

Loss of biodiversity

Causes of the loss of biodiversity

The main cause of the loss of biodiversity can be attributed to the influence of human beings on the world's ecosystem, In fact human beings have deeply altered the environment, and have modified the territory, exploiting the species directly, for example by fishing and hunting, changing the biogeochemical cycles and transferring species from one area to another of the Planet.

The threats to biodiversity can be summarized in the following main points:

1. **Alteration and loss of the habitats:** the transformation of the natural areas determines not only the loss of the vegetable species, but also a decrease in the animal species associated to them. Refer to "Alteration and loss of the habitats".
2. **Introduction of exotic species and genetically modified organisms:** species originating from a particular area, introduced into new natural environments can lead to different forms of imbalance in the ecological equilibrium. Refer to, "Introduction of exotic species and genetically modified organisms".
3. **Pollution:** human activity influences the natural environment producing negative, direct or indirect, effects that alter the flow of energy, the chemical and physical constitution of the environment and abundance of the species;
4. **Climate change:** for example, heating of the Earth's surface affects biodiversity because it endangers all the species that adapted to the cold due to the latitude (the Polar species) or the altitude (mountain species).
5. **Overexploitation of resources:** when the activities connected with capturing and harvesting (hunting, fishing, farming) a renewable natural resource in a particular area is excessively intense, the resource itself may become exhausted, as for example, is the case of sardines, herrings, cod, tuna and many other species that man captures without leaving enough time for the organisms to reproduce.

Changes in and loss of habitats

One of the greatest threats for the survival of the species are the changes, loss and fragmentation of their habitat. Human beings, in fact, have deeply modified the territory, as a result of a large growth in the population, industrial development, the expansion of transportation networks, and agriculture and fishing on an industrial scale. An example of the consequences of the changes in the habitats can be seen In the Mediterranean Sea. *Posidonia oceanica* is an endemic marine plant in the Mediterranean that forms submerged sea grass meadows on the sandy bottom, which are a fundamental component of the equilibrium and of the richness of the sea coast environment. This plant has a great environmental value, in fact, one square metre of sea grass meadow can produce 10 to 15 litres of oxygen per day. Furthermore the meadows give shelter to a great variability of biological species, both vegetable and animal, (400 vegetable species and approximately 1000 animal species), in fact many animals find food and shelter there. Another important function carried out by *Posidonia* is to protect the sea coast, where it guarantees stability, acting as a protection from sea currents and the waves. It has been calculated that a regression of only one metre of the sea grass meadows can lead to a loss of about 15-18 metres of sandy coastline. Among the principal causes of danger for the *Posidonia* sea grass meadows is the fishing activity with bottom trawling nets that tear away the plants leaving the subsoil uncovered; and subsequent recolonization of these plants becomes difficult. If the meadows disappear, the principal effects will be: a loss of biodiversity, a change in the trophic network, a decrease in productivity with consequent damage to fishing itself, a change in the metabolizing process of trophic chains, an increase in coastal erosion, and the consequent decrease in the quality of the environment.

During the last century, changes in the territory consisted mainly of an increase in the surface area taken by agriculture and livestock farming, an increase in the urban areas, the development of road networks and the related infrastructures,

the construction of hydroelectric plants and hydraulic plants, exploitation of underground deposits and fishing with more powerful boats and more efficient nets. Due to these changes, the natural environments are changed, destroyed and subdivided, which cause the loss, and division into small parts, of the habitats. The importance of the loss of the habitats is surely intuitive, while the concept of "fragmentation" is more difficult to understand. Fragmentation of the habitat is a division of the territory into various smaller areas that can remain, in some way connected to each other or may be totally isolated. The consequence of this leads to the subdivision of populations distributed in that particular area which are, therefore, less consistent than the original population. For this reason populations become more vulnerable to external stress, to climatic changes, to anthropic disturbance, epidemics and genetic deterioration due to cross-breeding among the population that is "related".

For example, it is calculated that every year approximately one million specimens of amphibians in the region of Lombardy, are affected by car traffic. In particular, the species that are most affected by this problem are the green frogs (*Rana kl. esculenta*) and the common toads (*Bufo bufo*). When these animals move toward the reproduction areas, they are forced to cross a number of asphalted roads that are often found around the waterways in Lombardy. Therefore the adult breeder specimens face mass extermination due to their slow and clumsy movement at dusk or during the night hours, before they have laid their eggs. It has been shown that the impact of roads can cause the extinction of these populations of amphibians.

Introduction of exotic species and genetically modified organisms (GMO)

Often a very important factor is neglected, which is the introduction of allochthonous species, i.e. species whose origin is in other geographic areas and that therefore have not adapted, through the long natural selection processes, to the new environment in which they are introduced.

It has been calculated that approximately 20% of the cases of extinction of birds and mammals is due to the direct action of animals introduced by man. The reason for this extinction can be attributed to various causes: to competition for limited resources, to predation by the "new" species, to the diffusion of new diseases and to the damages that the species that have been introduced can cause to the natural vegetation, to the cultivations and to zootechnics. An example of the problem in Europe is seen in the introduction of the grey squirrel (*Sciurus carolinensis*) imported from North America, that is replacing the red European squirrels (*Sciurus vulgaris*). Also the red eared slider (*Trachemis scripta elegans*) was imported into Italy from the United States as a pet animal, but when people started to free them in the ponds (because they became too big) this triggered a competitive mechanism between the American slider and the European pond turtle (*Emys orbicularis*).

Another problem that causes the loss of biodiversity is to be attributed to the introduction in the environment of genetically modified organisms (GMO) that are also known as transgenic organisms. A GMO is an organism, in whose chromosomes a foreign gene, taken from an organism of a different species, is inserted with genetic engineering techniques. In this way it is possible to create a new organism with particular desired characteristics: for example some organisms of the vegetable kingdom may become more resistant to herbicides or harmful insects; some livestock animals become more productive or more resistant to infections. With regard to the potential harmfulness of the GMO there is a violent debate between those who believe that the advantages for medicine and for society are greater than the possible effects on the environment, and those who state that too little is known to be able to use them, and that the environment will feel the effect of the genetic pollution of the natural species with numerous consequences: the involuntary transmission of resistance to herbicides in infesting plants, the evolution of more resistant parasites, the increased use of herbicides, the disappearance of species of insects and as a consequence the loss of biodiversity. Examples of GMO are to be found in two particular plants: maize and soya. In maize, resistance to harmful insects is obtained by introducing the Bt gene of the *Bacillus thuringiensis* bacterium. This bacterium, that lives in the soil, produces a protein that becomes toxic only in the insect's intestine, and causes its death. The protein is not toxic for humans nor for other animals, in fact, before the invention of these sophisticated techniques in genetic engineering, it was used as a natural insecticide, particularly in Canada to protect the forests from insect attacks. This technology, for the maize plants, leads to a decrease in the harmful insects and contamination by bacteria, virus and fungi, that can produce mycotoxins that are carcinogenic. The above technique is applied to soya in order to make it more resistant to

herbicides; in particular to glyphosate and glyphosinate, that are biodegradable herbicides that are harmless for man and animals, but can kill all the plants. In this way it is possible to eradicate all the infesting plants without the need for further treatments with products that are extremely harmful for man and the environment.