

U 1 - - - - - naturally preserved,  
— x ———— end

## (B) Ex-situ conservation:- (1)

Ex-situ conservation literally means, "off-site conservation." It is the process of protecting an endangered species, <sup>Botanical</sup> ~~extinct~~ <sup>of site</sup> ~~species~~ vulnerable species, different variety <sup>of</sup> or breed of plants or animal outside its natural habitat. For example, by removing part of the population from a threatened habitat and placing it in a new location, wild area or within the care of humans.

Ex-situ conservation may include:-

- 1/ Botanical Gardens & Arboreta.
- 2/ Zoo & Aquarium
- 3/ Seed Banks
- 4/ Gene Banks
- 5/ Cryopreservation

## 1) Botanical garden & Arboreta

A botanical garden is a place where the different plant species especially endangered rare can be preserved for the research purposes.

An arboretum is a botanical collection composed exclusively of tree. An Arboretum is an area devoted to specimens. It is plantings of trees and shrubs. It is a place where many varieties of trees are grown for research, education and ornamental purposes, where trees and shrubs are cultivated for exhibition.

There are botanical gardens & arboreta in the world containing more than 80,000 species. In India, 35 botanical gardens are there. There are some botanical parks in India.

<u>Name</u>	<u>State</u>
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1. Botanical garden, — Assam  
Guwahati
2. Sanjay Gandhi, — Bihar  
Jai Vik Udyan,  
Patna
3. Hyderabad Botanical — Telangana  
Garden
4. Botanical Garden — Chandigarh.  
(Punjab University)
5. Botanical garden — Gujarat.  
Vaghai, Saputara

(14)

(10)

(3)

(23)

6. Cubbon Park, — Karnataka  
Bangalore
  7. Curzon Park — Karnataka,  
Mysore
  8. Jawaharlal  
Nehru Tropical  
Botanical  
Garden &  
Research — Kerala.
  9. Jawaharlal — Kerala  
Nehru Tropical  
Botanical Garden & Research,  
in Shilp, Trivendrum — Odisha
  10. Odisha State Botanical Garden, — etc  
Nandankanan, Bhubaneswar.
- There are 80,000 plant species are grown in B.G.  
This is about 30% of world's plants. Kew Garden  
has about 25000 species, about 10% of which  
are globally threatened, most plant lack  
the complex behaviors that making it  
easier to keep them alive & breeding.

## ② Zoo & Aquarium

Zoo and Aquarium are the restricted  
area for the conservation of animals in our  
side the natural habitats. There are 800  
managed zoos. ~~with~~ having 7000-vertebrate  
species. eg. Amphibians, reptiles, birds, mammals.  
Majority of these zoos have well developed  
captive breeding programmes. In India  
275-zoo, deer parks, safari parks and  
aquaria are there. It is involved for  
rearing of threatened animals.



(13) (4)

(24)

Zoos are relatively good places for maintaining species in captivity & for captive breeding programs.

In human, artificial insemination or embryo transfer to surrogate mother is creating that closely related species. The whooping crane is an endangered bird that breeds in Canada & winters in Texas.  
① less than 200 species are left in the wild.

In many species, the reproductive rate can be increased by taking young (or eggs) away from their parents, so that the parent starts to breed again more rapidly.

Some places, like the San Diego Zoo, have made the breeding of endangered species a major part of their mission & have devoted considerable resources to captive breeding programs.  
The Zoological Society of San Diego has established a frozen zoo to store more than 355 species of different animals including reptiles, birds & mammals.

### ③ Seed Banks

Rare plants and rearing of threatened animal species in botanical & zoological gardens. Preserved the former in the form of seed banks by means of tissue culture techniques.

In seed banks, the seeds are kept in cold, dark conditions, which slow down the metabolism & prevents the seeds from germination. In this state, they can be preserved for many years (even decades).

(16) (5) (25)  
Currently about 10,000 - 20,000 of the world's plants are represented in seed banks. Some seed banks (one at Kew-England) have goals of obtaining not only a high representation of the world's.

Recalcitrant seeds are seeds that don't survive drying and freezing during ex-situ conservation & vice-versa. These seeds cannot resist the effects of drying & temperatures less than  $10^{\circ}\text{C}$ . Thus, they cannot be stored for long periods like orthodox seeds, because, they lose their viability. eg - Mango, lychee, cocco, Rubber tree, *Alseodaphne*, *Sesuvium*, medicinal plants.

Orthodox seeds are long lived seeds & can be successfully dried to moisture contents as low as 5% without injury & are able to tolerate freezing. In fact, the life span of orthodox seeds can be prolonged with low moisture content & freezing temperature. Ex-situ-Conservation of orthodox seeds is therefore, not problematic. eg - *Citrus aurantifolia*, *capsicum annum*, *Hamelia patens*, *Lantana camara*, guava (*Psidium guajava*), cashew (*Anacardium occidentale*) & most grains & legume type.

A seed bank stores seeds to preserve genetic diversity, hence, it is a type of gene bank. There are many reasons to store seeds. One is to preserve the genes that plant breeders need to increase yield, disease resistance, drought tolerance, nutritional quality, taste - etc of crops.



#### ④ gene banks :

(18) (16) (26)  
- A collection of seeds, plants & animals, maintained as a repository of genetic material, typically to preserve genetic diversity.

⑤

Cryopreservation -

It is a

in vitro

conservation

of genetic material

for preserving vegetatively propagated crops

eg. Potato, seeds of plants, preserving sperms & eggs, embryonic tissues of animals etc.

It is a technique for preserving vegetatively propagated crops

eg. Potato, seeds of plants, preserving sperms & eggs, embryonic tissues of animals etc.

Gene banks are a type of bio-repository which preserve genetic material. For Plants, this is done by in-vitro storage, freezing cuttings from the plant or storing the seeds. For animals, this is done by the freezing of sperms & eggs in Zoological freezers until further need.

Genetic material in a gene bank is preserved in a variety of ways, such as freezing at  $-196^{\circ}\text{C}$  in liquid nitrogen, being placed in artificial ecosystems & put them in controlled nutrient mediums.

National Bureau of Plant Genetic Resources (NBPGR) is located in New Delhi. Here, major agricultural & horticultural crops & their wild relatives are preserved by cryo-preservation of seeds, pollen etc. by using liquid nitrogen at low temp  $-196^{\circ}\text{C}$ . This process is called Cryopreservation. eg.

Brassica, turnip, Radish, Tomato, Onion, Carrot, Chilli, tobacco, Poppy etc. can be preserved successfully in liquid nitrogen for several years without losing seed viability.

N B A G R is located

at Karnal, Haryana. It preserves the semen of domesticated bovine animals.

15 countries have also resolved to set up a network of gene banks to facilitate the conservation of various varieties of aromatic & medicinal plants for which India is the natural co-ordinating country.