Threats to Biodiversity

Inquire: Threats to Biodiversity

Overview

The core threats to biodiversity are human population growth and unsustainable resource use. To date, the most significant causes of extinction are habitat loss, introduction of exotic species, and overharvesting. Habitat loss occurs through deforestation, damming of rivers, and other activities. Overharvesting is a threat particularly to aquatic species, but the taking of bushmeat in the humid tropics threatens many species in Asia, Africa, and the Americas. Exotic species have been the cause of a number of extinctions and are especially damaging to islands and lakes. Climate change is forcing range changes that may lead to extinction. It is also affecting adaptations to the timing of resource availability that negatively affects species in seasonal environments. The impacts of climate change are currently greatest in the arctic. Global warming will also raise sea levels, eliminating some islands and reducing the area of all others.

Big Question: What are the significant threats to biodiversity?

Watch: Three Threats to Biodiversity

Biodiversity, the variety in plants, animals, and other living organisms on our planet, is an important part of the life cycle and balance of our planet. Creatures interact in a way that is mutually beneficial, such as planets filtering toxins from our air.

When biodiversity declines, ecosystems struggle to survive. Biodiversity declines when certain species in an ecosystem have a low population or are completely gone. Local threats to biodiversity include habitat loss, overharvesting, and the introduction of exotic species in the ecosystem. Humans are unique in this as they can more easily move or adapt to changes in the environment than other species.

Habitat loss is when an entire habitat has been removed from an ecosystem and a species struggles to survive. One example of habitat loss is when a body of water is dredged, which basically means it’s drained of all water. Obviously, this means that the fish in that habitat can no longer survive due to lack of water.

Overharvesting is a very similar threat to habitat loss, where humans overharvest the resources in an area. One example of overharvesting is overfishing of certain specific marine life, such as whales, which are nearly extinct.

The introduction of exotic, completely foreign species can greatly influence biodiversity. These species usually come into the ecosystem through humans who intentionally or accidentally bring the new species
Let's discuss in more detail the significant threats to biodiversity.

**Read: Threats to Biodiversity**

**Overview**

The core threat to biodiversity on the planet is the combination of human population growth and the resources used by that population. The human population requires resources to survive and grow, and those resources are being removed from the environment in a way that the environment just can’t keep up with. The three greatest local threats to biodiversity are habitat loss, overharvesting, and introduction of exotic species. The first two of these are a direct result of human population growth and resource use. The third results from increased mobility and trade. A fourth major cause of extinction, anthropogenic (human-caused) climate change, has not yet had a large impact, but it is predicted to become significant during this century. Global climate change is also a consequence of human population needs for energy and the use of fossil fuels to meet those needs. Environmental issues, such as toxic pollution, have specific targeted effects on species, but are not generally seen as threats at the magnitude of the others.

**Habitat Loss**

Humans rely on technology to modify their environment and replace certain functions that were once performed by the natural ecosystem. Other species cannot do this. Elimination of their habitat — whether it is a forest, coral reef, grassland, or flowing river — will kill the individuals in the species. Remove the entire habitat within the range of a species and, unless they are one of the few species that do well in human-built environments, the species will become extinct. Human destruction of habitats accelerated in the latter half of the 20th century. Consider the exceptional biodiversity of Sumatra; it is home to one species of orangutan, a species of critically endangered elephant, and the Sumatran tiger, but half of Sumatra’s forest is now gone. The neighboring island of Borneo, home to the other species of orangutan, has lost a similar area of forest. Forest loss continues in protected areas of Borneo. The orangutan in Borneo is listed as endangered by the International Union for Conservation of Nature (IUCN), but it is simply the most visible of thousands of species that will not survive the disappearance of the forests of Borneo. The forests are removed for timber and to plant palm oil plantations. Palm oil is used in many products including food products, cosmetics, and biodiesel in Europe. A five-year estimate of global forest cover loss for the years from 2000 to 2005 was 3.1 percent. Much loss (2.4 percent) occurred in the humid tropics where forest loss is primarily from timber extraction. These losses certainly also represent the extinction of species unique to those areas.

Habitat destruction can affect ecosystems other than forests. Rivers and streams are important ecosystems and are frequently the target of habitat modification through building and from damming or water removal. Damming of rivers affects flows and access to all parts of a river. Altering a flow regime can reduce or eliminate populations that are adapted to seasonal changes in flow. For example, an estimated 91 percent of river lengths in the United States have been modified with damming or bank modifications. Many fish species in the United States, especially rare species or species with restricted distributions, have seen declines caused by river damming and habitat loss. Research has confirmed that species of amphibians that must carry out parts of their life cycles in both aquatic and terrestrial habitats
are at greater risk of population declines and extinction because of the increased likelihood that one of their habitats or access between them will be lost. This is of particular concern because amphibians have been declining in numbers and going extinct more rapidly than many other groups for a variety of possible reasons.

Overharvesting

Overharvesting is a serious threat to many species, but particularly to aquatic species. There are many examples of regulated fisheries monitored by fisheries scientists that have nevertheless collapsed. The western Atlantic cod fishery is the most spectacular recent collapse. While it was a hugely productive fishery for 400 years, the introduction of modern factory trawlers in the 1980s and the pressure on the fishery led to it becoming unsustainable. The causes of fishery collapse are both economic and political in nature. Most fisheries are managed as a common resource, available to anyone willing to fish, even when the fishing territory lies within a country’s territorial waters.

Common resources are subject to an economic pressure known as the **tragedy of the commons**, in which fishers have little motivation to exercise restraint in harvesting a fishery when they do not own the fishery. The general outcome of harvests of resources held in common is their overexploitation. While large fisheries are regulated to attempt to avoid this pressure, it still exists in the background. This overexploitation is exacerbated when access to the fishery is open and unregulated and when technology gives fishers the ability to overfish. In a few fisheries, the biological growth of the resource is less than the potential growth of the profits made from fishing if that time and money were invested elsewhere. In these cases — whales are an example — economic forces will drive toward fishing the population to extinction.

Coral reefs are extremely diverse marine ecosystems that face peril from several processes. Reefs are home to one third of the world’s marine fish species — about 4,000 species — despite making up only one percent of marine habitat. Most home marine aquaria house coral reef species are wild-caught organisms — not cultured organisms. Although no marine species is known to have been driven extinct by the pet trade, there are studies showing that populations of some species have declined in response to harvesting, indicating that the harvest is not sustainable at those levels. There are also concerns about the effect of the pet trade on some terrestrial species such as turtles, amphibians, birds, plants, and even the orangutans.

**Bushmeat** is the generic term used for wild animals killed for food. Hunting is practiced throughout the world, but hunting practices, particularly in equatorial Africa and parts of Asia, are believed to threaten several species with extinction. Traditionally, bushmeat in Africa was hunted to feed families directly; however, recent commercialization of the practice now has bushmeat available in grocery stores, which has increased harvest rates to the level of unsustainability. Additionally, human population growth has increased the need for protein foods that are not being met from agriculture. Species threatened by the bushmeat trade are mostly mammals including many monkeys and the great apes living in the Congo basin.

**Reflect Poll: Threats to Biodiversity**

The core threat to biodiversity on the planet is the combination of human population growth and the resources used by that population. The human population requires resources to survive and grow, and those resources are being removed unsustainably from the environment. The three greatest proximate threats to biodiversity are habitat loss, overharvesting, and the introduction of exotic species.
Based on what you know about threats to biodiversity, what steps would you want to take to prevent them?

- Removing invasive or exotic species through picking (plants) or hunting
- Planting native species that are low in population
- Conserving water
- Donating to local conservation efforts
- Volunteering with local conservation efforts

**Expand: Exotic Species**

**Exotic species** are species that have been intentionally or unintentionally introduced by humans into an ecosystem in which they did not evolve. Human transportation of people and goods, including the intentional transport of organisms for trade, has dramatically increased the introduction of species into new ecosystems. These new introductions are sometimes at distances that are well beyond the capacity of the species to ever travel itself and outside the range of the species’ natural predators.

Most exotic species introductions probably fail because of the low number of individuals introduced or poor adaptation to the ecosystem they enter. Some species, however, have characteristics that can make them especially successful in a new ecosystem. These exotic species often undergo dramatic population increases in their new habitat and reset the ecological conditions in the new environment, threatening the species that exist there. When this happens, the exotic species also becomes an invasive species. Invasive species can threaten other species through competition for resources, predation, or disease.

Lakes and islands are particularly vulnerable to extinction threats from introduced species. In Lake Victoria, the intentional introduction of the Nile perch was largely responsible for the extinction of about 200 species of cichlids. The accidental introduction of the brown tree snake via aircraft from the Solomon Islands to Guam in 1950 has led to the extinction of three species of birds and three to five species of reptiles endemic to the island. Several other species are still threatened. The brown tree snake is adept at exploiting human transportation as a means to migrate; one was even found on an aircraft arriving in Corpus Christi, Texas. Constant vigilance on the part of airport, military, and commercial aircraft personnel is required to prevent the snake from moving from Guam to other islands in the Pacific, especially Hawaii. Islands do not make up a large area of land on the globe, but they do contain a disproportionate number of endemic species because of their isolation from mainland ancestors.

Many introductions of aquatic species, both marine and freshwater, have occurred when ships have dumped ballast water taken on at a port of origin into waters at a destination port. Water from the port of origin is pumped into tanks on a ship empty of cargo to increase stability. The water is drawn from the ocean or estuary of the port and typically contains living organisms such as plant parts, microorganisms, eggs, larvae, or aquatic animals. The water is then pumped out before the ship takes on cargo at the destination port, which may be on a different continent. The zebra mussel was introduced to the Great Lakes from Europe prior to 1988 in ship ballast. The zebra mussels in the Great Lakes have cost the industry millions of dollars in clean up costs to maintain water intakes and other facilities. The mussels have also altered the ecology of the lakes dramatically. They threaten native mollusk populations, but have also benefited some species, such as smallmouth bass. The mussels are filter feeders and have dramatically improved water clarity, which in turn has allowed aquatic plants to grow along shorelines, providing shelter for young fish where it did not exist before. The European green crab, *Carcinus maenas*, was introduced to San Francisco Bay in the late 1990s, likely in ship ballast water, and has spread north along the coast to Washington. The crabs have been found to dramatically reduce the abundance of native clams and crabs with resulting increases in the prey of native crabs.
Invading exotic species can also be disease organisms. It now appears that the global decline in amphibian species recognized in the 1990s is, in some part, caused by the fungus *Batrachochytrium dendrobatidis*, which causes the disease *chytridiomycosis*. There is evidence that the fungus is native to Africa and may have been spread throughout the world by transport of a commonly used laboratory and pet species: the African clawed frog, *Xenopus laevis*. It may well be that biologists themselves are responsible for spreading this disease worldwide. The North American bullfrog, *Rana catesbeiana*, which has also been widely introduced as a food animal but which easily escapes captivity, survives most infections of *B. dendrobatidis* and can act as a reservoir for the disease.

Early evidence suggests that another fungal pathogen, *Geomyces destructans*, introduced from Europe is responsible for *white-nose syndrome*, which infects cave-hibernating bats in eastern North America and has spread from a point of origin in western New York State. The disease has decimated bat populations and threatens extinction of species already listed as endangered: the Indiana bat, *Myotis sodalis*, and potentially the Virginia big-eared bat, *Corynorhinus townsendii virginianus*. How the fungus was introduced is unknown, but one logical presumption would be that recreational cavers unintentionally brought the fungus on clothes or equipment from Europe.

### Lesson Toolbox

#### Additional Resources and Readings

- A quick video explaining the importance of biodiversity
  
  - Link to resource: https://www.youtube.com/watch?v=GK_vRtHZu4

- View a brief video discussing the role of marine ecosystems in supporting human welfare and the decline of ocean ecosystems.
  
  - Link to resource: https://video.nationalgeographic.com/video/why-ocean-matters

- Explore this interactive global database of exotic or invasive species
  
  - Link to resource: http://www.iucngisd.org/gisd/

### Lesson Glossary

- **bushmeat**: a wild-caught animal used as food (typically mammals, birds, and reptiles); usually referring to hunting in the tropics of sub-Saharan Africa, Asia, and the Americas
- **chytridiomycosis**: a disease of amphibians caused by the fungus *Batrachochytrium dendrobatidis*; thought to be a major cause of the global amphibian decline
- **exotic species**: (also, invasive species) a species that has been introduced to an ecosystem in which it did not evolve
- **tragedy of the commons**: an economic principle that resources held in common will inevitably be overexploited
- **white-nose syndrome**: a disease of cave-hibernating bats in the eastern United States and Canada associated with the fungus *Geomyces destructans*
Check Your Knowledge

1. White-nose syndrome is an economic principle that resources held in common will inevitably be overexploited.
   a. True
   b. False

2. Global warming will raise ocean levels due to meltwater from glaciers resulting in island size reduction.
   a. True
   b. False

3. The gradual melting and subsequent refreezing of glaciers could result in a reduction of salt water and a shortage of fresh water.
   a. True
   b. False

Answer Key:

Citations

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