APES Ch. 11 Notes: Biodiversity and Conservation

Central Case Study: Will We Slice Through the Serengeti?

- The Serengeti is home to a yearly migration of over _____ wildebeest, zebras, and antelope
- The Serengeti park complex is 30,000 km^2 and has 800,000 visitors a year, bringing in almost $3 billion
- Tanzania intends to build a highway across the Serengeti= encourage poaching (illegal killing of wildlife) and block migration route.

Genetic diversity

- Encompasses the differences in DNA composition among individuals
- Populations with higher genetic diversity can survive
  - *They can cope with environmental change*
- _____ = genetically similar parents mate and produce inferior offspring
  - *Cheetahs, bison, elephant seals*

Ecosystem diversity

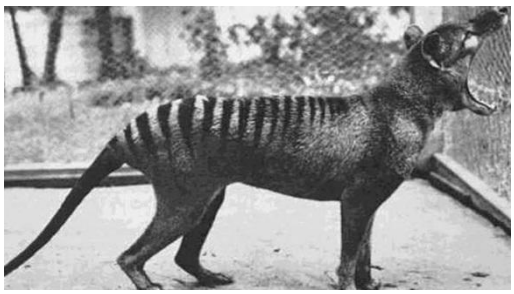
- **Ecosystem diversity** = the number and _____
  - *May include different biotic communities or habitats within an area*
  - *The open plains of the Serengeti hold a diversity of habitats, including savanna, grassland, wetland*

Some groups hold more species than others

- Species are not evenly distributed among taxonomic groups
  - *Insects predominate over all other life-forms*
  - _____ *are beetles*
  - *Beetles outnumber all other non-insect animals combined*

Many species await discovery

- 1.8 million species have been identified and described
- Estimates: from 3 million to 100 million
- Most widely accepted estimate of the number of species?
  - *Around* _____



Biodiversity is unevenly distributed

- Living things are not distributed evenly on Earth
- ***Latitudinal gradient*** = species richness increases _____
- Factors that contribute to higher diversity at the equator:
  - *High plant productivity supports more animals*
  - *Climate stability allows specialization, niches, and species coexistence*

Extinction and Biodiversity Loss

- _____ = the loss of all members of a species so it ceases to exist
- _____ = loss of a particular population, but not the entire species
  - *Can lead to extinction*
- Extinction occurs naturally
  - *99% of all species that ever lived have gone extinct*
  - *Although most extinction today is because of human action*
- **Background rate of extinction** = the pace of independent, one-by-one species loss

SPECIES EXTINCTION

- Species can become extinct:
  - ***Locally****: A species is no longer found in an area it once inhabited but is still found elsewhere in the world.*
  - ***Ecologically****: Occurs when so few members of a species are left they no longer play its ecological role.*
  - _____***:*** *Species is no longer found on the earth.*

Core Case Study: The Passenger Pigeon - Gone Forever

- Once the most numerous bird on earth.
- In 1858, _____ hunting became a big business.
- By 1900 they became extinct from over-harvest and habitat loss.

Endangered and Threatened Species: Ecological Smoke Alarms

- _____: so few individual survivors that it could soon become extinct.
- ***Threatened species***: still abundant in its natural range but is likely to become endangered in the near future.

Earth has experienced five mass extinction events

- Earth has had _____ in the past 440 million years
  - *Each event eliminated at least 50% of all species*
- Permo-Triassic: 250 million years ago
  - *80–95% of all species on Earth went extinct*
- Cretaceous-Tertiary (K-T): 65 million years ago
  - *Dinosaurs went extinct*
- Humans are causing this _____extinction event

We are setting the sixth mass extinction in motion

- Humans have driven hundreds of species to extinction
  - _____, *Carolina parakeet, passenger pigeon*
- Humans have been causing extinction for thousands of years
  - *Bird extinctions followed Polynesians arriving in Hawaii and New Zealand*
  - *Many large mammals went extinct in Australia after human arrival 50,000 years ago*

Current extinction rates are much higher than normal

- The current extinction rate is _____ greater than the background rate
- This rate is projected to increase tenfold in future decades
  - *Human population growth strains ecosystems*
- _____ = list of species facing high risks of extinction
  - *21% of mammal species, 13% of bird species, 30% of amphibian species, 20% of fish species threatened*

HABITAT LOSS, DEGRADATION, AND FRAGMENTATION

- Conservation biologists summarize the most important causes of premature extinction as "_____":
  - *Climate Change*
  - *Habitat destruction, degradation, and fragmentation*
  - *Invasive species*
  - *Population growth*
  - *Pollution*
  - *Overharvesting*

Habitat loss

- The _____ of biodiversity loss
- Habitats are destroyed, fragmented, and degraded
  - *Housing developments replace natural communities*
  - *Farming simplifies communities*
  - *Grazing modifies grassland structure and composition*
  - *Clearing forests removes resources organisms need*
  - *Hydroelectric dams turn rivers into reservoirs*
- _____ = occurs when continuous habitats are broken into small patches (by farming, roads, logging, etc.)
  - *Species needing larger areas of that habitat disappear from the small fragments*
  - *Can also prevent animals from moving to other places*
- Habitat loss occurs in nearly every biome
- Habitat loss is responsible for declines in 83% of mammals and 85% of birds
- Over 99% of U.S. prairies have been _____
  - *Grassland bird populations have declined 82–99%*

Pollution* and *Overharvesting

- Pollution harms organisms in many ways
  - *Air pollution* _____
  - *Water pollution impairs fish and amphibians*
  - *Toxins, garbage, oil, and chemicals impact organisms*

- Hunting or harvesting threatens K-selected species
  - *Large, long-lived organisms that have few young can be hunted to extinction*
  - *Elephants, gorillas, tigers, whales are at risk*

Invasive species* and *Climate change

- Introduction of non-native species to new areas
  - *Can be accidental or intentional*
  - _____ *species*
- Invaders lack natural predators, competitors, or parasites
- Impacts on the Earth's climate system are global
  - *Extreme weather events (storms)* _____
  - *Melting sea ice in the Arctic threatens polar bears*
- A 1.5–2.5°C temperature rise could put 20%–30% of plants and animals at increased risk of extinction

Amphibians are vanishing

- Reasons for the decline of a species can be complex
- Amphibian populations are _____
  - *2600 of the 6400 known species are in decline*

Biodiversity provides ecosystem services

- Healthy ecosystems provide us with _____
  - *Provides food, fuel, fiber, and shelter*
  - *Purifies air and water and detoxifies wastes*
  - *Stabilizes climate; moderates floods, droughts, wind, temperature*
  - *Cycles nutrients; renews soil fertility*
  - *Pollinates plants and controls pests and disease*
  - *Maintains genetic resources*
  - *Provides cultural and aesthetic benefits*
  - *Allows us to adapt to change*
- *The value of 17 ecosystem services = $48 trillion per year*

Biodiversity helps maintain ecosystem function

- It _____ and resilience of natural systems
- Decreased biodiversity reduces a system's ability to function and provide services to our society

Biodiversity enhances food security

- Industrial agriculture has narrowed our diet
  - _____ *of our food comes from 15 crops and 8 animal species*
- New potential food crops are waiting to be used
  - *Serendipity berry is 3000 times sweeter than sugar*

Organisms provide drugs and medicines

- People have used _____ for centuries
  - *Many modern medicines are derived from plants*
- Wild species produce $150 billion/year of drugs
- Taxol comes from the Pacific yew tree
  - *Treats cancer*
- Every species that goes extinct is a lost opportunity to cure disease
  - *Some organisms that show medical promise are threatened with extinction*

SAFE™ SAVING ANIMALS FROM EXTINCTION

Biodiversity boosts economies through tourism and recreation

- Biodiversity generates _____
  - *Especially in developing countries*
- Tanzania: savanna wildlife
  - *Ecotourism brings in one-quarter of all foreign money*
- Costa Rica: rainforests
- Australia: Great Barrier Reef
- Belize: reefs, caves, and rainforests

People value connections with nature

- _____ = notion that humans love nature and have an emotional bond with other living things
  - *We have an affinity for parks and wildlife*
  - *We love our pets*
  - *We value real estate with views of natural lands*
  - *Our interest in hiking, bird watching, fishing, etc.*
- "Nature deficit disorder" = alienation from biodiversity and nature
  - *Suggested to be behind the emotional and physical problems of the young*
  -

Do we have ethical obligations toward other species?

- Many people feel that other organisms have an inherent _____
  - *Biodiversity conservation is justified on ethical grounds alone*
- Humans are part of nature and need resources to survive
  - *But we can control our actions and make choices*

Conservation biology responds to biodiversity loss

- _____ = study of the factors behind the loss, protection, and restoration of biodiversity
  - *Scientists became alarmed at the degradation of natural systems*
  - *An applied and goal-oriented science*
- Conservation biologists integrate evolution, extinction, ecology, and environmental systems
  - *Aim of developing solutions to habitat degradation and species loss*
  - ***Metapopulations** = a network of subpopulations*

Endangered species are a focus of conservation efforts

- **Endangered Species Act** _____ (1973) = the primary U.S. legislation for protecting biodiversity
- It forbids the government and citizens from taking actions that destroy endangered species or their habitats or trading in products made from endangered species

Endangered species are a focus of conservation efforts

- Opponents feel that the ESA values endangered organisms _____ the livelihood of people
  - *Protection will restrict land use and cost jobs*
  - *"Shoot, shovel, and shut up" = landowners conceal the presence of endangered species on their land*
  - *But the ESA has stopped few development projects*
- **Species at Risk Act** _____ (2002) = Canada's endangered species law
  - *Stresses cooperation between federal government and landowners or provincial governments*
  - *Criticized as being weak and failing to protect habitat*

International treaties promote conservation

- **UN Convention on International Trade in Endangered Species of Wild Fauna and Flora** (1973) _____ = protects endangered species by banning international transport of their body parts
- Goals of the **Convention on Biological Diversity** (1992):
  - _____
  - *Use biodiversity in a sustainable manner*
  - *Ensure the fair distribution of biodiversity's benefits*

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

- _____ = individuals are bred and raised so they can be reintroduced into the wild
  - *65 plant and animal species exist only in captivity*
- Reintroductions can be successful
  - *Black rhinos were reintroduced into Serengeti National Park to reestablish that population*
  - *California condors have been reintroduced and went from 22 to over 230 birds in the wild*
- Reintroductions can be controversial
  - *Ranchers opposed reintroducing wolves to Yellowstone National Park*

Forensics can help to protect species

- **Forensic science** _____ = the analysis of evidence to identify or answer questions relating to a crime
- Conservation scientists use forensics to protect species
  - *Researchers use DNA to identify a species or subspecies and its geographic origin*

Some species act as "umbrellas" that protect habitat and communities

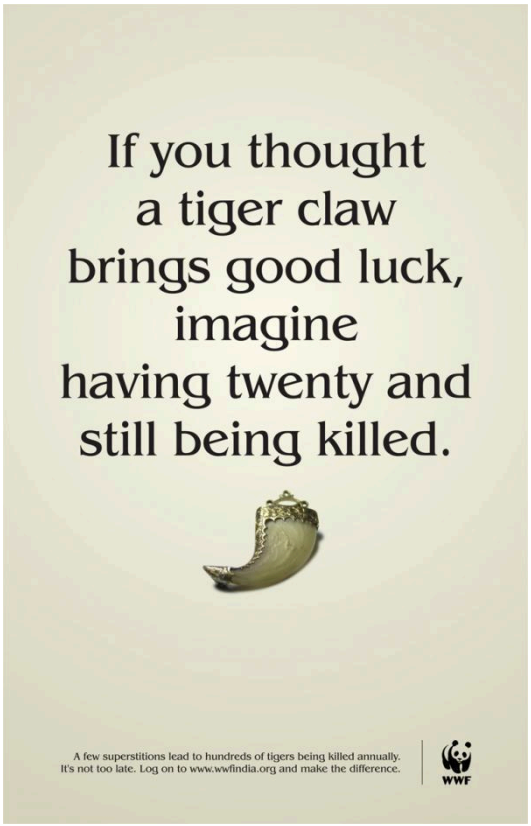
- _____ = species that, when protected, also help protect other, less charismatic species
  - *Often large species that need large amounts of habitat*
  - *Protecting their habitat automatically protects others*
- _____= large and charismatic species used as spearheads for biodiversity conservation
  - *The World Wildlife Fund's panda*

Biodiversity hotspots pinpoint regions of high diversity

- **Biodiversity** _____ = regions most important globally for biodiversity
  - *Support a great number of **endemic species** = species found nowhere else in the world*
  - *The area must have at least 1500 endemic plant species (0.5% of the world total)*
  - *It must have lost 70% of its habitat due to humans*
- 2.3% of the planet's land surface contains 50% of the world's plant species and 42% of all terrestrial vertebrate species
  - *Focusing on hotspots protects the greatest number of species per unit effort*

We can restore degraded ecosystems

- The best way to safeguard biodiversity and natural systems?
  - *Protect natural areas before they become degraded*
- _____ = process of restoring degraded areas to some semblance of their former condition
  - *Also reestablishes the processes that make ecosystems function*
- *Restoration ecology* = restoring damaged systems to bring back species and reestablish ecological processes
  - *Filter pollutants, clean water and air, build soil, etc.*



Animal around the world are losing their habitats due to global warming. www.wwf.org