National Park, Samburu and the Aberdares. The Lewa Wildlife Conservancy in Kenya is an award-winning model for community conservation. It is a



great stronghold for endangered Black Rhino and they offer a variety of alternative safari activities. The Lewa Wildlife Conservancy was a cattle ranch founded by the Craig family in the 1920's through a colonial settlement program. In the 1980's part of the ranch was converted into a sanctuary for Black Rhino whose numbers had been reduced to less than 300 due to poaching. In 1995 the Conservancy was founded and the area expanded to include the whole farm and part of the Ngare Ndare Forest Reserve.

Lewa Downs has been an exclusive safari destination for many years, but was made famous when Britain's Prince William proposed to Catherine Middleton there in 2010. It is considered to be one of the greatest conservation success stories in the world and is a model for sustainable tourism. Another event the Conservancy is famous for is the Safaricom Marathon, an annual event held to raise money for the Conservancy's environmental initiatives.



Prior to the introduction of conservancies in **Masai Mara**, the land that borders the reserve were divided into small parcels and used for cattle herding, village communities and agriculture. As a result,

wildlife was at risk of losing established migration routes, food and water resources and other wildernesses that animals have relied upon for generations. The establishment of Kenya's conservancies that encircle Masai Mara National Reserve advanced wildlife management strategies that

are core to AfricanMecca's preservation values. The conservancies essentially extend the protected land for flora and fauna. If government-operated lands were the only type of protection in Kenya, only 10% of Kenya's land would be set aside for national park conservation. The presence of conservancies, though, more than doubles those figures. Additionally, these conservancies in Masai Mara are "stand-alone" entities that support their own operations, including patrolling and security. The Mara conservancies are the result of a brilliant approach to wildlife management – work with local Maasai landowners to set aside land and help communities benefit from the generated revenue. Under the conservancy agreements, landowners establish zones that are not to be used for grazing and agriculture. Instead, these zones are allowed to return to a natural and pristine state. Once flora re-establishes in the zone, grazing and foraging herbivores return, along with many species of avi-fauna. These prey animals in turn attract predators, including birds of prey, scavengers and Kenya's powerful hunters – lions, cheetahs, leopards, hyenas and wild dogs

Slow leopard conservancy (2010) final report for the disney support for the years 2007-09 Muse Creative Initiatives for Sustainable Development, Kaza, Spiti, Himachal Pradesh.

<http://www.worldanimalfoundation.org/articles/article/8948432/186530.htm>

[http://www.biologicaldiversity.org/programs/biodiversity/elements\\_of\\_biodiversity/extinction\\_crisis/](http://www.biologicaldiversity.org/programs/biodiversity/elements_of_biodiversity/extinction_crisis/)