Conservation biology

**Conservation biology** is the scientific study of the nature and status of [Earth](http://en.wikipedia.org/wiki/Earth)'s [biodiversity](http://en.wikipedia.org/wiki/Biodiversity) with the aim of protecting [species](http://en.wikipedia.org/wiki/Species), their [habitats](http://en.wikipedia.org/wiki/Habitats), and [ecosystems](http://en.wikipedia.org/wiki/Ecosystems) from excessive rates of [extinction](http://en.wikipedia.org/wiki/Extinction).

*In Situ* Conservation Methods

In-situ conservation, the conservation of species in their natural habitats, is considered the most appropriate way of conserving biodiversity.

Conserving the areas where populations of species exist naturally is an underlying condition for the conservation of biodiversity. That's why protected areas form a central element of any national strategy to conserve biodiversity.

*Ex Situ* Conservation Methods

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.  Some of these include:

* Gene banks, e.g. seed banks, sperm and ova banks, field banks;
* In vitro plant tissue and microbial culture collections;
* 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.

Ex-situ conservation measures can be complementary to in-situ methods as they provide
an "insurance policy" against extinction. These measures also have a valuable role to play in recovery programmes for endangered species.  The Kew Seed Bank in England has 1.5 per cent of the world's flora - about 4,000 species - on deposit.

In agriculture, ex-situ conservation measures maintain domesticated plants which cannot survive in nature unaided.

Ex-situ conservation provides excellent research opportunities on the components of biological diversity. 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.

Ex situ conservation measures should support in-situ conservation measures (in-situ conservation should be the primary objective).

The role of *Protected Areas* in maintaining biodiversity

A protected area is a geographically defined area that is designated or regulated and managed to achieve specific conservation objectives. It may be set aside for the protection of biological diversity, and of natural and associated cultural resources and is managed through legal or other effective means.

This includes national parks and nature reserves, sustainable use reserves, wilderness areas and heritage sites

Protected areas (Pas) have been widely used as a conservation tool in order to maintain a representative sample of unaltered species and eco-systems for the future, and to limit the potential for environmental degradation through human mismanagement of resources.

At present, approximately 8,500 PAs exist throughout the world in 169 countries.  This covers about 750 million hectares of marine and terrestrial ecosystems, which amounts to 5.2 % of the Earth’s land surface.

The World Conservation Union (IUCN) has a key role in promoting the establishment of protected areas throughout the world.  Since 1948, IUCN has developed standards and guidelines for PA management.  Protected areas have been established following the categories defined by the IUCN.

(It should be noted that strict protection categories (categories I – III) have mostly been applied in the developing countries, whereas categories V and VI are the most commonly used in the developed world).

**Category I** Strict Protection. Sometimes called strict nature reserve/wilderness areas. Protected areas managed mainly for science or wilderness protection. Generally smaller areas where the preservation of important natural values with minimum human disturbance are emphasized.

**Category II** Ecosystem Conservation and Tourism. Sometimes called national parks. Generally larger areas with a range of outstanding features and ecosystems that people may visit for education, recreation, and inspiration as long as they do not threaten the area's values.

**Category III** Conservation of Natural Features. Sometimes called natural monuments. Similar to National Parks, but usually smaller areas protecting a single spectacular natural feature or historic site.

**Category IV** Conservation through Active Management. Sometimes called habitat and wildlife (species) management areas. Areas managed to protect and utilise wildlife species.

**Category V** Landscape/Seascape Conservation and Recreation. Sometimes called protected landscapes/seascapes.

**Category VI** Sustainable Use of Natural Ecosystems. Sometimes called managed resource protected areas. Protected areas managed mainly for the sustainable use of natural ecosystems.

In the past, it was assumed that the best way to preserve biodiversity was to conserve it through protected areas by reducing human activities or completely excluding humans.  Population growth and poverty were seen as main causes of environmental degradation; people were regarded as a problem from which the environment needed protecting.  Accordingly, protected areas and parks were fenced off from local people, traditional practices were prohibited, and people were held under penalties of fines or imprisonments for utilising park resources.  However, there are very controversial scientific and social problems with this approach, which was characterized by serious conflicts between local communities and the state.

This therefore led to a transformation in thinking and the recognition that:

1.      Local people understand their environment and have extensive knowledge of the resources within their local environment

2.      The exclusion of local people from protected areas may actually lead to impoverishment of their biological diversity, with both ecological and social costs

3.      Traditional practices enable people to live with nature in a mutually beneficial way.   For example, instead of banning hunting altogether, a series of regulations could be put in place to regulate hunting, i.e., prohibitions on killing juveniles, or pregnant females

4.      Many communities still do not see wildlife and the environment as their own property because they are not involved in decision-making and have little responsibility in conservation projects

5.      Revenues earned from PAs have not always been passed on to communities

PA management has taken on a more holistic approach to assessing biodiversity and environmental protection -   it has to be effective in linking conservation with human needs.  PA management must take into account the local people’s realities, that is, policy formulation must be based on a more realistic understanding of the social and political dimensions of natural resources management.

**ADDITONAL SOURCE MATERIAL**

**Taken from** <http://www.countrysideinfo.co.uk/biodvy2.htm>

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| **How do we Conserve Biodiversity?***There are two main ways to conserve biodiversity. These are termed ex situ (i.e. out of the natural habitat) and in situ (within the natural habitat)*  |
| **Ex Situ Conservation** - **out of the natural habitat** |
| **(Species-based)*** **Zoos** - These may involve captive breeding programmes,
* **Aquaria** - research, public information and education
* **Plant Collections**- breeding programmes and seed storage

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| **ZOOS** |
| AN01124_.wmf (24236 bytes) | In the past, zoos were mainly display facilities for the purpose of public enjoyment and education. As large numbers of the species traditionally on display have become rarer in the wild, many zoos have taken on the additional role of building up numbers through captive breeding programmes. |
| Although comparatively far more invertebrates than vertebrates face extinction, most captive breeding programmes in zoos focus on vertebrates. Threats to vertebrate extinction tend to be well publicised (e.g. Dormouse, Panda). People find it easier to relate to and have sympathy with animals which are more similar to ourselves, particularly if they are cute and cuddly (at least in appearance, if not in fact!). Not many visitors to zoos are likely to get excited over the prospect of the zoo 'saving' a tiny beetle, which they can barely see, let alone spiders or other invertebrates which often invite horror rather than wonder. Vertebrates therefore serve as a focus for public interest. This can help to generate financial support for conservation and extend public education to other issues. This is a very important consideration, as conservation costs money and needs to be funded from somewhere.The focus on vertebrates is not solely pragmatic. Many of the most threatened vertebrates are large top carnivores, which the world stands to lose in disproportionate numbers. Such species require extensive ranges to provide sufficient prey to sustain them. In many cases, whole habitats for these predators have all but disappeared. Some biased expenditure on their survival may therefore be justified.Several species are now solely represented by animals in captivity. Captive breeding programmes are in place for numerous species. At least 18 species have been reintroduced into the wild following such programs. In many cases the species was actually extinct in the wild at the time of reintroduction (Arabian Oryx, Pere David Deer, American Bison). In some cases, all remaining individuals of a species, whose numbers are too low for survival in the wild, have been captured and the species has then been reintroduced after captive breeding (California Condor).The role of zoos in conservation is limited both by space and by expense. At population sizes of roughly 100-150 individuals per species, it has been estimated that world zoos could sustain roughly 900 species. Populations of this size are just large enough to avoid inbreeding effects. However, zoos are now shifting their emphasis from long-term holding of species, to returning animals to the wild after only a few generations. This frees up space for the conservation of other species.Genetic management of captive populations via stud records is essential to ensure genetic diversity is preserved as far as possible. There are now a variety of international computerised stud record systems which catalogue genealogical data on individual animals in  zoos around the world. Mating can therefore be arranged by computer, to ensure that genetic diversity is preserved and in-breeding minimised (always assuming the animals involved are prepared to co-operate).Research has led to great advances in technologies for captive breeding. This includes techniques such as artificial insemination, embryo transfer and long-term cryogenic (frozen) storage of embryos. These techniques are all valuable because they allow new genetic lines to be introduced without having to transport the adults to new locations. Therefore the animals are not even required to co-operate any longer. However, further research is vital. The success of zoos in maintaining populations of endangered species is limited. Only 26 of 274 species of rare mammals in captivity are maintaining self-sustaining populations.**Reintroduction of species to the wild poses several different problems.*** **Diseases**The introduction of new diseases to the habitat, which can decimate existing wild populations. Alternatively, the loss of resistance to local diseases in captive-bred populations.
* **Behaviour**Behaviour of captive-bred species is also a  problem. Some behaviour is genetically determined and innate, but much has to be learned from other adults of the species, or by experience. Captive-bred populations lack the *in situ*learning of their wild relatives and are therefore at a huge disadvantage in the wild. In one case of reintroduction, a number of monkeys starved because they had no concept of having to search for food to eat - it had always been supplied to them in captivity. In the next attempt, the captive monkeys were taught that they had to look for food, by hiding it in their cages, rather than just supplying it.
* **Genetic Races** Reintroduced populations may be of an entirely different genetic make-up to original populations. This may mean that there are significant differences in reproduction habits and timing, as well as differences in general ecology. Reintroduction of individuals of a species into an area where the species has previously become extinct, is in many cases just like introducing a foreigner. The Large Copper Butterfly is a good example of this. Although extinct in Britain, it persists in continental Europe. There have been over a dozen attempts to re-establish it in Britain over the last century, but none have been successful. This is probably due to the differing ecology of the introduced races. Replacement of extinct populations by reintroduction from other areas may not therefore be an option.
* **Habitat**The habitat must be there for reintroduction to take place. In many cases, so much habitat has been destroyed, that areas must first be restored to allow captive populations to be reintroduced. Suitable existing habitats will also (unless the species is extinct in the wild) usually already contain wild members of the species. In this case, it is likely that within the habitat, there are already as many individuals as the habitat can support. The introduction of new individuals will only lead to stress and tension as individuals fight for limited territory and resources such as food. In this case, nothing positive has been accomplished by reintroduction, it has merely increased the stress on the species. It may even in some cases result in a decrease in numbers. In contrast, the provision of additional restored habitat nearby can allow wild populations to expand into it without the need for reintroduction.

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