Chapter 9: Sustaining Biodiversity: The Species Approach

APES 2013

Extinction

- Background extinction - continuous, low level of extinction of species

- Extinction rate - expressed as a percentage or number of species that go extinct within a certain time period

- Before humans, extinction rate 1/1,000,000 species per year (0.0001%)

- Mass extinction - extinction of many species in a relatively short period of time

    - Has probably happened 5 times (50-95% of all species extinct)

    - Biodiversity returns, but it takes millions of years

Levels of Extinction

Fig. 9-2

Passenger pigeon   Great auk   Dodo   Golden toad   Aepyornis (Madagascar)

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- Local extinction - species is no longer found in an area it once inhabited but is still found elsewhere

- Ecological extinction - so few members of a species are left that it can no longer play its ecological roles

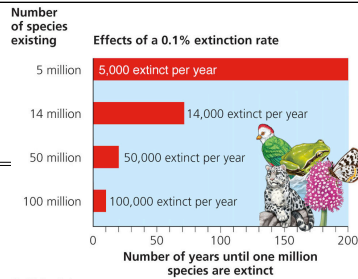- Biological extinction - species is no longer found anywhere on Earth

Human Impact

* Estimated that humans have disturbed between 50-85% of the Earth's land surface

Pg. S24

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Human Impact

Fig. 9-3
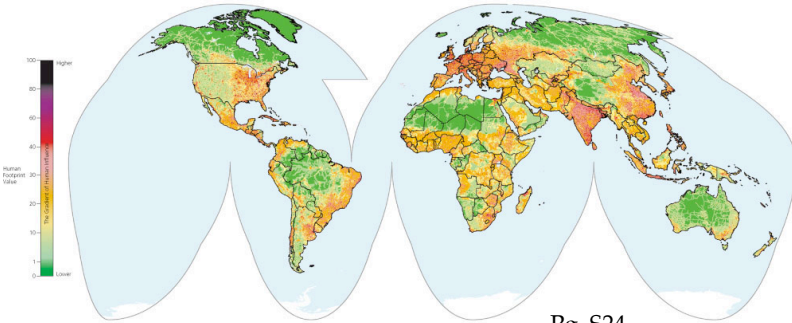
* Conservation biologists project extinction rate will increase to 10,000 times the background rate

    * Causes: habitat loss, climate change

    * At a 1% extinction rate, one-fourth of species will be gone by 2050 and half could be gone by the end of the century.

    * Will increase because of: human population growth; rates are higher in biodiversity "hotspots;" elimination, degradation, and fragmentation

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Endangered vs. Threatened Species

* Endangered species - so few individual survivors that it could soon become extinct over all or most of its natural range

* Threatened species (vulnerable species) - abundant in its natural range, but because of declining numbers, it could soon become endangered
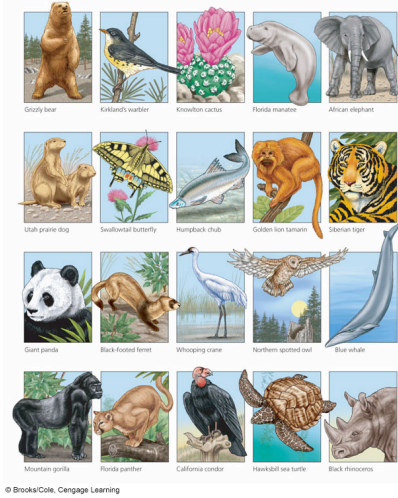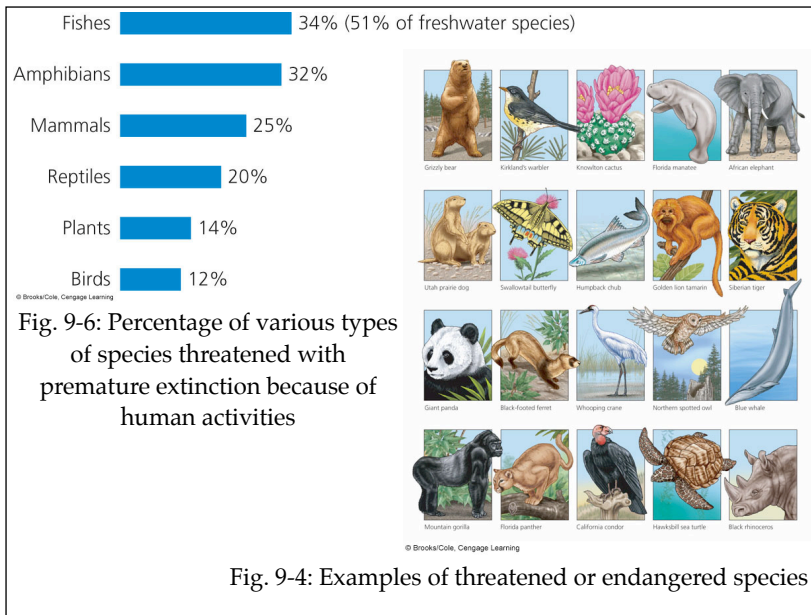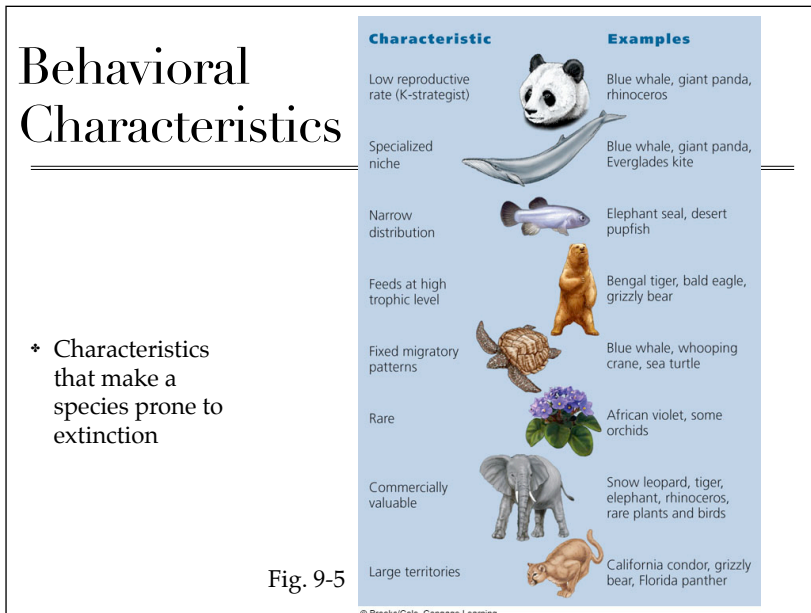
* Red List database www.iucnredlist.org

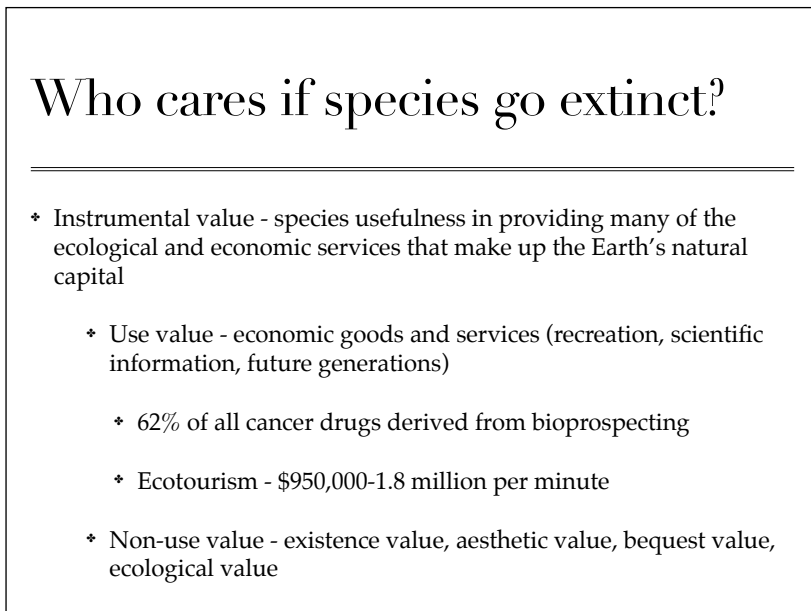## Slide 7

Fishes — 34% (51% of freshwater species)
Amphibians — 32%
Mammals — 25%
Reptiles — 20%
Plants — 14%
Birds — 12%

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Fig. 9-6: Percentage of various types of species threatened with premature extinction because of human activities

Fig. 9-4: Examples of threatened or endangered species

Behavioral Characteristics

* Characteristics that make a species prone to extinction

Fig. 9-5

Characteristic	Examples
Low reproductive rate (K-strategist)	Blue whale, giant panda, rhinoceros
Specialized niche	Blue whale, giant panda, Everglades kite
Narrow distribution	Elephant seal, desert pupfish
Feeds at high trophic level	Bengal tiger, bald eagle, grizzly bear
Fixed migratory patterns	Blue whale, whooping crane, sea turtle
Rare	African violet, some orchids
Commercially valuable	Snow leopard, tiger, elephant, rhinoceros, rare plants and birds
Large territories	California condor, grizzly bear, Florida panther

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Who cares if species go extinct?

* Instrumental value - species usefulness in providing many of the ecological and economic services that make up the Earth's natural capital

    * Use value - economic goods and services (recreation, scientific information, future generations)

        * 62% of all cancer drugs derived from bioprospecting

        * Ecotourism - $950,000-1.8 million per minute

    * Non-use value - existence value, aesthetic value, bequest value, ecological value

Greatest Threats to Species

* **HIPPCO**

    * **H**abitat destruction, degradation, and fragmentation

    * **I**nvasive (nonnative) species

    * **P**opulation and resource use (too many people using too many resources)

    * **P**ollution

    * **C**limate change

    * **O**verexploitation

Greatest Threat: Habitat Loss

* Deforestation in tropical areas is the greatest eliminator of species

* Degradation of coral reefs and wetlands (2nd)

* Plowing grasslands (3rd)

* Pollution of streams, lakes, and oceans (4th)

* Temperate biomes have been affected the most because of development over the last 200 years

* Island species (especially endemic ones) are most vulnerable (Hawaii is the U.S. extinction capital - 63% of species at risk)

Habitat Disruption

* Habitat Island - a habitat surrounded by a different one

    * National Parks surrounded by logging, mining, energy extraction, and industry

    * Freshwater lakes (nonnative species introduction)

* Habitat Fragmentation - occurs when a large contiguous area of habitat is reduced and divided into smaller, scattered, isolated patches

    * Caused by roads, logging, agriculture, and urban development

    * Block migrations, divide populations of species (more vulnerable to predators, competitors, disease, and catastrophic events)

Birds

- 70% declining in number (12% already threatened with extinction)

- Habitat loss, fragmentation, and degradation

- Hawaii - 30 of 71 bird species are endangered or threatened

- Birds are indicator species - live in almost every climate and biome, respond quickly to environment, easy to track and count

- Provide essential natural services - insect population control, remove dead animal carcasses, pollinate, spreading seeds
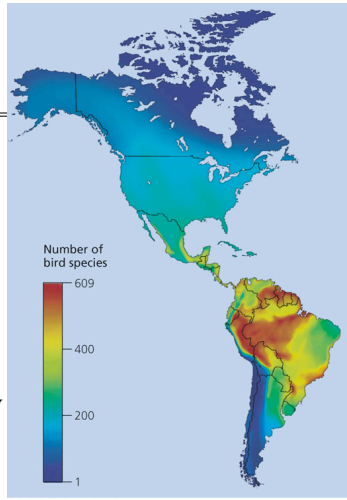
Number of bird species
- 609
- 400
- 200
- 1

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Fig. 9-12

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Introduction of Species

- Biggest causes of reduction of biodiversity after habitat disruption

- Often important to humans: corn, rice, wheat, cattle, poultry, tree farms,

- Introduced species do not have natural predators or competitors to control numbers. Thus they end up overtaking the environment.

- Estimated invader species cost U.S. $261,000 per minute

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Kudzu Vine

- Deliberately introduced

- Imported from Japan and planted to help control soil erosion

- Does control soil erosion, but it overtakes everything

- Attempting to find uses for it.

  - Edible

  - Possibly used for making paper

  - Possible treatment for alcoholism

Fig. 9-15

Kudzu Taking Over an Abandoned House in Mississippi, U.S.

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Argentina fire ant

- Accidentally introduced

- May have arrived on shiploads of lumber or coffee from South America

- Without predators, it spread rapidly

- Wipe out 90% of native ants

- Kill deer, birds, livestock, pets, and humans

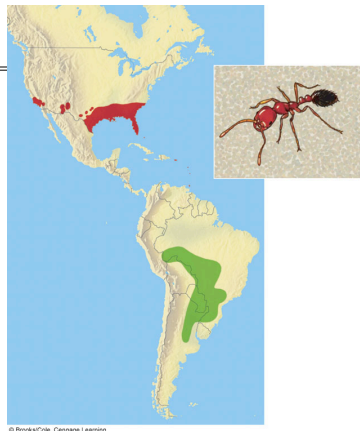- $68,000 damage per hour

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Fig. 9-16

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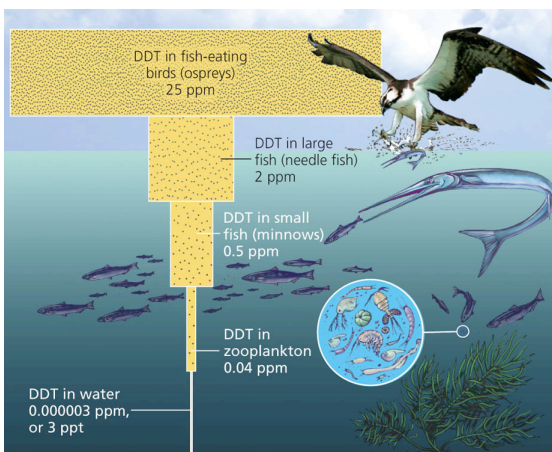# Burmese Python

- Bought as pets

- Get too big and have been dumped into Everglades

- Live 25 years, and reach 20 ft., and weigh 200 lbs.

- Possible they will spread to most of the southern half of the U.S.

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Extinction via Pesticides

DDT in fish-eating birds (ospreys) 25 ppm

DDT in large fish (needle fish) 2 ppm

DDT in small fish (minnows) 0.5 ppm

DDT in zooplankton 0.04 ppm

DDT in water 0.000003 ppm, or 3 ppt

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Bioaccumulation and Biomagnification

Fig. 9-19

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Polar Bears

* Impacted by climate change

* Bears hunt on sea ice, but sea ice breaks up earlier and starts later

* Summer sea ice could be gone by 2030 (perhaps as soon as 2012)

* Also impacted by bioaccumulation of pesticides (ex. DDT and PCBs)

* Poachers in Russia

Fig. 9-20

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Fig. 9-21

Illegal Killing

* Poaching - illegal killing for valuable parts

    * Poachers make huge amounts of money

    * Tigers, gorillas, reptiles, birds...

* Best way to solve this problem is through research and education

* Pets

    * Exotic birds are endangered and still imported to the U.S.

    * Exotic fish (removal destroys coral reefs)

    * Exotic plants (orchids, cacti)

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Protecting Species

* International Treaties

    * 1975 Convention of International Trade in Endangered Species (CITES) - bans hunting, capturing, and selling threatened and endangered species (lists 900 species). Also restricts trade of about 5,000 animals and 28,000 plants

        * Signed by 172 counties (but enforcement and punishment varies by country)

    * Convention on Biological Diversity (CBD) - legal commits participating governments to reversing the global decline of biodiversity

        * Ratified by 192 countries (Not U.S., Andorra, Somalia)

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U.S. Endangered Species Act

* Endangered Species Act of 1973 (Amended in 1982, 1985, and 1988)

    * Created to identify and protect endangered species in the U.S. and abroad

    * National Marine Fisheries Service (NMFS) is responsible for identifying endangered and threatened ocean species

    * U.S. Fish and Wildlife Service (USFWS) is responsible for identifying all other endangered and threatened species

    * Any attempt to add or remove any species is based on biological factors alone (Economics can be used in determinations of how to protect habitats and developing recovery plans)

U.S. Endangered Species Act

* Forbids federal agencies (except the Department of Defense) from carrying out, funding, or authorizing project that would jeopardize an endangered or threatened species or their habitats

* For crimes on private land, fines can be as high as $100,000 and 1 year in prison

* ESA also made it illegal for Americans to sell or buy any product made from and endangered or threatened species, or to hunt, kill, collect, or injure such a species

U.S. Endangered Species Act

* Between 1973 and 2007 species listed have increased from 92 to about 1,350 (55% plants, 45% animals)

* For each species listed, the USFWS and NMFS is supposed to create a recovery plan that includes protecting and designating habitat

    * Successful examples: american alligator, gray wolf, peregrine falcon, and bald eagle

* ESA also requires that all shipments of wildlife or wildlife products enter or leave through one of nine designated ports

U.S. Endangered Species Act

* Amendments to the ESA have given private landowners incentives to save species

* Habitat Conservation Plan (HCP) - landowner, developer, or logger is allowed to destroy some critical habitat in exchange for taking steps to protect members of the species (setting aside land, paying to relocate)

    * Once the plan is approved it can not be changed even if new data shows the plan is not working

Many think the ESA should be further weakened

* Their suggestions:

    * Make protection of endangered species on private land voluntary

    * Force government to compensate landowners to protect species

    * Make it harder to list new endangered species

    * Eliminate the designation of critical habitats

    * Allow the Secretary of the Interior to permit a species to become extinct without trying to save it

    * Allow the Secretary of the Interior to grant permanent exemptions with no public notification or public comment

Bush Administration

* Bush Administration attempted to reverse the ESA

* That was hugely unpopular with the American public

* Instead decided to reinterpret the ESA so that it only protects species in areas where they are currently struggling to survive (not over their entire range)

    * This would remove 80% of the species listed

    * It would also make it almost impossible to add species

Other ways to protect species

* Wildlife Refuges

* Gene or seed banks - preserve genetic information of endangered species (plants)

* Zoos and Aquariums - protect with the goal of reintroducing species

    * Egg pulling - collecting eggs of endangered birds and hatching in zoos

    * Captive breeding - individuals captured for breeding in captivity so offspring can be introduced into the wild

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California Condor

* Largest bird in U.S.

* Nearly extinct (22 birds remained in the wild)

* Bred in captivity

* As of 2007, 135 condors have been released into the wild

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