11

Biodiversity and Conservation Biology

Chapter Objectives
This chapter will help you:

- Characterize the scope of biodiversity on Earth
- Contrast the background extinction rate with periods of mass extinction
- Evaluate the primary causes of biodiversity loss
- Specify the benefits of biodiversity
- Assess the science and practice of conservation biology
- Analyze efforts to conserve threatened and endangered species
- Compare and contrast conservation efforts above the species level

Lecture/Reading Outline

I. Central Case: Saving the Siberian Tiger

A. Up until the past 200 years, tigers roamed widely across the Asian continent, from Turkey to northeast Russia to Indonesia.

B. Of the tigers that still survive in small pockets of their former range, those in the subspecies known as the Siberian tiger are the largest cats in the world.

C. For thousands of years, the Siberian tiger coexisted with the native people of what is today the Russian Far East, who equated the tiger with royalty and viewed it as a guardian.

D. The Russians who moved into and exerted control over the region in the early 20th century had no cultural traditions that expressed respect for the animal, causing the species to decline to as few as 20, perhaps 30, animals.

E. International conservation groups began to get involved, working with Russian biologists to try to save the dwindling tiger population.

F. Today, the population is in a range of 430 to 500 tigers, and 1,500 more survive in zoos around the world.

II. Our Planet of Life

1. _____, or biodiversity, is the sum total of all organisms in an area.

    a. Biodiversity takes into account the diversity of species, their genes, their populations, and their communities.

A. Biodiversity encompasses multiple levels.

1. _____ is expressed as the number or variety of species in the world or in a particular region.

    a. A _____ is a distinct type of organism, a set of individuals that uniquely share certain characteristics and can breed with one another and produce fertile offspring.

    b. Speciation, the generation of new species, adds to species diversity, while extinction decreases species diversity.

    c. _____, the scientists who classify species, use an organism's physical appearance and genetic makeup to determine its species.

    d. Biodiversity exists below the species level in the form of *subspecies*, populations of a species that occur in different geographic areas and differ from one another in some characteristics.

2. _____ encompasses the differences in DNA composition among individuals within a given species.

    a. Genetic diversity provides the raw material for adaptation to local conditions.

    b. In the long term, populations with more genetic diversity may stand better chances of persisting, because their variation provides them more genetic options with which to cope with environmental change.

    c. Populations with little genetic diversity are vulnerable to environmental change, because they may happen to lack genetic variants that would help them adapt to novel conditions.

3. Ecosystem diversity, community diversity, habitat diversity, and landscape diversity are all ways to view biodiversity.

B. Some groups hold more species than others.

C. Measuring biodiversity is not easy.

1. Many species are tiny and easily overlooked.

2. Many organisms are so difficult to identify that ones thought to be identical sometimes turn out, once biologists look more closely, to be multiple species.

3. Some areas of Earth still have been hardly explored. D. Biodiversity is unevenly distributed.

D. Biodiversity is unevenly distributed.

1. The latitudinal gradient influences the species diversity of Earth's biomes.

2. For any given area, species diversity tends to increase with the diversity of habitats, because each habitat supports a somewhat different set of organisms.

III. Biodiversity Loss and Species Extinction

1. _____ occurs when the last member of a species dies and the species ceases to exist; in contrast, the extinction of a certain population from a given area, but not the entire species globally, is called _____.

A. Extinction occurs naturally.

1. Most extinctions preceding the appearance of humans have occurred one by one, at a rate that paleontologists refer to as the _____.

B. Earth has experienced five _____ episodes.

C. Humans are setting the sixth mass extinction in motion. D. Current extinction rates are much higher than normal.

1. To keep track of the current status of endangered species, the World Conservation Union (IUCN) maintains the _____.

E. Biodiversity loss involves more than extinction.

F. Several major causes of biodiversity loss stand out:

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

IV. Benefits of Biodiversity

A. Biodiversity provides ecosystem services free of charge.

B. Biodiversity helps maintain ecosystem function.

C. Biodiversity enhances food security.

D. Organisms provide drugs and medicines.

E. Biodiversity generates economic benefits through tourism and recreation.

F. People value and seek out connections with nature.

1. Edward O. Wilson has popularized the notion of _____, asserting that human beings have an instinctive love for nature and feel an emotional bond with other living things.

G. Do we have ethical obligations toward other species?

V. Conservation Biology: The Search for Solutions

A. Conservation biology arose in response to biodiversity loss.

1. _____ is a scientific discipline devoted to understanding the factors, forces, and processes that influence the loss, protection, and restoration of biological diversity.

B. Conservation biologists work at multiple levels.

C. Endangered species are a focus of conservation efforts.

1. The primary legislation for protecting biodiversity in the United States is the _____. Passed in 1973, the Endangered Species Act forbids the government and private citizens from taking actions that destroy endangered species or their habitats.

D. Conservation efforts include international treaties.

1. The 1973 _____ protects endangered species by banning the international transport of their body parts.

2. In 1992, the leaders of many nations agreed to the _____, a treaty outlining the importance of conserving biodiversity, using it sustainably, fairly distributing its benefits, and committing signatory nations to conserving this diversity.

E. Captive breeding, reintroduction, and cloning are being used to save species.

1. Zoos and botanical gardens have become centers for the _____ of endangered species, so that large numbers of individuals can be raised and then reintroduced into the wild.

2. The newest idea for saving species from extinction is to create individuals through cloning.

F. Forensics is being used to protect threatened species.

1. By analyzing DNA from organisms or their body parts sold at market, researchers can often determine the species or subspecies of organism, and sometimes its geographic origin. The analysis can help detect illegal activity and enforce the laws protecting wildlife.

G. Some species act as "umbrellas" for protecting habitat and communities.

H. Parks and protected areas help conserve biodiversity at the ecosystem level.

I. Biodiversity hotspots pinpoint regions of high diversity.

1. _____ are areas that support an especially great diversity of species, particularly species that are _____ to the area, or found nowhere else in the world.

J. Innovative economic strategies are being employed.

1. One strategy is the _____. In such a swap, a conservation organization raises money and offers to pay off a portion of a developing nation's international debt in exchange for a promise by the nation to set aside reserves, fund environmental education, and better manage protected areas.

2. A newer strategy that Conservation International has pioneered is the *conservation concession*. Developing nations often sell "concessions" to foreign multinational corporations, allowing them to extract resources from the nation's land.

K. We can restore degraded ecosystems.

L. Community-based conservation is growing.

1. In _____, biologists engage local people in efforts to protect land and wildlife.

VI. Conclusion

A. The erosion of biological diversity could bring on a mass extinction event equivalent to the major ones of the geological past.

B. The primary causes of biodiversity loss include habitat alteration, invasive species, pollution, overharvesting, and global climate change.

C. Many conservation biologists are rising to the challenge with traditional and innovative strategies to save endangered species and their habitats.

Key Terms for Chapter 11

background rate of extinction
biodiversity hotspots
biological diversity (biodiversity)
biophilia
captive breeding
community-based conservation
conservation biology
Convention on Biological Diversity
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
ecological restoration
ecosystem services
Endangered Species Act (ESA)
endemic
extinction
extirpation
genetic diversity
habitat fragmentation
mass extinction
Red List
species
species diversity