CONSERVATION OF BIODIVERSITY

The geological history of biodiversity is about 3.5 to 4 billion years old. The first appearance of multicellular organism was perhaps a mile stone in the history of biodiversity which did not diversify until about 600 million years ago. It is true that biodiversity is a source, once extinct can not be regenerated again. Due to human activities and over exploitation of ecosystem, the most severe extinction has occured. This is our one of the first

and most important requirement *i.e.*, conservation. From biological point of view, its our responsibility to conserve plants, animals (including cultivated plants and domestic animals, and their wild relatives.

In view of the importance of biodiversity (economic, environmental, scientific and medical) the urgent need for conservation of biodiversity was felt in Rio conference. The World Summit on sustainable development held in Johannesburg in August 2002 reiterated that the conservation of biodiversity was necessary for the survival of human race on this earth. In the Convention on Biodiversity (CBD), which has 42 Articles, Articles, 8 and 9 are about in-situ conservation and *ex-situ* conservation respectively. The objectives of CBO clearly stated the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from the utilization of genetic resources. The conservation has to be *ex-situ* as also in-situ. Both are complimentary to each other.

CONSERVATION OF BIODIVERSITY BY INDIA

Dr. M.S. Swaminathan (1983) reviewed the scientific aspects of conservation. He suggested that the first step in conservation should be defining the categories of materials (plants/genes) for preservation and the major methods preserving them. He suggested that the following categories should be usually regarded as important.

1. Cultivated varieties in current use.
2. Obsolete cultivars.
3. Primitive cultivars or land races.
4. Wild species and weedy species closely related to cultivated varieties.
5. Wild species of potential value to man.
6. Special genetic stock developed by man.

The principle of any technology designed for germplasm conservation should be to preserve the maximum possible genetic diversity of a particular plant or genetic stock for future use. Diversity in plants is at the level of species, varieties and individuals. Special genetic stocks may include the material (mutant or breed lines with identified gene or gene combination) developed and used in on going breeding programme. It has been estimated that the survival of approximately 9,000 wild species of plants is some way threatened and that the majority of these are from tropical regions. This further highlights the need for a positive approach to conservation of endangered plants. When new cultivars replace the primitive or conventionally used agricultural crops, it becomes especially important that the crop be properly documented and conserved.

According to Swaminathan (1983) conservation methodologies can take the following three forms :

1. Entire biomass
2. *In situ* preservation
3. *Ex situ* preservation

Many ways are being suggested for preserving biodiversity,

1. No undisturbed land use.
2. Catalogues of genetic resources and national biological inventories be prepared.
3. Measures should be taken to reduce emission of green house gases and ozone destroying compounds. Some of them include following:
4. Effective measures for the conservation of biodiversity be developed and strengthened in all countries.

The details of these conservation methods made a separate sub-discipline of biodiversity studies called *conservation biology*. These techniques of conservation of biodiversity include:

1. *In situ* conservation
2. *Ex situ* conservation

Conservation of biodiversity can be achieved in a number of complementary ways. These methods, all of them falling within the broader concepts of gene banks.

EX-SITU CONSERVATION

"*Ex-situ*" conservation: It means the wild-life conservation in captivity under human care. In this, the endangered plants and animals are collected and bred under controlled conditions in gardens, zoos, sanctuaries etc., wild-life management in captivity have the following advantages:

(*i*) The organisms are assured of food, water, shelter and security and hence can have longer life span and longer span of breeding activity, thereby increasing the possibility of having more number of offsprings.

(*ii*) The chances of survival of endangered species increase because of human care under secure conditions.

(*iii*) This offers the possibility of using genetic techniques to improve the species concerned.

However, there are some disadvantages and limitations of wild-life management is captivity:

(*i*) Since maintenance and breeding of plants and animals under captivity is very expensive, it can be adopted only for a few selected species.

(*ii*) Wild-life captivity only under a set of favourable environmental conditions deprives the organisms the opportunity to adopt to ever-changing natural environment. Therefore, new life forms cannot evolve and thus the gene-pool gets stagnant.

Ex-situ conservation, using sample populations, is done through establishment of gene banks which include genetic resource centres, zoo's, botanical gardens, culture collections etc.

Ex-situ conservation, is the chief mode for preservation of genetic resources, which may include both cultivated and wild material. Generally seeds or in-vitro maintained plant cells, tissue and organs are preserved under appropriate conditions for long term' storage as gene banks. This requires considerable knowledge of the genetic structure of population sampling techniques, methods of regeneration and maintenance of varietal genepools, particularly in cross pollinated plants.

THE METHODS OF *EX-SITU* CONSERVATION

The practice of ex-situ conservation involves technique which are essentially meant to maintain, multiply or help the species to survive under natural conditions. These include—

(*i*) Long term captive breeding
(*ii*) Short term propagation and release
(*iii*) Animal translocations
(*iv*) Animal Reintroduction

Instead of the above methods there are three techniques also used for ex-situ conservation. They are —

(*i*) Seed banks
(*ii*) Gene banks
(*iii*) In-vitro
(*iv*) In-vivo

Certain conservation agencies, botanical gardens and many research institutions are also working in this field. Establishment of "Central Zoo Authority" by Govt. of India is another milestone in the way of Ex-situ conservation.

IN-SITU CONSERVATION

In-situ conservation is the conservation of ecosystem where all the flora, fauna and wildlife survive in tandem with nature. Development of gene sanctuaries, biosphere reserves, national parks, protected areas and reserve forests, where wildlife could grow and multiply, constitutes the vital forms of in-situ conservation. Development of biosphere reserves (in-situ conservation) has more than one advantage. It allows natural agencies of creating variation to act unabatedly, thus the range of natural variation continues to reshuffling and replenishing the plantation is never exhausted. The reserves are instrumental in preserving much of wildlife in the vicinity of human establishments.

Approximately 42% of the total geographical area of the country has been earmarked for extensive in-situ conservation of habitats and ecosys-

tem. A protected area network of 99 National Parks and 523 wildlife sanctuaries has been created. The results of this network have been significant in restoring viable population of large mammals such as tiger, lion rhinoceros, crocodiles, elephants etc. Ten biodiversity rich areas of the country have been designated as biosphere reserves.

In-situ means in the natural, original place or position, as in the location of the explant on the mother plant prior to excision. In-situ conservation which include conservation of plant and animals in their native ecosystems or even in man made ecosystem, where they naturally occur. This type of conservation applies only of wild fauna and flora and not to the domesticated animals and plants, because conservation is achieved by protection of populations in nature. This method of conservation mainly aims at preservation of land races with wild relatives in which genetic exists and/or in which the weedy/wild forms present hybrids with related cultivars. These are evolutionary systems that are difficult of plant breeders to stimulate and should not be knowingly destroyed.

The in-situ conservation of habitats has received high priority in the world conservation strategy programmes launched since 1980. Institutional, arrangement, especially in countries of the developing world, have been emphasized. This mode of conservation has some limitations however, there is risk of material being lost due to environmental hazards. Further the cost of maintaining a large portion of available genotypes in nurseries or fields may be extremely high.

In-situ conservation includes a system of protected areas of different categories e.g. National parks, Sanctuaries, National Monument, Cultural landscape, Biosphere Reserves etc. One of the best methods to save wildlife species, which is on the road to extinction, is to put it in a special enclosure to reproduce. Sanctuaries and National Parks, whose legal definition varies from country to country, best illustrate this.

NATIONAL PARKS, WILDLIFE SANCTUARIES AND BIOSPHERE RESERVES

National Parks or a Sanctuary may be defined as an area, declared by state, for the purpose of protecting, propagating or developing wild life therein, or its natural environment for their scientific educational and recreational value. Human activities like hunting, firewood, collection, timber harvesting etc. are restricted in these areas.

The creation of National Parks, Wildlife Sanctuaries and Biosphere Reserves in an attempt to manage wildlife by defining protected areas. Wildlife therein is regularly monitored and necessary management strategies for their perpetuation and preservation are formulated and implemented. These protected areas not only benefit wildlife, but indirectly humans too. Their protection means the protection of entire ecosystem, which is necessary to continue to enjoy the benefits that we may now receive from it.

A National Park is an area dedicated to conserve the scenery (or environment) and natural objects and the wildlife therein. In national parks, all private rights are non-existent and all forestry operations and other usages such as grazing of domestic animals are prohibited.

Sanctuaries are also of range between 100 sq. kms to 500 sq. kms. The boundaries of sanctuaries are often not well defined. Controlled biotic interference is permitted in sanctuaries which allow tourist activities as well.

The national reserve or biosphere reserve are usually large protected areas with boundaries circumscribed by legislation and are usually more than 5000 sq. kms in area. The protected area network in India includes 99 National Parks and 523 Wildlife Sanctuaries, 43 Conservation Reserves and three Community Reserves. Realizing the gigantic task of managing our protected areas The National Wildlife Action Plan (2002-2016) was adopted in 2002, emphasizing the people participation and their support for wildlife conservation.

TABLE

Important National Parks and Wildlife Sanctuaries in India

States	National Parks and Wildlife Sanctuaries
Andhra Pradesh	Pakhal Wildlife Sanctuary, Pocharam Wildlife Sanctuary, Kawal Wildlife Sanctuary, Kolleru
Arunachal Pradesh	Namdapha Pelicanary Wildlife Sanctuary
Assam (Asom)	Kaziranga National Park Manas Wildlife Sanctuary
Jharkhand	Hazaribagh National Park, Betla National Park
Goa	Mollen Wildlife Sanctuary
Gujarat	Gir National Park, Velavader National Prak Wild Ass
Haryana	Sultanpur Lake Bird Sanctuary
Jammu and Kashmir	Dechigam Wildlife Sanctuary
Karnataka	Bandipur National Park, Nagarhole National Park, Ranganthitto Bird Sanctuary, Silent Valley National Park
Kerala	Periyar Wildlife Sanctuary Wynad Wildlife Sanctuary
Madhya Pradesh	Kanha National Park, Shivpuri National Park, Bandhavgarh National Park, Panna National Park
Maharashtra	Tadoda National Park, Yawal Wildlife Sanctuary
Mainpur	Keibul Lamjao National Park
Meghalaya	Balpakram Sanctuary
Mizoram	Dampa Wildlife Sanctuary
Nagaland	Intangki Wildlife Sanctuary
Orissa	Simlipal National Park, Chilka Lake Bird Sanctuary
Punjab	Abohar Wildlife Sanctuary
Rajasthan	Ranthambore National Park, Sariska Wildlife Sanctuary Ghana Bird Sanctuary
Sikkim	Kanchenjunga National Park
Tamil Nadu	Mudumalai Wildlife Sanctuary, Vedanthangal Water Bird Sanctuary
Uttar Pradesh	Dudhwa National Park
Uttarakhand	Corbett National Park, Rajaji National Park,
West Bengal	Jaldapara Wildlife Sanctuary

TABLE

Biosphere Reserves in India

S. No.	Name	Year of Estbl.	Area (in km²)	Location
1.	Nilgiri	1986	5520	Part of Wynad, Nagarhole, Bandipur and Madumalai, Nilambur, Silent Valley and Siruvani hills (Tamil Nadu, Kerala and Karnataka)
2.	Nanda Devi	1988	5860.69	Part of Chamoli, Pithoragarh and Almora districts in (Uttarakhand)
3.	Nokrek	1988	820	Part of East, West and South Garo hills (Meghalaya)
4.	Manas	1989	2837	Part of Kokrajhar, Bongaigaon, Barpeta, Nalbari, Kamprup and Darang districts (Asom)
5	Sunderban	1989	9630	Part of delta of Ganges & Brahamaputra river system in West Bengal.
6.	Gulf of Mannar	1989	10,500	Indian part of Gulf of Mannar extending from Rameswaram island in the North Kanyakumari in the South of (Tamil Nadu)
7.	Great Nicobar	1989	885	Southern most islands of Andaman and Nicobar (A&N Islands)
8.	Similipal	1994	4374	Part of Mayurbhanj (Orissa)
9.	Dibru-Saikhova	1997	765	Part of Dibrugarh and Tinsukia (Asom)
10.	Dehang-Dibang	1998	5111.50	Part of Upper Siang, West Siang and Dibang Valley (Arunachal Pradesh)
11.	Pachmarhi	1999	4981.72	Part of Betul, Hoshangabad and Chhindwara (M.P.)
12.	Khangchendzonga	2000	2931.12	Part of North and West districts in Sikkim.
13.	Agasthyamalai	2001	3500.36	Part of Thirunelveli and Kanyakumari (Tamil Nadu) and Thiruvanthapuram, Kollam and Pathanmthitta (Kerala)
14.	Achanakmar-Amarkantak	2005	3835.51	Parts of Anuppur and Dindori districts of M.P. and Bilaspur (Chhattisgarh)
15.	Kachchh	2008	12,454	Part of Kachchh, Rajkot, Surendranagar and Patan districts in Gujarat.
16.	Cold Desert	2009	7,770	Pin Valley National Park and surroundings; Chandratal & Sarchu; and Kibber Wildlife sanctuary in Himachal Pradesh
17.	Seshachalam	2010	4755.997	Seshachalam hill ranges in Eastern Ghats encompassing part of Chittoor and Kadapa Andhra Pradesh
18.	Panna	2011	2998.98	Part of Panna and Chhattarpur (M.P.)

EVOLUTION

Evolution is descent wit...