AP Environmental Science Ch. 9

**Sustaining Biodiversity: Saving Species and Ecosystem Services**

Core Case Study: Where Have All the Honeybees Gone?

* Bees play a key role in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Globally, about one third of the \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ comes from insect-pollinated plants
* Currently, agriculture depends heavily on a \_\_\_\_\_\_\_\_\_\_ species of bee
  + Suffering from Colony Collapse Disorder
    - Each year, \_\_\_\_\_\_\_\_\_\_ of colonies in Europe and the U.S.

9-1 What Role Do Humans Play in the Loss of Species and Ecosystem Services?

* Species are becoming extinct \_\_\_\_\_ to \_\_\_\_\_ times faster than they were before modern humans arrived on the earth
  + By the end of this century, the extinction rate is expected to be \_\_\_\_\_ times higher than that background rate

Extinctions Are Natural but Sometimes They Increase Sharply

* \_\_\_\_\_\_\_\_\_\_ extinction
  + No species member alive
* Trophic \_\_\_\_\_\_\_\_\_\_
  + Population declines or extinctions among connected species
* \_\_\_\_\_\_\_\_\_\_ extinction
  + Many species in a short amount of time

Some Human Activities Hasten Extinctions and Threaten Ecosystem Services

* \_\_\_\_\_\_\_\_\_\_ extinction rate
  + 1 extinct species / year / 1 million species
* Extinction rates have \_\_\_\_\_\_\_\_\_\_ recently
  + Current extinction rate is at least \_\_\_\_\_ times higher than typical background rate of 0.0001%
* Rate of extinction and threats to ecosystem services likely to rise sharply in the next 50-100 years
  + Due to harmful \_\_\_\_\_\_\_\_\_\_ impacts
* Biodiversity \_\_\_\_\_\_\_\_\_\_
  + Extinction rates projected to be much \_\_\_\_\_\_\_\_\_\_ than average
* Biologically diverse environments are being eliminated or fragmented

Endangered and Threatened Species Are Ecological Smoke Alarms

* \_\_\_\_\_\_\_\_\_\_ species
  + So few members that the species could soon become extinct
* \_\_\_\_\_\_\_\_\_\_ species (vulnerable species)
  + Still enough members to survive, but numbers declining
  + May soon be endangered
* \_\_\_\_\_\_\_\_\_\_ extinct
  + In areas a species is normally found
* \_\_\_\_\_\_\_\_\_\_ extinct
  + To the point at which species can no longer play a functional role in the ecosystem

9-2 Why Should We Care about the Rising Rate of Species Extinction?

* We should avoid speeding up the extinction of wild species because:
  + Of the ecosystem and economic services they provide
  + It can take \_\_\_\_\_\_\_\_\_\_ of years for nature to recover from large-scale extinctions
  + Many people believe that species have a \_\_\_\_\_\_\_\_\_\_ to exist regardless of their usefulness to us

Species Are a Vital Part of the Earth’s Natural Capital

* Major reasons to prevent extinctions
* Species provide vital \_\_\_\_\_\_\_\_\_\_ services
  + Help keep \_\_\_\_\_ alive and support our economies
* Many species also contribute economic services
  + \_\_\_\_\_\_\_\_\_\_ for food, fuel, lumber, and medicine
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* It will take \_\_\_\_\_\_\_\_\_\_ million years to regain species biodiversity after this century’s extinctions
* Many people believe species have an \_\_\_\_\_\_\_\_\_\_ right to exist
* How do we decide which species to protect?

9-3 How Are We Threatening Species and Ecosystem Services?

* The greatest threats to any species are (in order):
  + Loss or degradation of its \_\_\_\_\_\_\_\_\_\_
  + Harmful \_\_\_\_\_\_\_\_\_\_ species
  + \_\_\_\_\_\_\_\_\_\_ population growth
  + \_\_\_\_\_\_\_\_\_\_
  + Climate change
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Loss of Habitat Is the Single Greatest Threat to Species: Remember HIPPCO

* Habitat destruction, degradation, and fragmentation
* Invasive (nonnative) species
* Population and resource use growth
* Pollution
* Climate change
* Overexploitation
  + Habitat fragmentation
    - Large intact habitat \_\_\_\_\_\_\_\_\_\_ by roads, crops, and urban development
  + National parks and nature reserves as habitat \_\_\_\_\_\_\_\_\_\_

We Have Moved Disruptive Species into Some Ecosystems

* Many species introductions are \_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_ species may have no natural:
  + Predators, competitors, parasites, pathogens
* Nonnative species can crowd out \_\_\_\_\_\_\_\_\_\_ species
* Invasive species

Case Study: The Kudzu Vine and Kudzu Bugs

* Imported from Japan in the 1930s
  + Help control soil erosion
* Very difficult to kill
* Could there be benefits of kudzu?
* Kudzu bug – imported from Japan
  + Can kill Kudzu vine
  + Also kills soybeans

Some Accidentally Introduced Species Can Disrupt Ecosystems

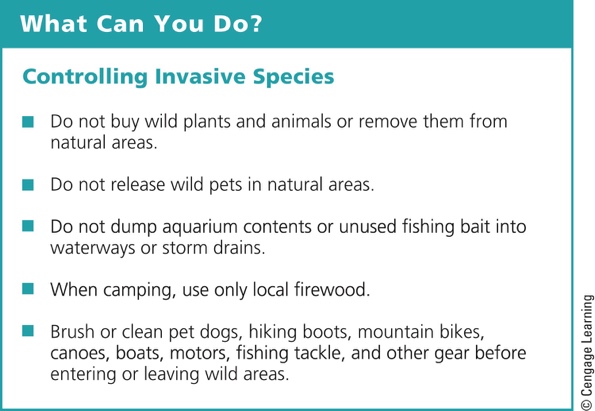
* Argentine fire ant – introduced in the \_\_\_\_\_
  + Reduced populations of native ants
  + Painful stings can kill
  + Pesticide spraying in \_\_\_\_\_ and \_\_\_\_\_ worsened conditions
  + Tiny parasitic \_\_\_\_\_\_\_\_\_\_ may help control fire ants

Case Study: Burmese Pythons Are Eating Their Way through the Florida Everglades

* \_\_\_\_\_\_\_\_\_\_ introduced
* Reproduce rapidly and are hard to kill
* Greatly depleted \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ populations of:
  + Rabbits, foxes, raccoons, opossums, and deer

Prevention Is the Best Way to Reduce Threats from Invasive Species

* Research programs identifying invaders
* Establishing international treaties banning transfer between countries
* Public education about exotic pets and plants
* What else can be done to prevent invasive species?



Other Causes of Species Extinctions

* Human population growth and overconsumption
  + Degrading habitat
* Pollution
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can cause extinctions of species not directly affected by pollution
* Climate change
  + Some species will become extinct, some will spread

Case Study: Polar Bears and Climate Change

* Live only in the Arctic
* Arctic ice is melting
  + Decreasing polar bear habitat
  + Polar bears must swim farther between ice
    - Weaker females; less reproduction

Illegal Killing, Capturing, and Selling of Wild Species Threatens Biodiversity

* Poaching and smuggling of animals and plants
  + Animal parts
  + Pets
  + Plants for landscaping and enjoyment
* Prevention
* Research and education

A Rising Demand for Bushmeat Threatens Some African Species

* West and Central African wild animals
  + Supply major cities with exotic meats
* Hunting has driven one species to extinction
  + Miss Waldron’s red colobus monkey
* Threatened species:
  + Monkeys, apes, antelope, elephants, and hippos

Case Study: A Disturbing Message from the Birds

* 70% of the world’s bird species are declining
* Habitat loss and fragmentation of the birds’ breeding habitats
  + Forests cleared for farms, lumber plantations, roads, and development
* Intentional or accidental introduction of nonnative species
* These species eat the birds
* Exposure to pesticides
* Overexploitation
  + For pets
* Birds are indicator species
  + Respond quickly to environmental changes
* Birds perform critical ecosystem and economic services
* Extinctions could affect many other species

9-4 How Can We Sustain Wild Species and Their Ecosystem Services?

* We can reduce species extinction and sustain ecosystem services by:
  + Establishing and enforcing national environmental \_\_\_\_\_ and international \_\_\_\_\_\_\_\_\_\_
  + Creating protected wildlife \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Taking \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ measures to prevent such harm

International Treaties and National Laws Help to Protect Species

* \_\_\_\_\_ – Convention on International Trade in Endangered Species (CITES)
  + Signed by 172 countries
* Convention on Biological Diversity (BCD)
  + Focuses on ecosystems
  + Ratified by \_\_\_\_\_ countries (not the U.S.)

Case Study: The U.S. Endangered Species Act

* Endangered Species Act (ESA) – 1973 and later amended in 1982, 1985, and 1988
  + Identify and protect endangered species in the U.S. and abroad
* National Marine Fisheries Service for ocean species
* U.S. Fish and Wildlife Service for all others
* Forbids federal agencies (except Defense) from funding or authorizing projects that jeopardize endangered or threatened species
  + In 2012, \_\_\_\_\_ species officially listed
* Offer incentives to private property owners to help
* Is the ESA a failure?
  + Species are listed only when in serious danger
  + Conditions for more than half of listed species are stable or improving
  + Budget is about \_\_\_\_\_ cents per U.S. citizen

We Can Establish Wildlife Refuges and Other Protected Areas

* In \_\_\_\_\_, Theodore Roosevelt established the first federal wildlife refuge
  + Pelican Island, Florida
* Wildlife refuges
  + Most are wetland sanctuaries
  + More needed for endangered plants
  + Are not immune from disturbance

Seed Banks, Botanical Gardens, and Wildlife Farms Can Help Protect Species

* \_\_\_\_\_\_\_\_\_\_ banks
  + Preserve genetic material of endangered plants
* Botanical gardens and arboreta
  + Living plants
* Farms can raise organisms for commercial sale

Zoos and Aquariums Can Protect Some Species

* Techniques for preserving endangered terrestrial species
  + Egg pulling
  + Captive breeding
  + Artificial insemination
  + Embryo transfer
  + Use of incubators
  + Cross-fostering
* Goal of ultimately releasing/reintroducing populations to the wild
* Limited space and funds



The Precautionary Principle

* Precautionary principle
  + Act to prevent or reduce harm when preliminary evidence indicates acting is needed
* Species are the primary components of biodiversity
* Should we focus on the preservation of species or the preservation of ecosystems?

Case Study: Protecting Honeybees and Other Pollinators

* Failure to protect honeybees
  + Loss of vital ecosystem services
* Farmers are:
  + Breeding bees resistant to harmful parasitic mites and fungi
  + Raising their own colonies
* Improving bee nutrition

Three Big Ideas

* We are hastening the extinction of wild species and degrading the ecosystem services they provide by:
  + Destroying and degrading habitats
  + Introducing harmful invasive species
  + Increasing human population growth, pollution, climate change, and overexploitation
* We should avoid causing the extinction of wild species
  + Species provide vital ecosystem and economic services
  + Their existence should not depend primarily on their usefulness to us
* We can work to prevent the extinction of species and to protect overall biodiversity and ecosystem services by:
  + Using laws and treaties
  + Protecting wildlife sanctuaries
  + Making greater use of the precautionary principle