

# Chapter 5: Biodiversity and Conservation,

Click to add Text

# What is biodiversity

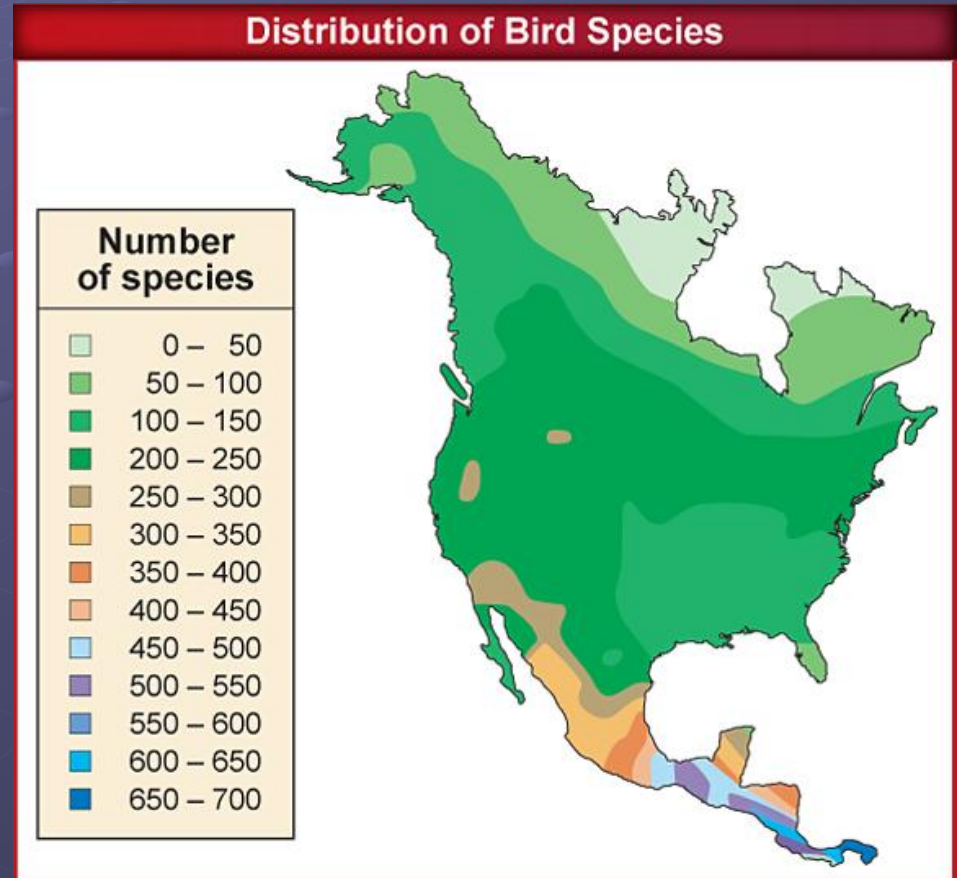
- Biodiversity is the variety of life in an area that is determined by the number of different species in that area.
- Biodiversity increases the stability of an ecosystem and contributes to the health of the biosphere.

# Genetic Diversity

- The variety of genes or inheritable characteristics that are present in a population comprises its genetic diversity.
- Genetic diversity within an interbreeding population increases the chances that some species will survive during changing environmental conditions or during the outbreak of disease.

# Species Diversity

- The number of different species and the relative abundance of each species in a biological community is called species diversity.



# Ecosystem Diversity

- The variety of ecosystems that are present in the biosphere is called ecosystem diversity.
- An ecosystem is made up of interacting populations and the abiotic factors that support them.
- All of the ecosystems on Earth support a diverse collection of organisms.

# The Importance of Biodiversity

- There are direct and indirect economic, aesthetic, and scientific reasons for preserving biodiversity.

**Domestic corn plant**



**Teosinte plant**



**Madagascar periwinkle**



# Direct Economic Value

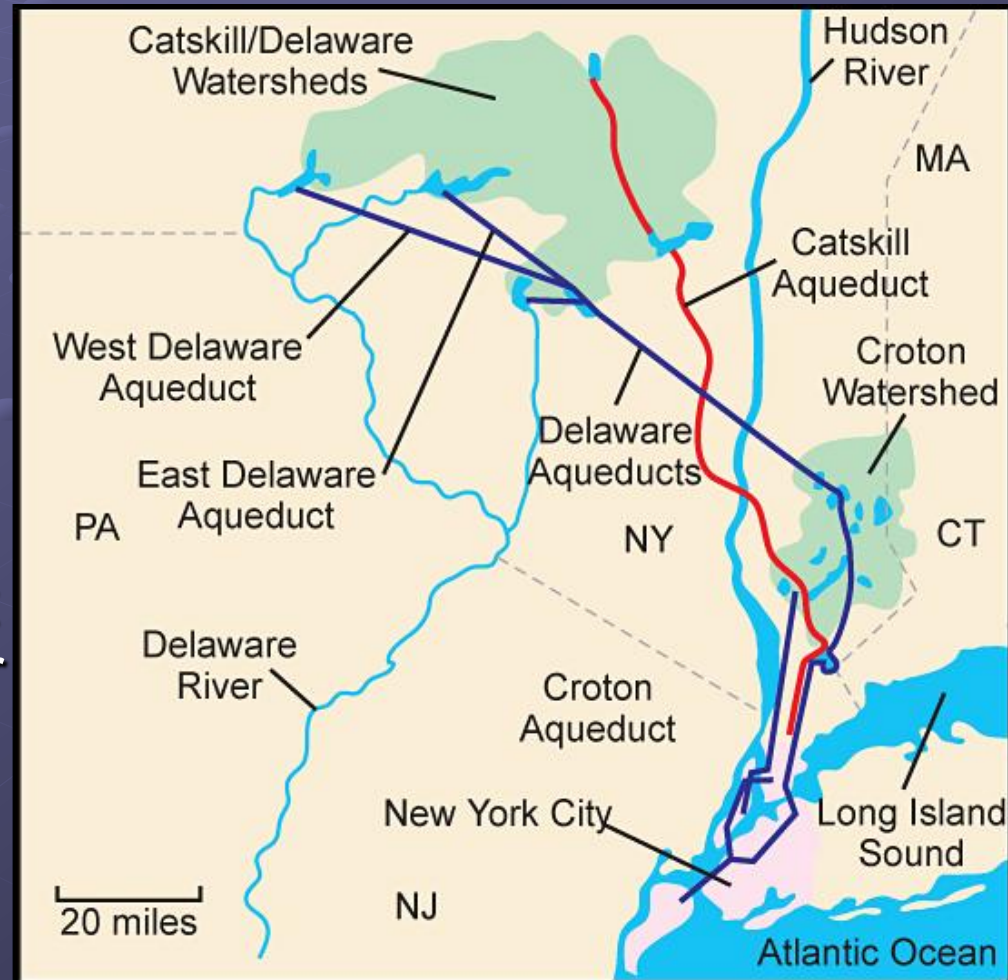
- Humans depend on plants and animals to provide food, clothing, energy, medicine, and shelter.
- Genetic diversity in species that might be needed in the future is important because...
  - Most of the world's food crops come from just a few species.
  - Wild species serve as reservoirs of desirable genetic traits that might be needed to improve domestic crop species (disease- and insect-resistance).
  - Many of the medicines that are used today are derived from plants or other organisms.
  - Scientists continue to find new extracts from plants and other organisms that help in the treatment of human diseases.
  - However, many species of organisms are yet to be identified, especially in remote regions of Earth, so their usefulness in providing extracts or useful genes is unknown.

# Indirect Economic Value

- A healthy biosphere provides many services to humans and other organisms that live on Earth.
- Green plants provide oxygen to the atmosphere and remove carbon dioxide.
- Natural processes provide drinking water that is safe for human use.
- Healthy ecosystems provide protection against floods and droughts, generate and preserve healthful fertile soils, detoxify and decompose wastes, and regulate local climates.

# Indirect Economic Value

- It is difficult to attach an economic value to the services that a healthy biosphere provides humans.
- An economic study determined that restoring the biodiversity in the ecosystem (1.5 billion) that filtered the water supply for New York City was less expensive than building a new water filtration system (6 billion).



# Aesthetic and Scientific Value

- It is difficult to attach a value to something that is beautiful or something that is interesting to study.
- Perhaps it is best to consider how life would be if all that was present on Earth was a barren and desolate landscape.
- The value of biodiversity and healthy ecosystems would be more obvious to us then.

# Extinction Rates

- Extinction is a process that happens when an entire species permanently disappears from the biosphere due to the death of the species' last member.
- The gradual process of species becoming extinct is known as background extinction.
- Mass extinction is an event in which a large percentage of all living species become extinct in a relatively short period of time.

# Extinction Rates

**Estimated Number of Extinctions Since 1600**

Group	Mainland	Island	Ocean	Total	Approximate Number of Species	Percent of Group Extinct
Mammals	30	51	4	85	4000	2.1
Birds	21	92	0	113	9000	1.3
Reptiles	1	20	0	21	6300	0.3
Amphibians*	2	0	0	2	4200	0.05
Fish	22	1	0	23	19,100	0.1
Invertebrates	49	48	1	98	1,000,000+	0.01
Flowering plants	245	139	0	384	250,000	0.2

\*An alarming decrease of amphibian populations has occurred since the mid-1970s, and many species might be on the verge of extinction.

# Extinction Rates

- The accelerated loss of species began several centuries ago.
- Many of the species' extinction in the past have occurred on islands.
- Islands are particularly vulnerable to extinction due to several factors.
  - Many species evolved without the presence of natural predators.
  - Introduction of nonnative species with diseases.
  - Islands have relatively small populations sizes

# Factors that Threaten Biodiversity

- The current high rate of extinction is due to the activities of a single species—*Homo sapiens*.
- Humans are changing conditions on Earth faster than new traits can evolve to cope with the new conditions.
- Evolving species might not have the natural resources they need.
- Natural resources are all materials and organisms found in the biosphere, including minerals, fossil fuels, nuclear fuels, plants, animals, soil, clean water, clean air, and solar energy.

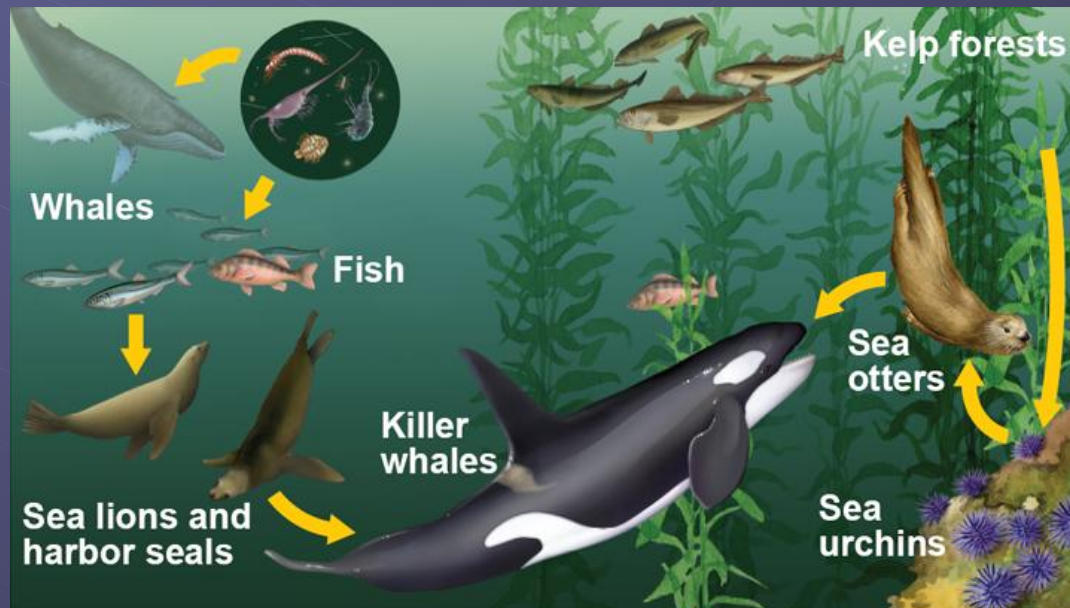
# Overexploitation

- Overexploitation, or excessive use, of species that have economic value is a factor increasing the current rate of extinction.
- Historically, overexploitation was the primary cause of species extinction.
  - Bison
  - Passenger Pigeons
  - Ocelot
  - Rhinoceros

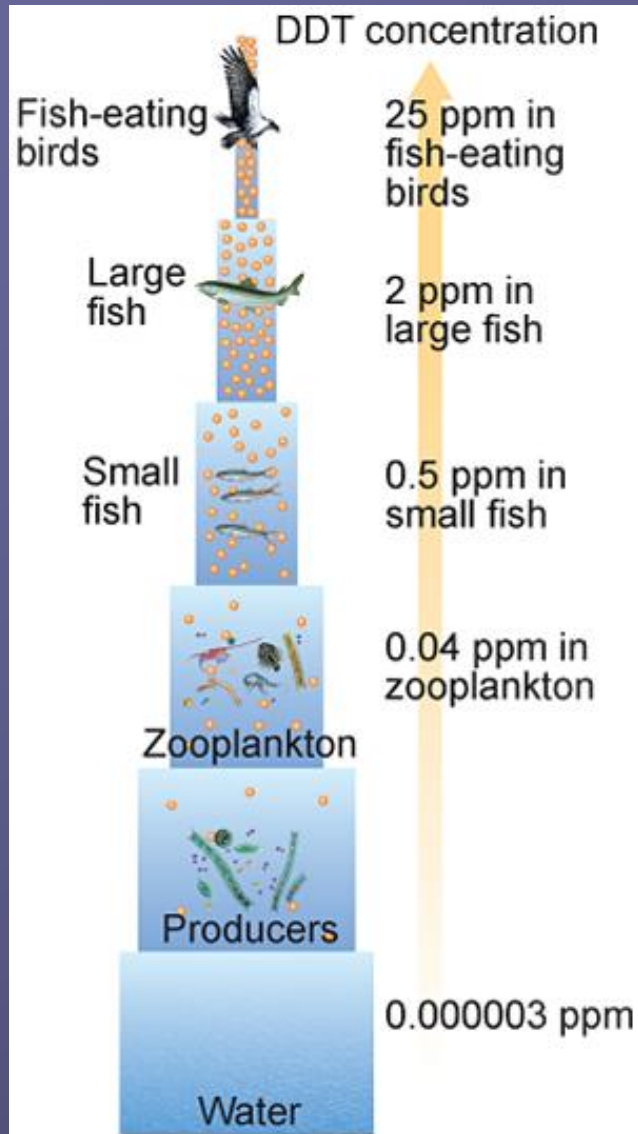


# Habitat Loss

- If a habitat is destroyed or disrupted, the native species might have to relocate or they will die.
- Destruction of habitat - such as the clearing of tropical rainforests, has a direct impact on global biodiversity.
- Disruption of habitat - the declining population of one species can affect an entire ecosystem.



# Pollution - Biological Magnification



- Pollution and atmospheric changes threaten biodiversity and global stability.
- Biological magnification is the increasing concentration of toxic substances in organisms as trophic levels increase in a food chain or food web.
- Pesticides - DDT

# Pollution – Acid Rain

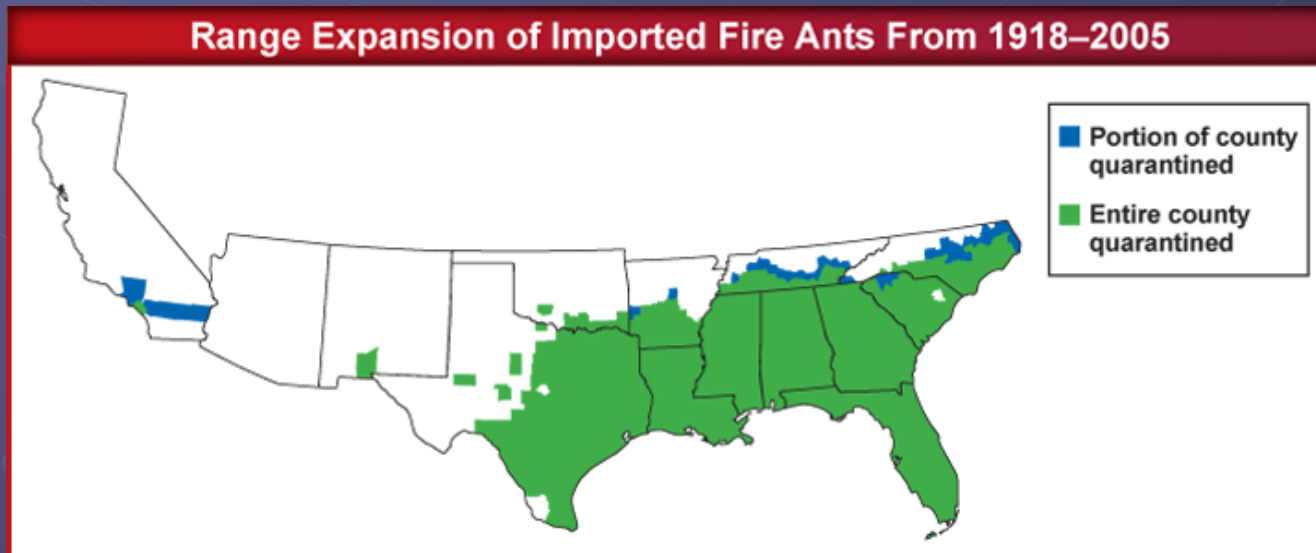
- Sulfur and nitrogen compounds react with water and other substances in the air to form sulfuric acid and nitric acid.
- Acid precipitation removes calcium, potassium, and other nutrients from the soil, depriving plants of these nutrients.
- It damages plant tissue and slows their growth.
- Sometimes, the acid concentration is so high in lakes, rivers, and streams that fish and other organisms die.

# Pollution - Eutrophication

- Eutrophication occurs when fertilizers, animal wastes, sewage, or other substances rich in nitrogen and phosphorus flow into waterways, causing extensive algae growth.
- The algae use up the oxygen supply during their rapid growth and after their deaths during the decaying process.
- Other organisms in the water suffocate.
- Eutrophication is a natural process, but human activities have accelerated the rate at which it occurs.

# Introduced Species

- Nonnative species that are either intentionally or unintentionally transported to a new habitat are known as introduced species.
- Introduced species often reproduce in large numbers because of a lack of predators, and become invasive species in their new habitat.
- Introduced species are a worldwide environmental problem. An estimated 40% of the extinctions that have occurred since 1750 are due to introduced species, and billions of dollars are spent every year in an effort to clean up or control the damage caused by introduced species.



# Protecting Biodiversity

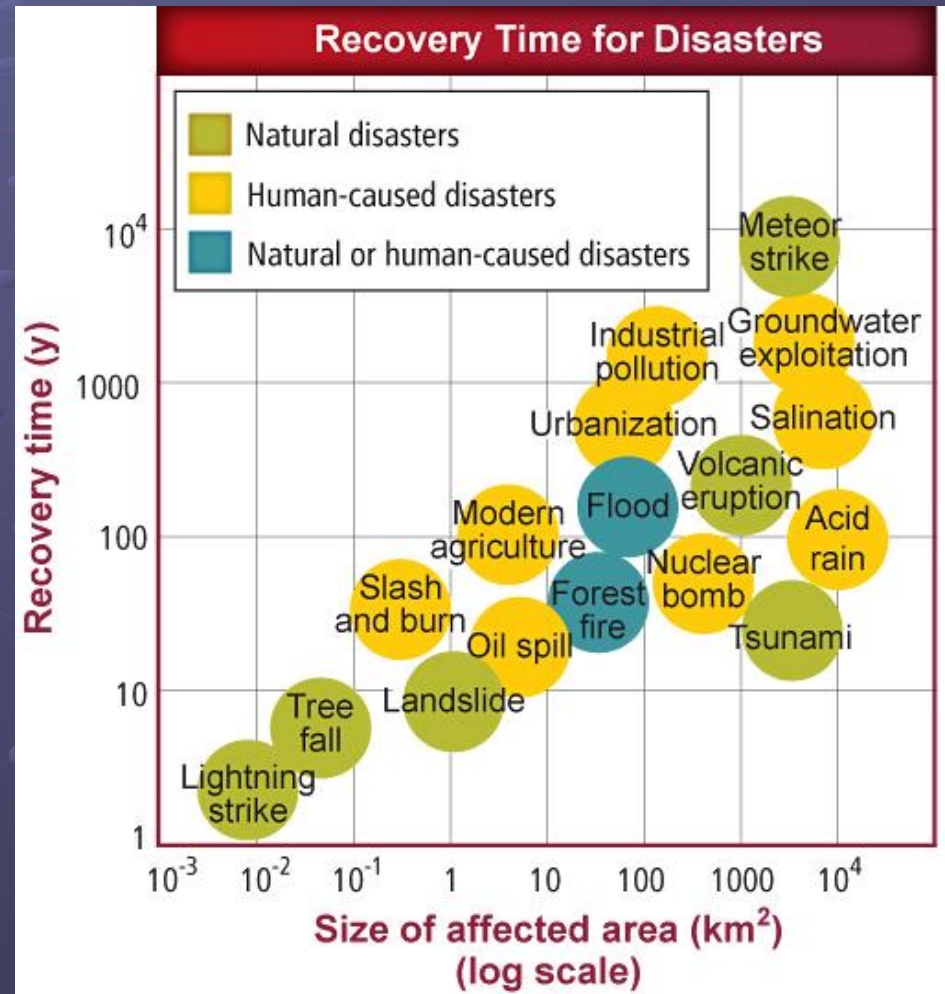
- Many efforts are underway worldwide to slow the loss of biodiversity and to work toward sustainable use of natural resources.
- Protected areas in the United States include national parks and nature reserves. First national park – 1872 – Yellowstone National Park.
- Currently, about seven percent of the world's land is set aside as some type of reserve.
- The United Nations supports a system of Biosphere Reserves and World Heritage sites.

# Biodiversity Hot Spots

- A biodiversity hotspot is a biogeographic region with a significant reservoir of biodiversity that is under threat from humans.
- Locations around the world that are characterized by exceptional levels of endemic species – species that are only found in that specific geographic area – and critical levels of habitat loss.
  - At least 1500 species of vascular plants are endemic.
  - The region must have lost at least 70 percent of its original habitat.
- Approximately  $\frac{1}{2}$  of all plant and animal species are found in hot spots.
  - These hot spots originally covered 15.7 percent of Earth's surface, however, only about a tenth of that habitat remains.

# Restoring Ecosystems

- Given time, biological communities can recover from natural and human-made disasters.
- The length of time for recovery is not related directly to whether the disaster is natural or human-made.
- The size of the area affected and the type of disturbance are determining factors for recovery time.
- Ecologists use two methods to speed the recovery process of these damaged ecosystems
  - Bioremediation
  - Biological Augmentation



# Bioremediation



- The use of living organisms, such as prokaryotes, fungi, or plants, to detoxify a polluted area is called bioremediation.
  - Microorganisms can be used in ecosystems to remove toxins from soils that are contaminated by accidental oil or fuel spills.
  - Some species of plants are being used to remove toxic substances such as zinc, lead, nickel, and organic chemicals. From damaged soils.

# Biological Augmentation



- Adding natural predators to a degraded ecosystem is called biological augmentation.
- Ladybugs can be introduced into an ecosystem to control aphid populations.

# Legally Protecting Biodiversity

- During the 1970's, a great deal of attention was focused on the destruction to the environment and maintaining biodiversity.
- Laws were enacted in countries around the world and many treaties between countries were signed in an effort to preserve the environment.
- Since the 1970's, many more laws and treaties have been enacted and signed with the purpose of preserving biodiversity for future generations.