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