

Threats to Biodiversity

★ An Overview



- ★ How do scientists account for the development of life on earth?
- ★ What is biological evolution by natural selection, and how can it account for the current diversity of organisms on the earth?
- ★ How can geologic processes, climate change and catastrophes affect biological evolution?
- ★ What is an ecological niche, and how does it help a population adapt to changing the environmental conditions?



Chapter Overview

Questions

- ★ How do extinction of species and formation of new species affect biodiversity?
- ★ What is the future of evolution, and what role should humans play in this future?
- ★ How did we become such a powerful species in a short time?



Chapter Overview

- ★ How have human activities affected the earth's biodiversity?
- ★ How should forest resources be used, managed, and sustained globally and in the United States?
- ★ How serious is tropical deforestation, and how can we help sustain tropical forests?
- ★ How should rangeland resources be used, managed, and sustained?



Chapter Overview

- ★ What problems do parks face, and how should we manage them?
- ★ How should we establish, design, protect, and manage terrestrial nature reserves?
- ★ What is wilderness, and why is it important?
- ★ What is ecological restoration, and why



Chapter Overview

- ★ How do biologists estimate extinction rates, and how do human activities affect these rates?
- ★ Why should we care about protecting wild species?
- ★ Which human activities endanger wildlife?
- ★ How can we help prevent premature



ORIGINS OF LIFE

- ★ 1 billion years of chemical change to form the first cells, followed by about 3.7 billion years of biological change.

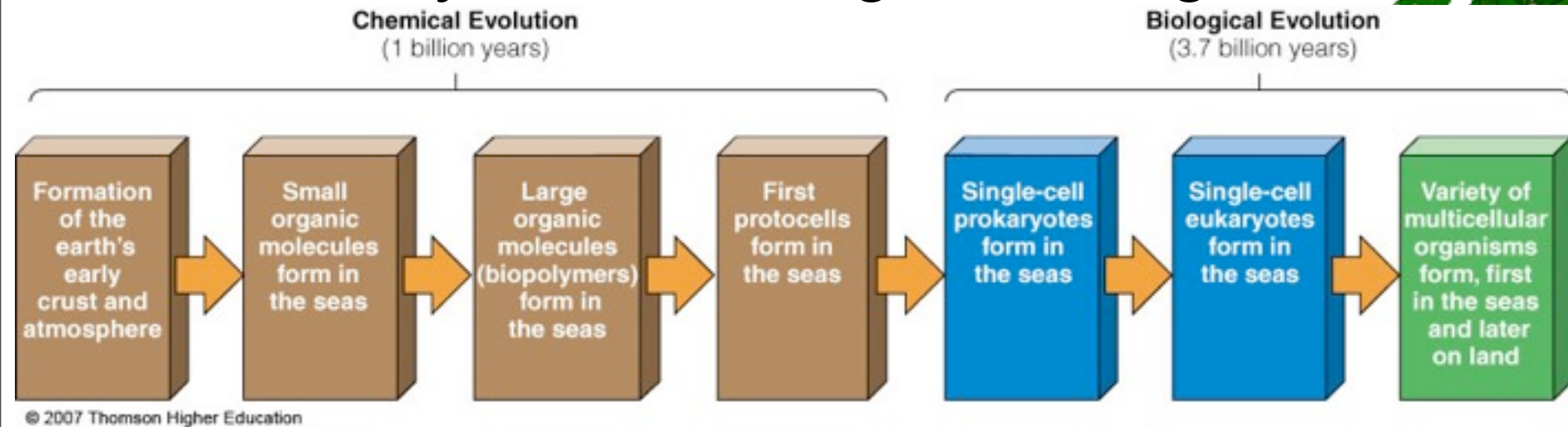
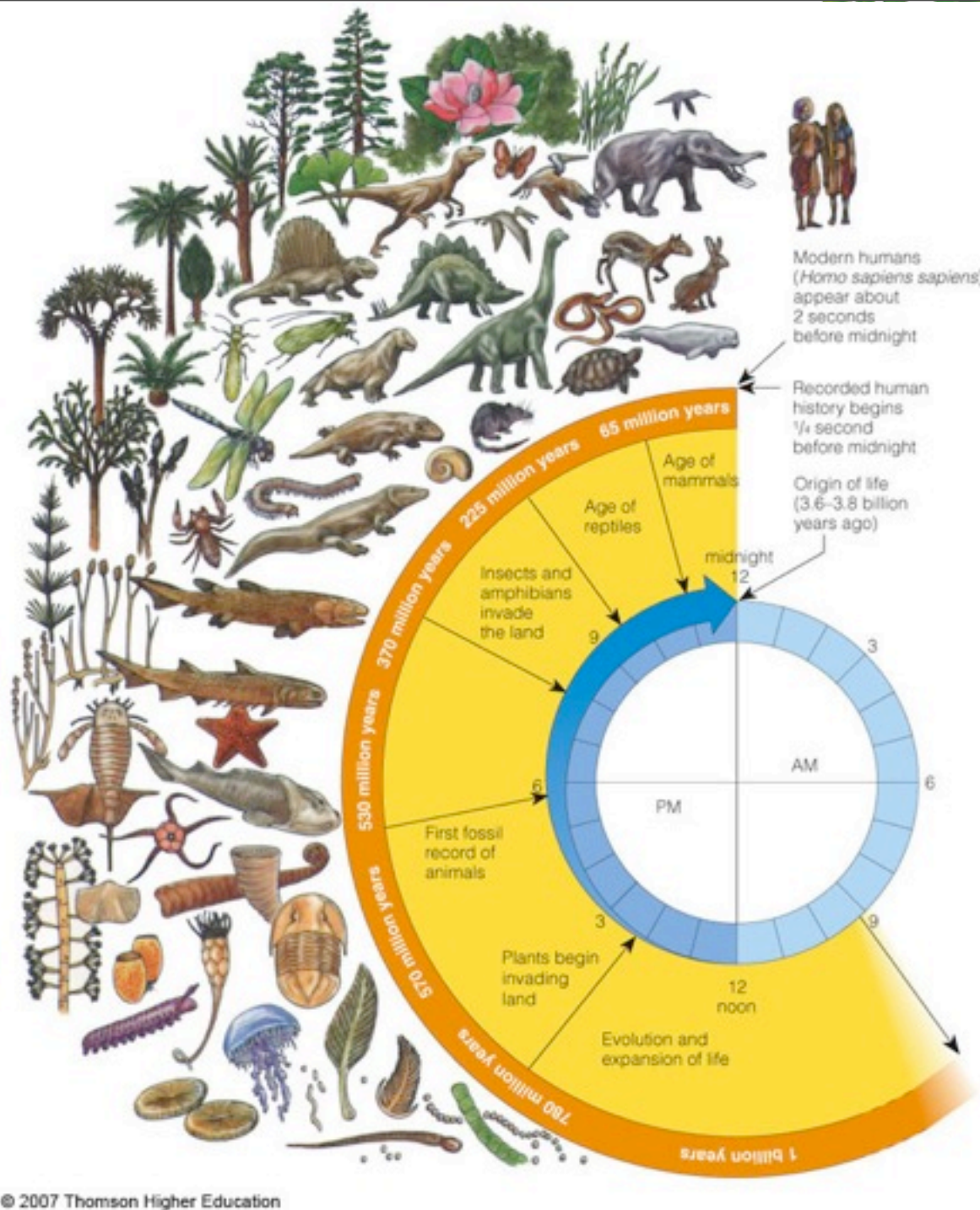


Figure 4-2

Biological Evolution

- ★ This has led to the variety of species we find on the earth today.



How Do We Know Which Organisms Lived in the



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★ Our knowledge about past life comes from fossils, chemical analysis, cores drilled out of buried ice, and DNA analysis.

Figure 4-4

EVOLUTION, NATURAL SELECTION, AND

- ★ Biological evolution by natural selection involves the change in a population's genetic makeup through successive generations.
 - Genetic Variability
 - Mutations
 - Adaptation
 - Differential Reproduction
 - Limits



Hybridization and Gene Swapping: other Ways to

- ★ New species can arise through hybridization.
 - Occurs when individuals to two distinct species crossbreed to produce an fertile offspring.
- ★ Some species (mostly microorganisms) can exchange genes without sexual reproduction.
 - Horizontal gene transfer



Common Myths about Evolution through Natural Selection

- ★ Evolution through natural selection is about the most descendants.
 - Organisms do not develop certain traits because they need them.
 - There is no such thing as genetic perfection.



GEOLOGIC PROCESSES, CLIMATE CHANGE, CATASTROPHES, AND

- ★ The movement of solid (tectonic) plates making up the earth's surface, volcanic eruptions, and earthquakes can wipe out existing species and help form new ones.
 - The locations of continents and oceanic basins influence climate.





225 million years ago



135 million years ago



65 million years ago



Present

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Climate Change and Natural Selection

- ★ Changes in climate throughout the earth's history have shifted where

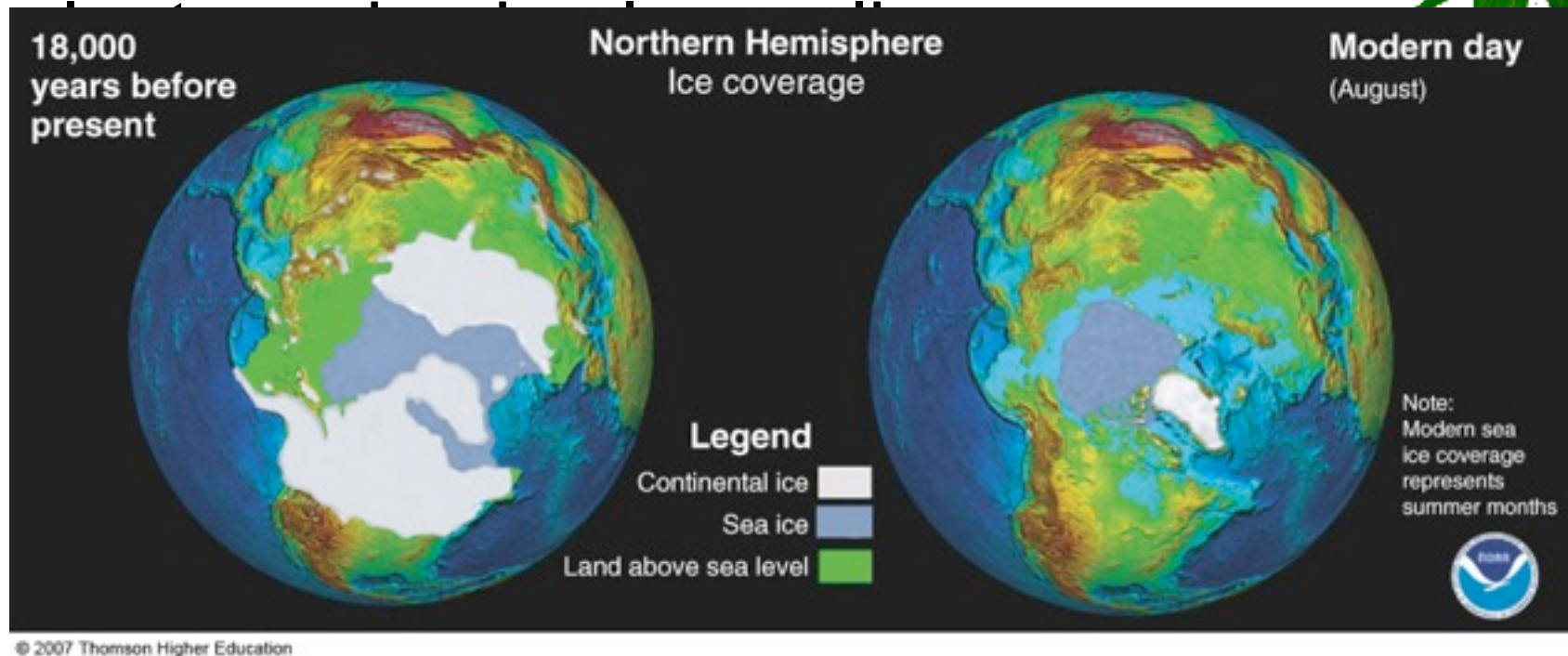


Figure 4-6

Catastrophes and Natural Selection

- ★ Asteroids and meteorites hitting the earth and upheavals of the earth from geologic processes have wiped out large numbers of species and created evolutionary opportunities by natural selection of new species.



SPECIATION, EXTINCTION, AND BIODIVERSITY

- ★ Speciation: A new species can arise when member of a population become isolated for a long period of time.
 - Genetic makeup changes, preventing them from producing fertile offspring with the original population if reunited.



Geographic Isolation



Arctic Fox

Adapted to cold through heavier fur, short ears, short legs, short nose. White fur matches snow for camouflage.

Different environmental conditions lead to different selective pressures and evolution into two different species.

Gray Fox

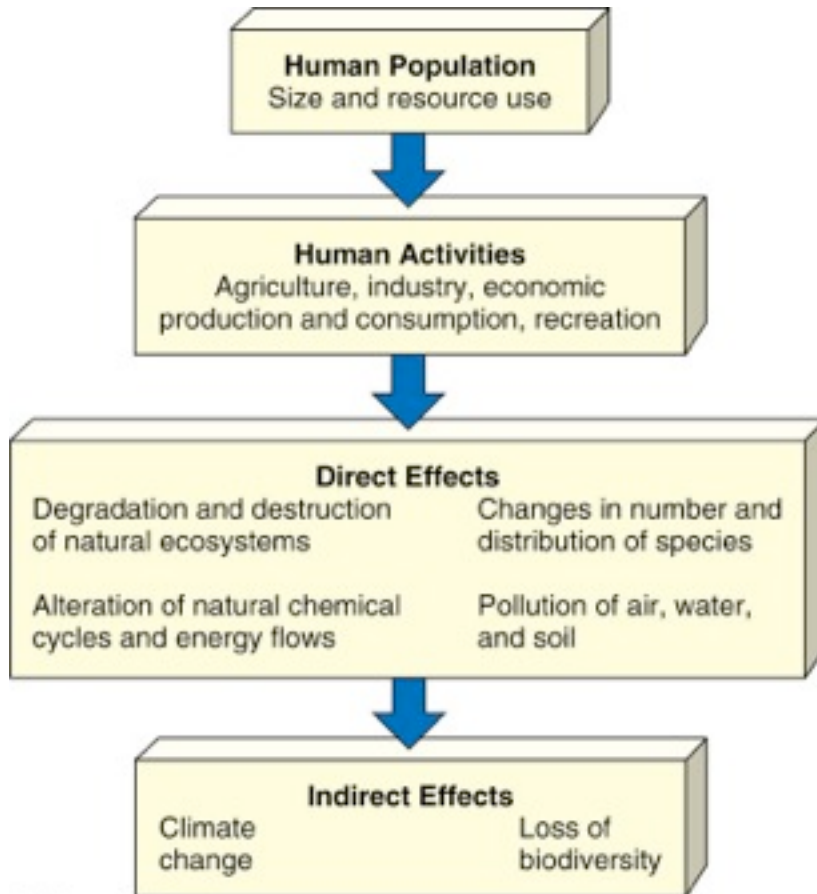
Adapted to heat through lightweight fur and long ears, legs, and nose, which give off more heat.

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- ★ ...can lead to reproductive isolation, divergence of gene pools and speciation.

Figure 4-10

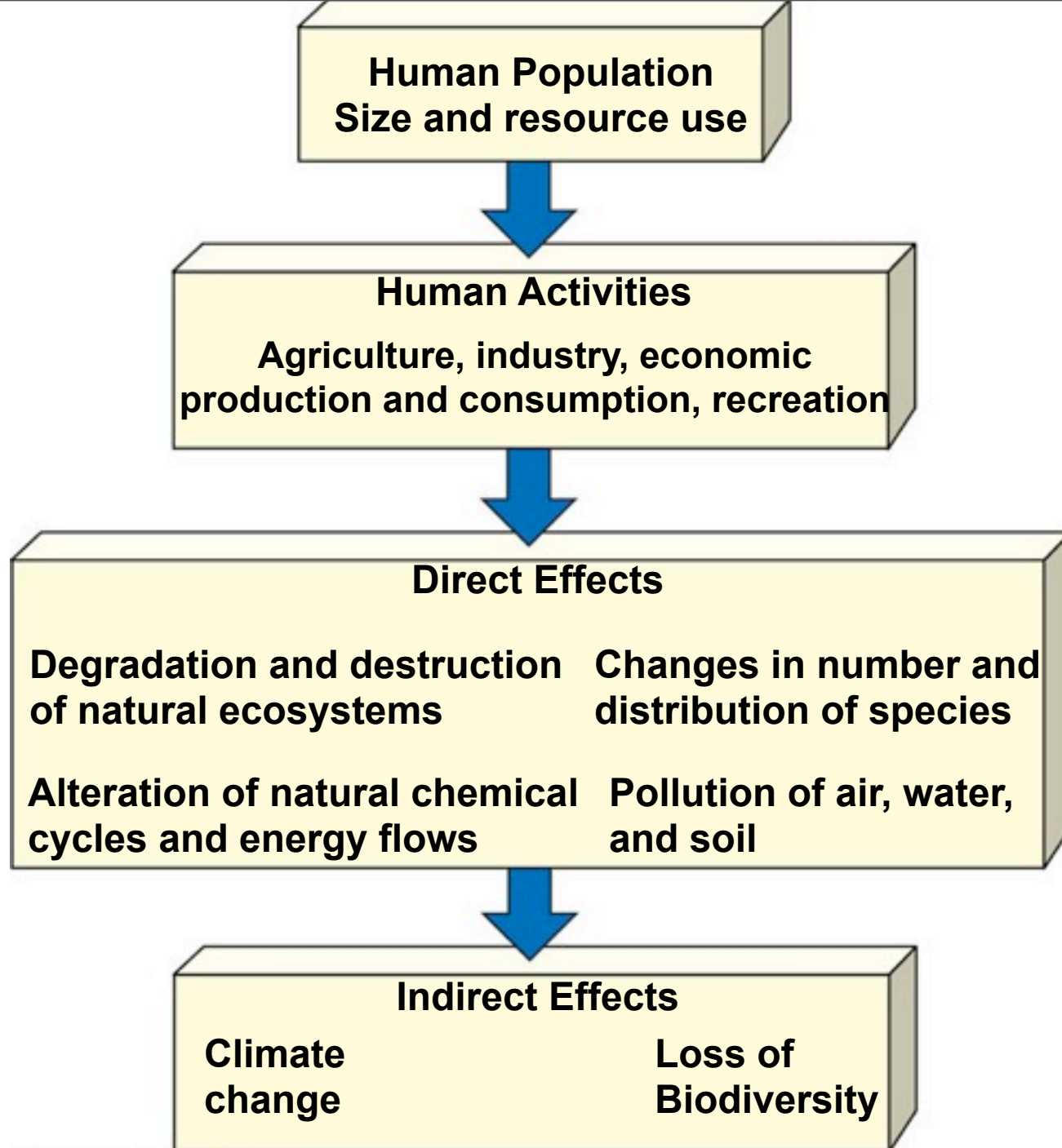
HUMAN IMPACTS ON TERRESTRIAL



- ✦ We have depleted and degraded some of the earth's biodiversity and these threats are expected to increase.

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Figure 10-2



Why Should We Care About Biodiversity?



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- ★ **Use Value:** For the usefulness in terms of economic and ecological services.
- ★ **Nonuse Value:** existence, aesthetics, bequest for future generations.

Figure 10-3

Natural Capital

Forests

Ecological Services

Support energy flow and chemical cycling

Reduce soil erosion

Absorb and release water

Purify water and air

Influence local and regional climate

Store atmospheric carbon

Provide numerous wildlife habitats



Economic Services

Fuelwood

Lumber

Pulp to make paper

Mining

Livestock grazing

Recreation

Jobs



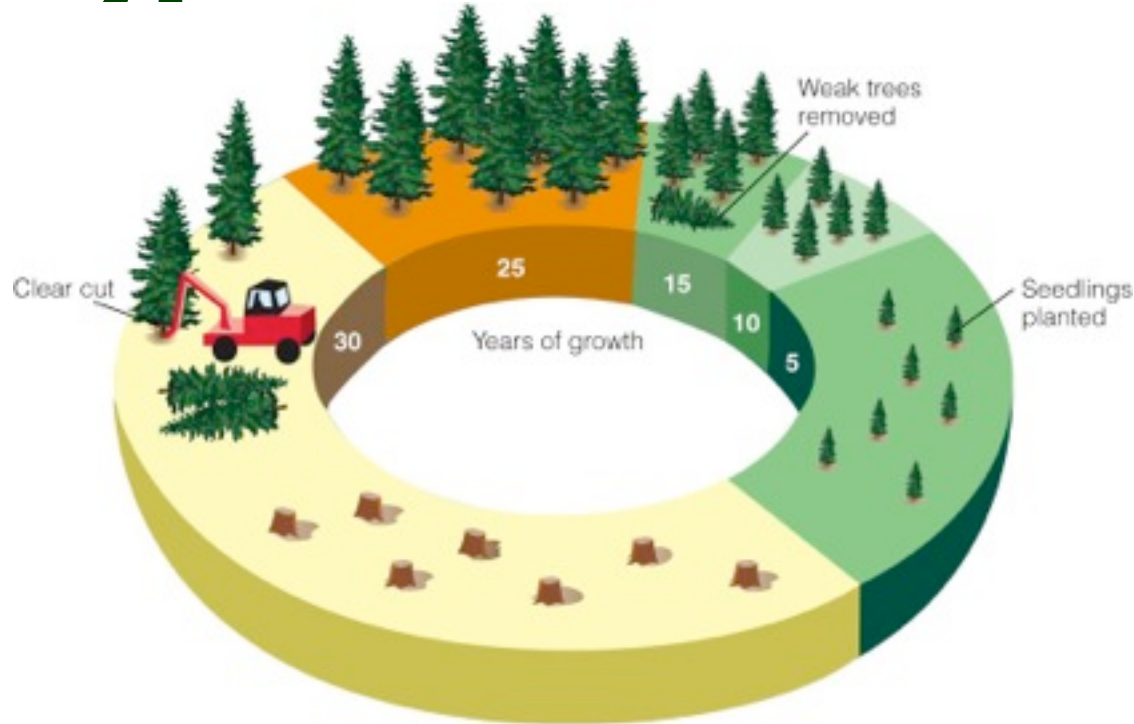
Types of Forests

- ★ ***Old-growth forest:***
uncut or regenerated forest that has not been seriously disturbed for several hundred years.
 - 36% of world's forest.
 - Hosts many species with specialized niches.



Figure 10-5

Types of Forests



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- ★ **Second-growth forest**: a stand of trees resulting from natural secondary succession. (60%)
- ★ **Tree plantation**: planted stands of a particular tree species. (4%)

Figure 10-6

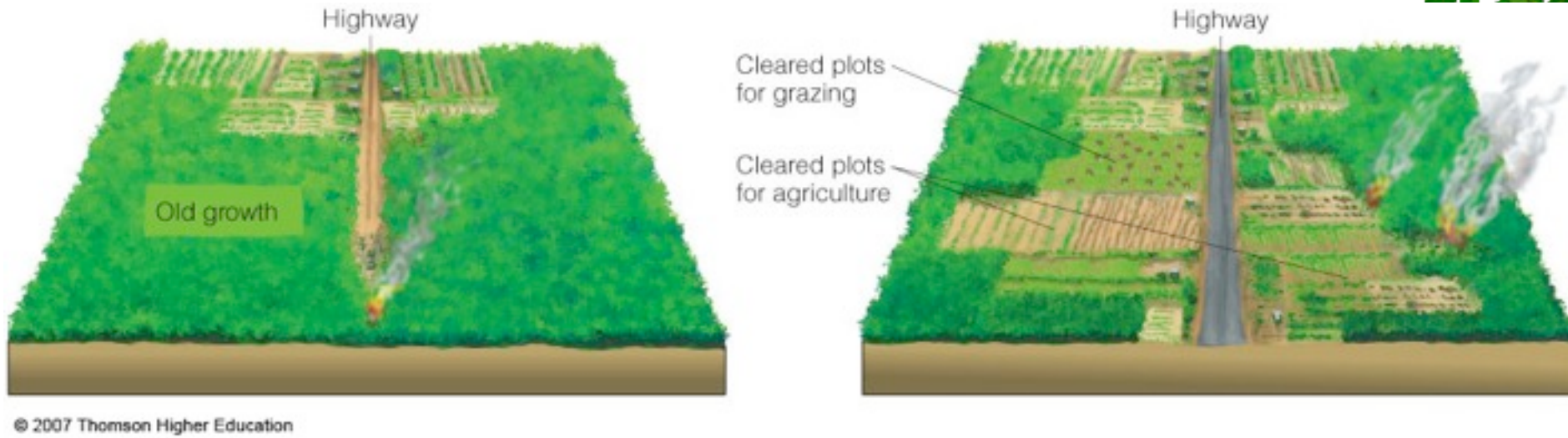
Natural Capital Degradation

Deforestation

- **Decreased soil fertility from erosion**
- **Runoff of eroded soil into aquatic systems**
- **Premature extinction of species with specialized niches**
- **Loss of habitat for native species and migratory species such as birds and butterflies**
- **Regional climate change from extensive clearing**
- **Release of CO₂ into atmosphere**
- **Acceleration of flooding**



Harvesting Trees

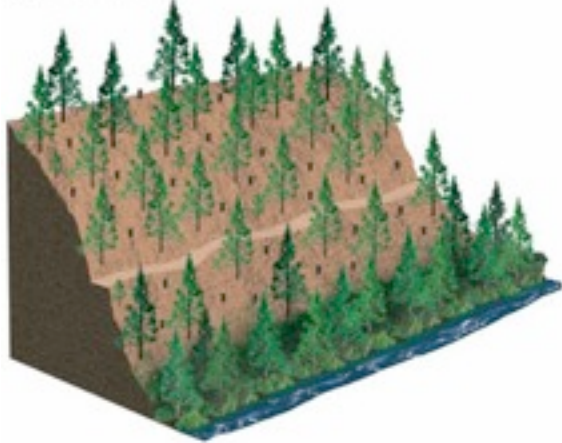


- ★ Building roads into previously inaccessible forests paves the way for fragmentation, destruction, and degradation.

Figure 10-8



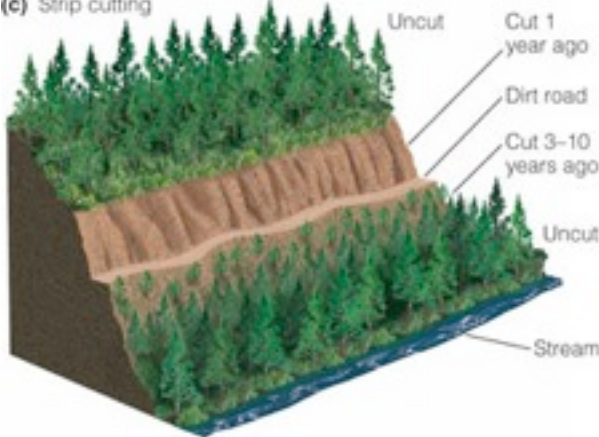
(a) Selective cutting



(b) Clear-cutting



(c) Strip cutting



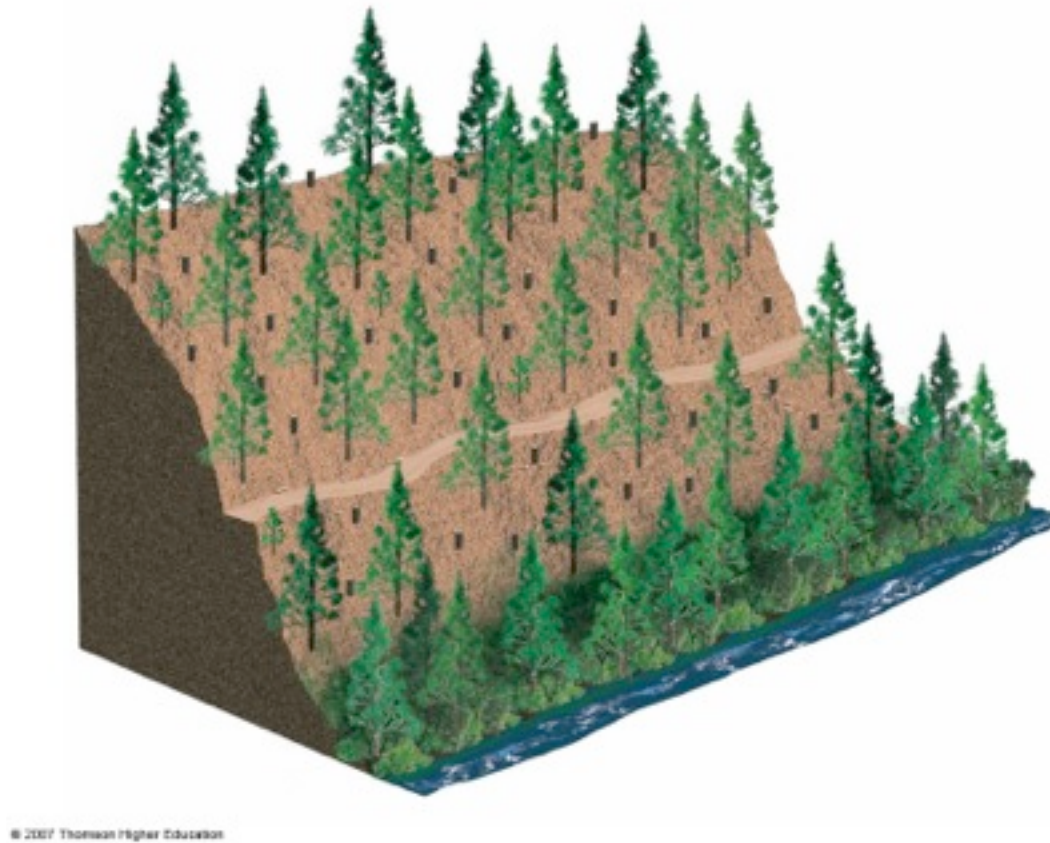
Harvesting Trees

- ★ Trees can be harvested individually from diverse forests (selective cutting), an entire forest can be cut down (clear cutting), or portions of the forest is harvested (e.g. strip cutting).

Figure 10-9



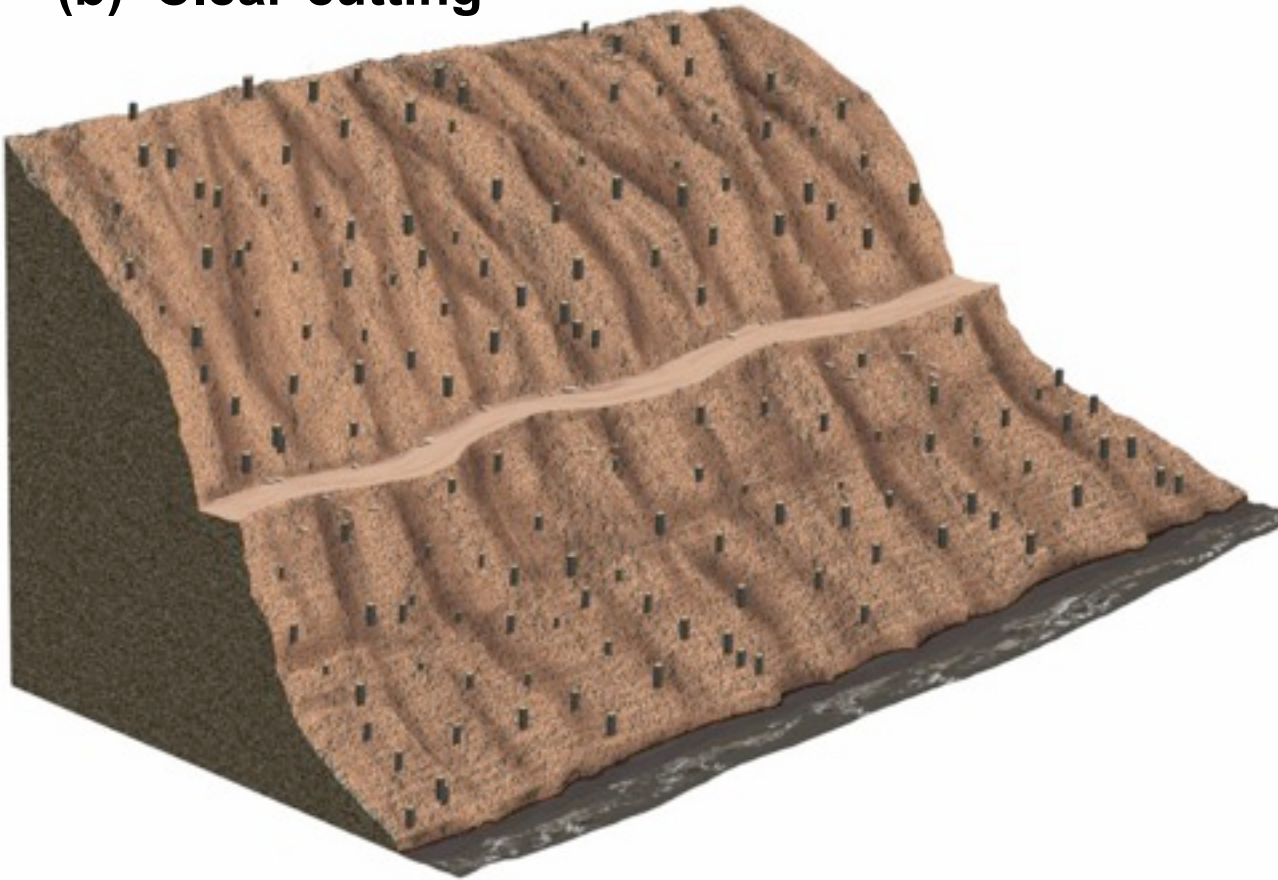
(a) Selective cutting



Cut intermediate to mature aged trees

Fig. 10-9a, p. 198

(b) Clear-cutting



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Most efficient but does considerable damage

Fig. 10-9b, p. 198



(c) Strip cutting

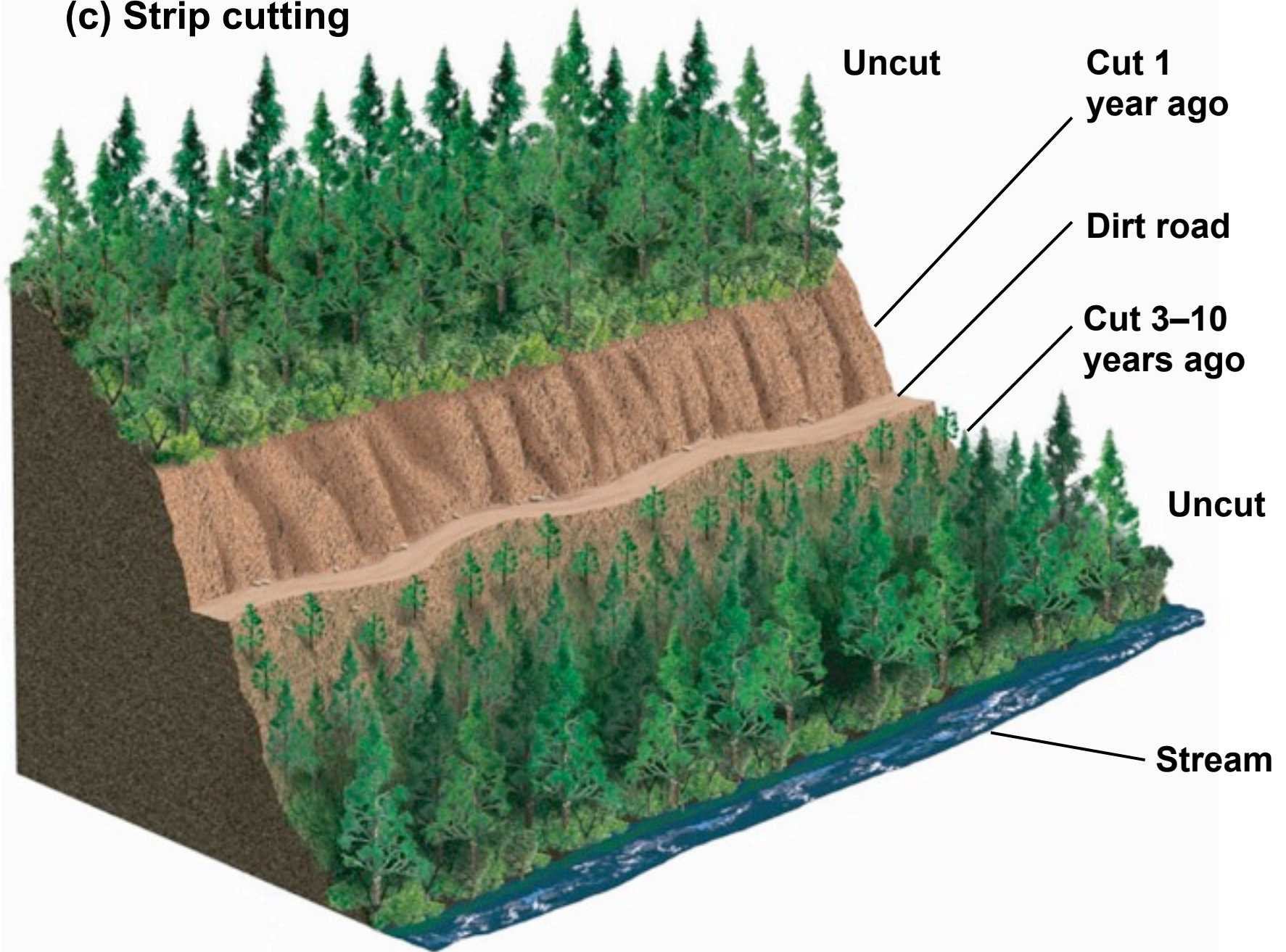


Fig. 10-9c, p. 198

Harvesting Trees

Trade-Offs	
Clear-Cutting Forests	
Advantages	Disadvantages
Higher timber yields	Reduces biodiversity
Maximum profits in shortest time	Disrupts ecosystem processes
Can reforest with fast-growing trees	Destroys and fragments wildlife habitats
Short time to establish new stand of trees	Leaves large openings
Needs less skill and planning	Increases water pollution, flooding, and erosion on steep slopes
Good for tree species needing full or moderate sunlight	Eliminates most recreational value

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Effects of clear-cutting in the state of Washington, U.S.

Figures 10-10 and 10-11

Trade-Offs

Clear-Cutting Forests

Advantages

Disadvantages

Higher timber yields

Maximum profits in shortest time

Can reforest with fast-growing trees

Short time to establish new stand of trees

Needs less skill and planning

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Reduces biodiversity

Disrupts ecosystem processes

Destroys and fragments wildlife habitats

Leaves large openings

Increases water pollution, flooding, and erosion on steep slopes

Eliminates most recreational value

- Identify and protect forest areas high in biodiversity
- Grow more timber on long rotations
- Rely more on selective cutting and strip cutting
- Stop clear-cutting on steep slopes
- Cease logging of old-growth forests
- Prohibit fragmentation of remaining large blocks offorest
- Sharply reduce road building into uncut forest areas
- Leave most standing dead trees and fallen timber for wildlife habitat and nutrient recycling
- Certify timber grown by sustainable methods
- Include ecological services of forests in estimating their economic value
- Plant tree plantations on deforested and degraded land
- Shift government subsidies from harvesting trees to planting trees



Threats to Forest Ecosystems

- Wildfires

- Insects

- Disease

- ban imported timber that might introduce harmful insects and disease
 - remove infected trees
 - conventional pesticides



Types and Effects of



Surface Fire-burns
undergrowth and
leaf litter



Crown fire- burns
whole trees, kill
wildlife

- ★ Depending on their intensity, fires can benefit or harm forests.
 - Burn away flammable ground material.
 - Release valuable mineral nutrients.

Figure 10-13

Solutions:

Controversy Over Fire

- ★ To reduce fire damage:
 - Set controlled surface fires.
 - Use goats in populated areas
 - Allow fires to burn on public lands if they don't threaten life and property.
 - Clear small areas around property subject to fire.
 - Remove small fire prone trees and underbrush



Solutions:

Controversy Over Fire

- ★ In 2003, U.S. Congress passed the *Healthy Forest Restoration Act*:
 - Allows timber companies to cut medium and large trees in 71% of the national forests.
 - In return, must clear away smaller, more fire-prone trees and underbrush.
 - Some forest scientists believe this could increase severe fires by removing fire resistant trees and leaving highly flammable slash.

Controversy over Logging in U.S. National Forests

Trade-Offs	
Logging in U.S. National Forests	
Advantages	Disadvantages
Helps meet country's timber needs	Provides only 4% of timber needs
Cut areas grow back	Ample private forest land to meet timber needs
Keeps lumber and paper prices down	Has little effect on timber and paper prices
Provides jobs in nearby communities	Damages nearby rivers and fisheries
Promotes economic growth in nearby communities	Recreation in national forests provides more local jobs and income for local communities than logging
	Decreases recreational opportunities

★ There has been an ongoing debate over whether U.S. national forests should be primarily for:

- Timber.
- Ecological services.
- Recreation.
- Mix of these uses.

Figure 10-14

Trade-Offs

Logging in U.S. National Forests

Advantages

Helps meet country's timber needs

Cut areas grow back

Keeps lumber and paper prices down

Provides jobs in nearby communities

Promotes economic growth in nearby communities



Disadvantages

Provides only 4% of timber needs

Ample private forest land to meet timber needs

Has little effect on timber and paper prices

Damages nearby rivers and fisheries

Recreation in national forests provides more local jobs and income for local communities than logging

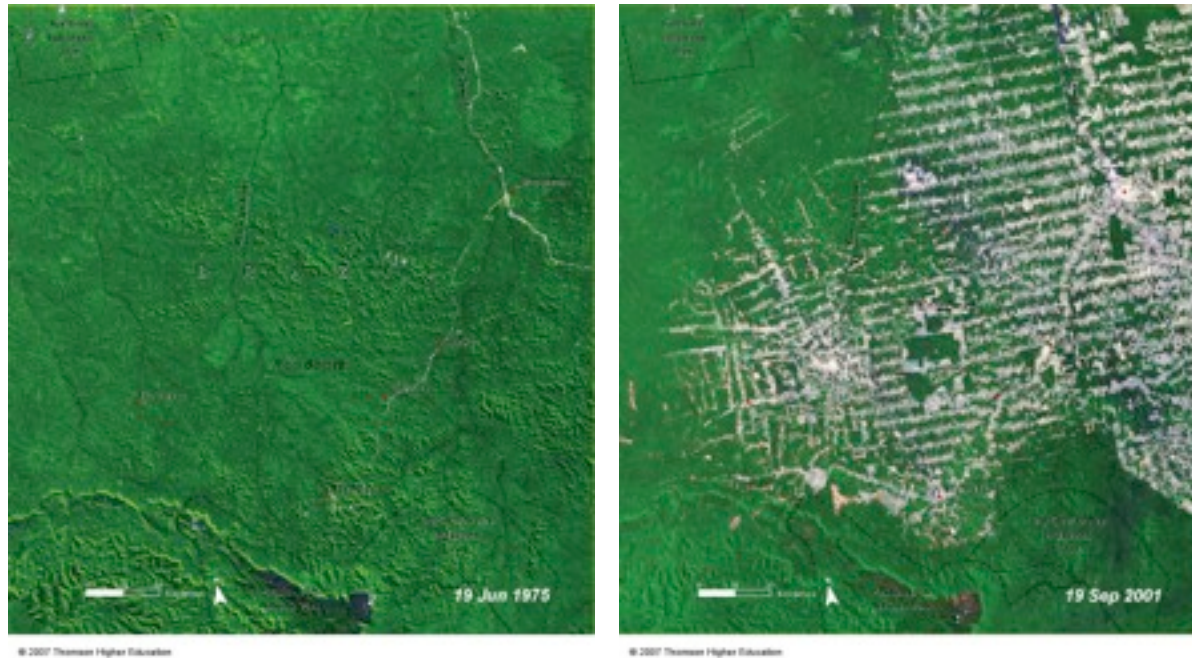
Decreases recreational opportunities

Deforestation

- Tropical rainforest loses
- Northern Boreal Forest
 - Alaska, Canada, Russia
 - Large storehouse of carbon
- There has been some improvement, but some of that is because of the spread of commercial tree farms.



CASE STUDY: TROPICAL DEFORESTATION



- ★ Large areas of ecologically and economically important tropical forests are being cleared and degraded at a fast rate.

Figure 10-16

Solutions:



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- ★ Tree harvesting can be reduced by wasting less wood and making paper and charcoal fuel from fibers that do not come from trees.

- Kenaf is a promising plant for paper production.

Figure 10-15

American Forests in a

- ★ Timber from tree plantations in temperate and tropical countries is decreasing the need for timber production in the U.S.
 - This could help preserve the biodiversity in the U.S. by decreasing pressure to clear-cut old-growth and second-growth forests.



CASE STUDY: TROPICAL DEFORESTATION



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- ★ At least half of the world's terrestrial plant and animal species live in tropical rain forests.
- ★ Large areas of tropical forest are burned to make way for cattle ranches and crops.

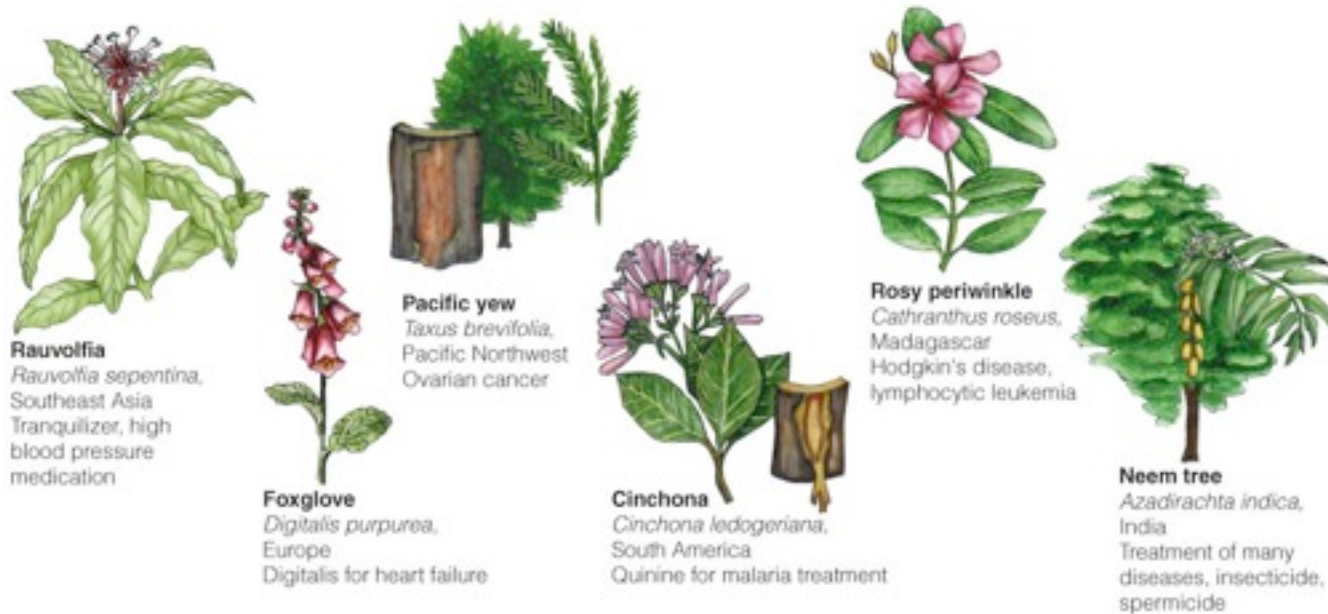
Figure 10-17

Causes of Tropical Deforestation

- ★ Subsidies
- ★ Population growth
- ★ Poverty
- ★ Crop and timber exports
- ★ Fires
- ★ Logging
- ★ Roads
- ★ Tree plantations



Why Should We Care about the Loss of Tropical Forests?



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- ★ About 2,100 of the 3,000 plants identified by the National Cancer Institute as sources of cancer-fighting chemicals come from tropical forests.

Figure 10-18

Solutions

Sustaining Tropical Forests

Prevention

Protect most diverse and endangered areas

Educate settlers about sustainable agriculture and forestry

Phase out subsidies that encourage unsustainable forest use

Add subsidies that encourage sustainable forest use

Protect forests with debt-for-nature swaps and conservation easements

Certify sustainably grown timber

Reduce illegal cutting

Reduce poverty

Slow population growth



Restoration

Reforestation

Rehabilitation of degraded areas

Concentrate farming and ranching on already-cleared areas

Reducing Tropical Deforestation

- ★ Conservation Concession
 - Gov't or private organizations pay nations for concessions to preserve their natural resources
- ★ Debt for nature swaps
 - Participating countries as to protect forest reserves in return for aid



Kenya's Green Belt Movement:

- ★ Wangari Maathai founded the Green Belt Movement.
- ★ The main goal is to organize poor women to plant (for fuelwood) and protect millions of trees.
- ★ In 2004, awarded Nobel peace prize.



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Figure 10-10A

Rangeland/Grassland

- ★ Unfenced grasslands in temperate & tropical climates that supply vegetation for animals
- ★ After forests, they are the ecosystem most altered by humans.
- ★ Importance
 - Soil formation
 - Erosion control
 - Nutrient cycling



MANAGING AND SUSTAINING GRASSLANDS

- ★ Almost half of the world's livestock graze on natural grasslands (rangelands) and managed grasslands (pastures).
- ★ We can sustain rangeland productivity by controlling the number and distribution of livestock and by restoring degraded rangeland.



MANAGING AND SUSTAINING GRASSLANDS



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- ★ Overgrazing (left) occurs when too many animals graze for too long and exceed carrying capacity of a grassland area.

Figure 10-21

MANAGING AND SUSTAINING GRASSLANDS



- ★ Example of restored area along the San Pedro River in Arizona after 10 years of banning grazing and off-road vehicles.
- ★ Rotational Grazing
- ★ Replanting, herbicides, controlled burning, trampling by livestock

Figure 10-22

Case Study: Grazing and Urban Development in the

- ★ Ranchers, ecologists, and environmentalists are joining together to preserve the grasslands on cattle ranches.
 - Paying ranchers conservation easements (barring future owners from development).



NATIONAL PARKS

- ★ Countries have established more than 1,100 national parks, but most are threatened by human activities.
 - Local people invade park for wood, cropland, and other natural resources.
 - Loggers, miners, and wildlife poachers also deplete natural resources.
 - Many are too small to sustain large-animal species.



Case Study: Stresses on U.S. National Parks



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- ★ Overused due to popularity.
- ★ In need of \$ for repairs and infrastructure.
- ★ Have become small islands of biodiversity.
- ★ Air pollution.

Figure 10-23

Solutions

National Parks

- **Integrate plans for managing parks and nearby federal lands**
- **Add new parkland near threatened parks**
- **Buy private land inside parks**
- **Locate visitor parking outside parks and use shuttle buses for entering and touring heavily used parks**
- **Increase funds for park maintenance and repairs**
- **Survey wildlife in parks**
- **Raise entry fees for visitors and use funds for park management and maintenance**
- **Limit the number of visitors to crowded park areas**
- **Increase the number and pay of park rangers**
- **Encourage volunteers to give visitor lectures and tours**
- **Seek private donations for park maintenance and repairs**



NATURE RESERVES

- ★ Ecologists call for protecting more land to help sustain biodiversity, but powerful economic and political interests oppose doing this.
 - Currently 12% of earth's land area is protected.
 - Only 5% is strictly protected from harmful human activities.
 - Conservation biologists call for full protection of at least 20% of earth's land area representing multiple examples of all biomes.
 - Most of the progress being made is because of private organizations



Design & Connection

- ★ Core Area
- ★ Buffer Zone
- ★ Habitat Corridors
- ★ Ex. Costa Rica



NATURE RESERVES

- ★ Large and medium-sized reserves with buffer zones help protect biodiversity and can be connected by corridors.

- ★ Costa Rica has consolidated its parks and reserves into 8 megareserves designed to sustain 80% of its biodiversity.



Figure 10-10B



4 Point Strategy

- ★ Map global ecosystems
- ★ Locate and protect endangered ecosystems & species
- ★ Restore as many degraded ecosystems as possible
- ★ Make development biodiversity-friendly





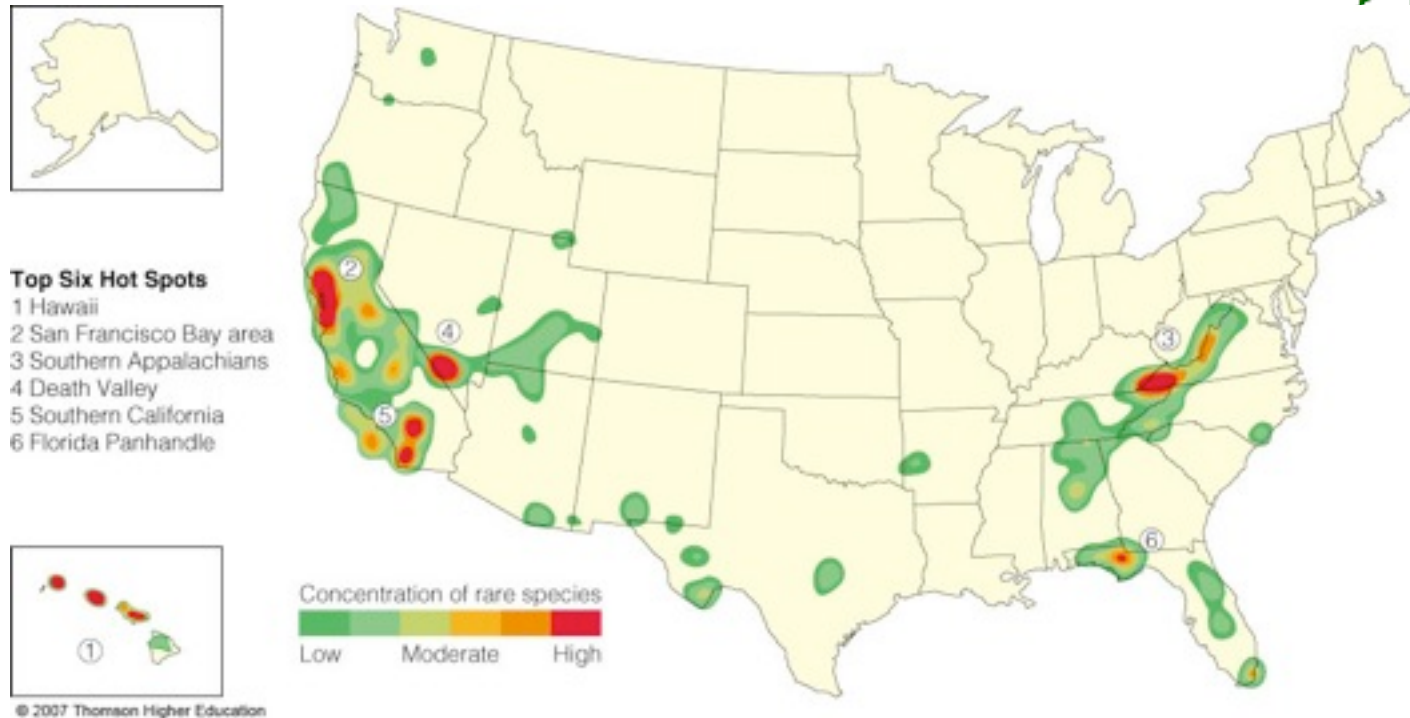
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- ★ 34 hotspots identified by ecologists as important and endangered centers of biodiversity.

Figure 10-26

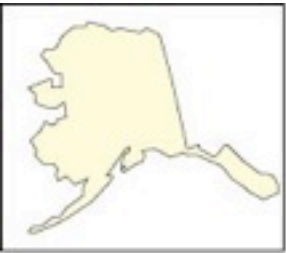
Case Study:

The U.S. Endangered Species Act

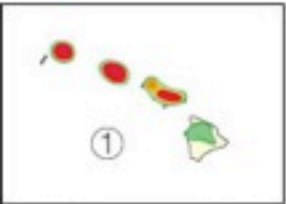


- ★ Biodiversity hotspots in relation to the largest concentrations of rare and potentially endangered species in the U.S.

Figure 11-18



- Top Six Hot Spots**
- 1** Hawaii
 - 2** San Francisco Bay area
 - 3** Southern Appalachians
 - 4** Death Valley
 - 5** Southern California
 - 6** Florida Panhandle



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Concentration of rare species

Low Moderate High

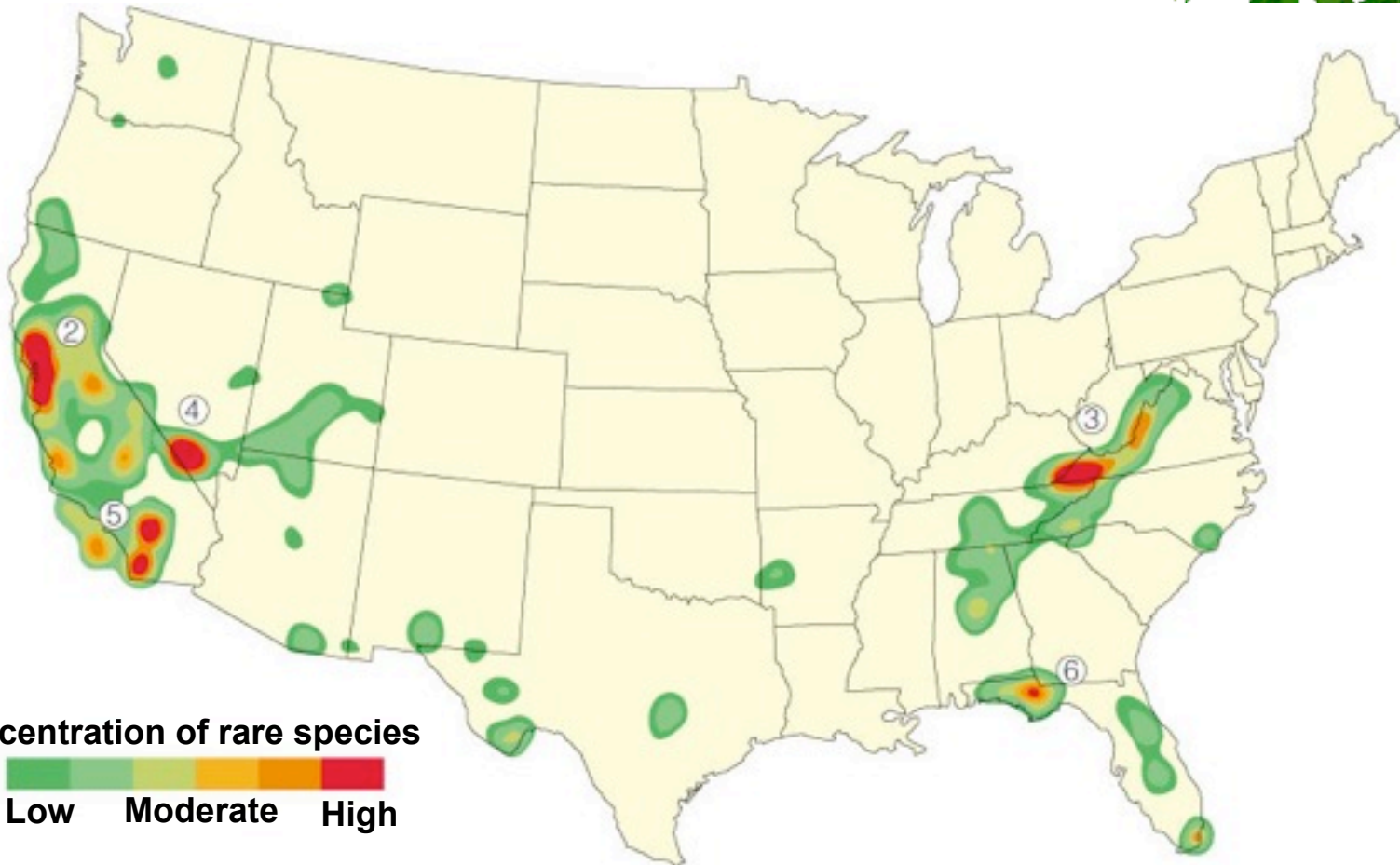


Fig. 11-18, p. 241



ECOLOGICAL

- ★ ***Restoration***: trying to return to a condition as similar as possible to original state.
- ★ ***Rehabilitation***: attempting to turn a degraded ecosystem back to being functional.
- ★ ***Replacement***: replacing a degraded ecosystem with another type of



ECOLOGICAL

- ★ Five basic science-based principles for ecological restoration:
 - Identify cause.
 - Stop abuse by eliminating or sharply reducing factors.
 - Reintroduce species if necessary.
 - Protect area from further degradation.
 - Use adaptive management to monitor



Will Restoration Encourage Further Destruction?

- ★ There is some concern that ecological restoration could promote further environmental destruction and degradation.
 - Suggesting that any ecological harm can be undone.
 - Preventing ecosystem damage is far cheaper than ecological restoration.



Mitigation Costs

- The costs of offsetting damages. For example, how much would it cost to protect a forest from cutting, move an endangered species to a new habitat, or restore a statue damaged by air pollution?



Preservation

- ★ Setting aside or protecting undisturbed natural areas from harmful human activities.



Remediation

- ★ Repairing an ecosystem that has been destroyed.



Sustainability

- ★ Ability of a system to survive for some specified time.



WHAT CAN WE DO?

- ★ Eight priorities for protecting biodiversity:
 - Take immediate action to preserve world's biological hot spots.
 - Keep intact remaining old growth.
 - Complete mapping of world's biodiversity for inventory and decision making.
 - Determine world's marine hot spots.



WHAT CAN WE DO?

- Ensure that the full range of the earth's ecosystems are included in global conservation strategy.
- Make conservation profitable.
- Initiate ecological restoration products to heal some of the damage done and increase share of earth's land and water allotted to the rest of nature.



New Approach

- ★ Reconciliation/Applied Ecology
 - Establish and maintain new habitats to conserve species in places where people live, work, and play
 - Community-based conservation



Biodiversity

Definition: Variety of
different species.



Species Diversity:

Number of different species and their relative abundances in a given area.
Combination of species richness & evenness.

- richness: number of species an ecosystem contains

- evenness: abundance of individuals within each species



Genetic Diversity:

Variety in the genetic makeup of organisms of a species that allow the species to reproduce and gain a competitive advantage



Ecosystem Diversity:

The variety of forests,
deserts, grasslands,
oceans, lakes, etc.



Importance of Diversity

- ★ Stability- stable environment
- ★ Genetic reserves- genetic diversity
- ★ Medicinal- medicines
- ★ Agricultural- food
- ★ Industrial- building homes; things we use
- ★ Scientific- experimental; new technology
- ★ Aesthetic- beautiful
- ★ Ethical- what should we do regarding the environment
- ★ Religious- religious beliefs regarding environment



Extinction: Lights Out

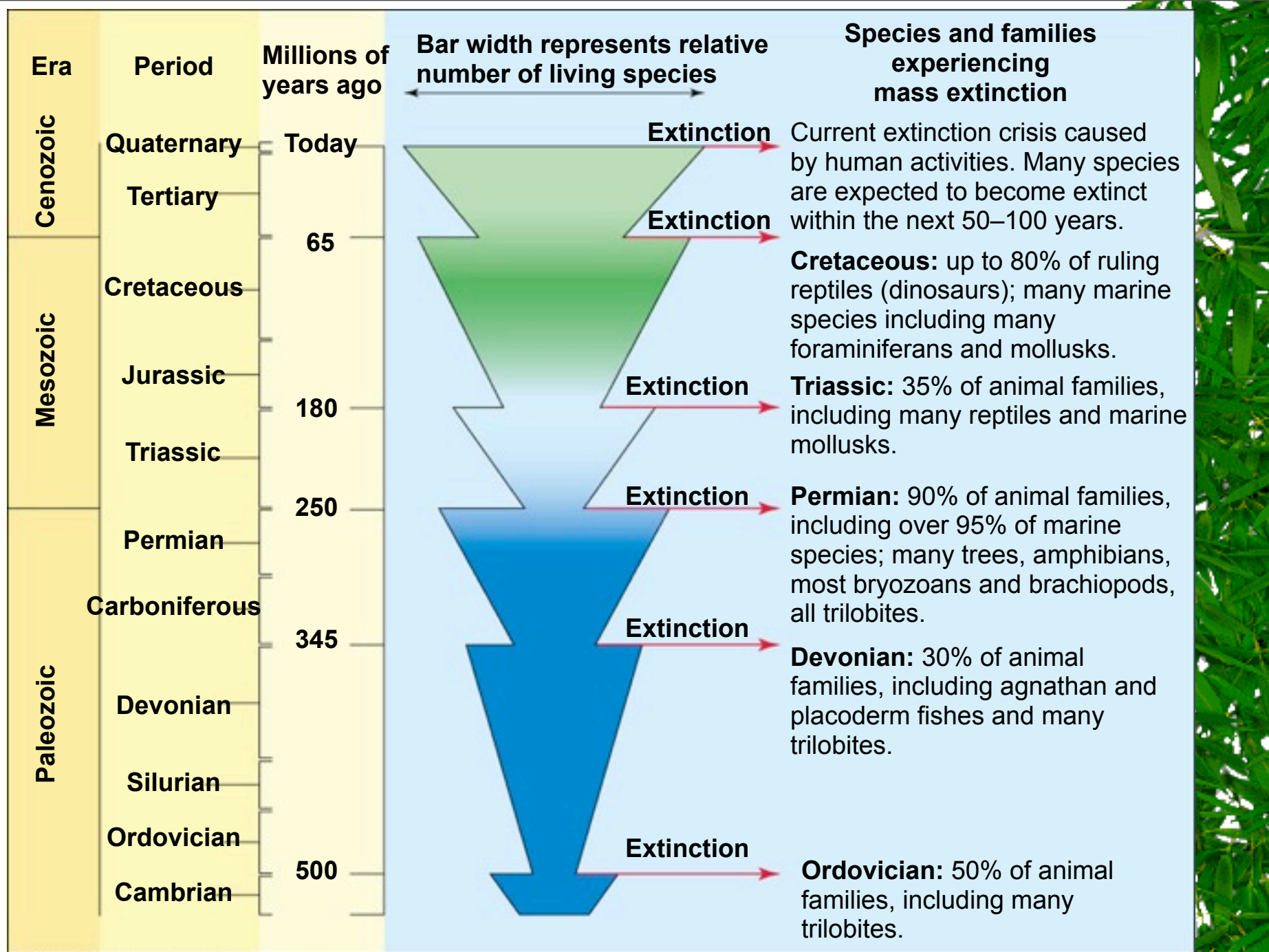


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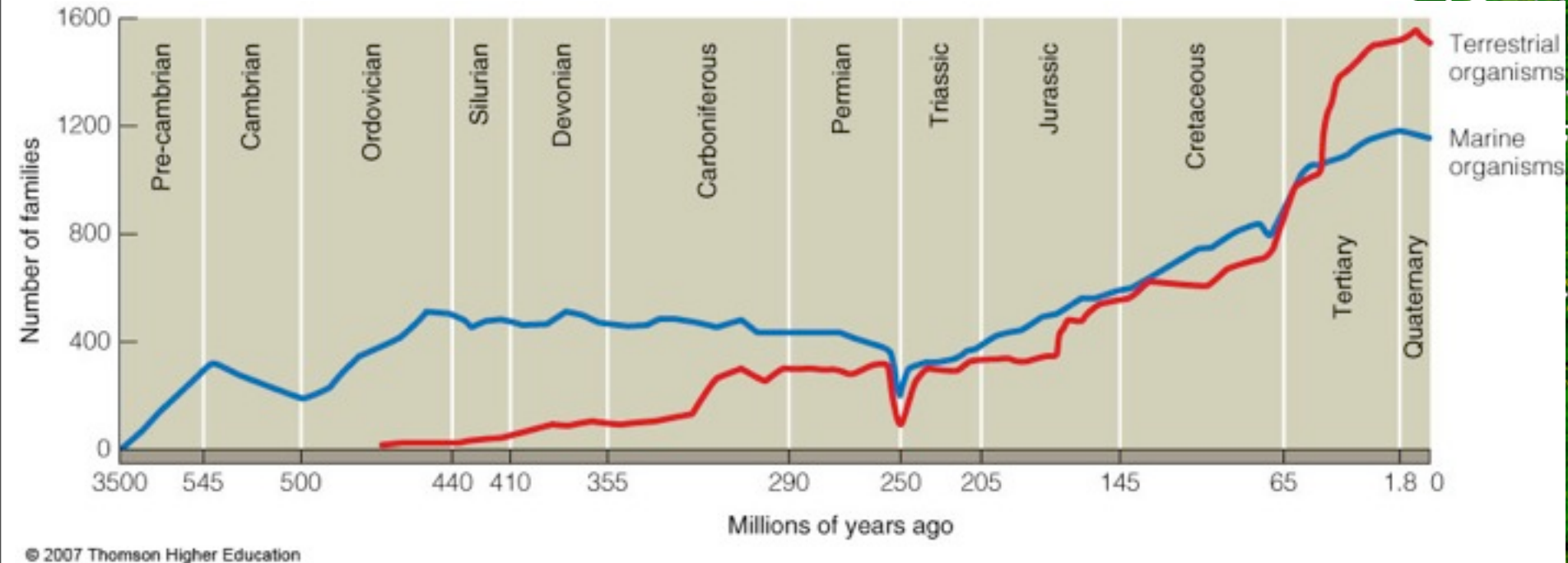
➤ The golden toad of Costa Rica's Monteverde cloud forest has become extinct because of changes in climate.

- ★ Extinction occurs when the population cannot adapt to changing environmental conditions.

Figure 4-11

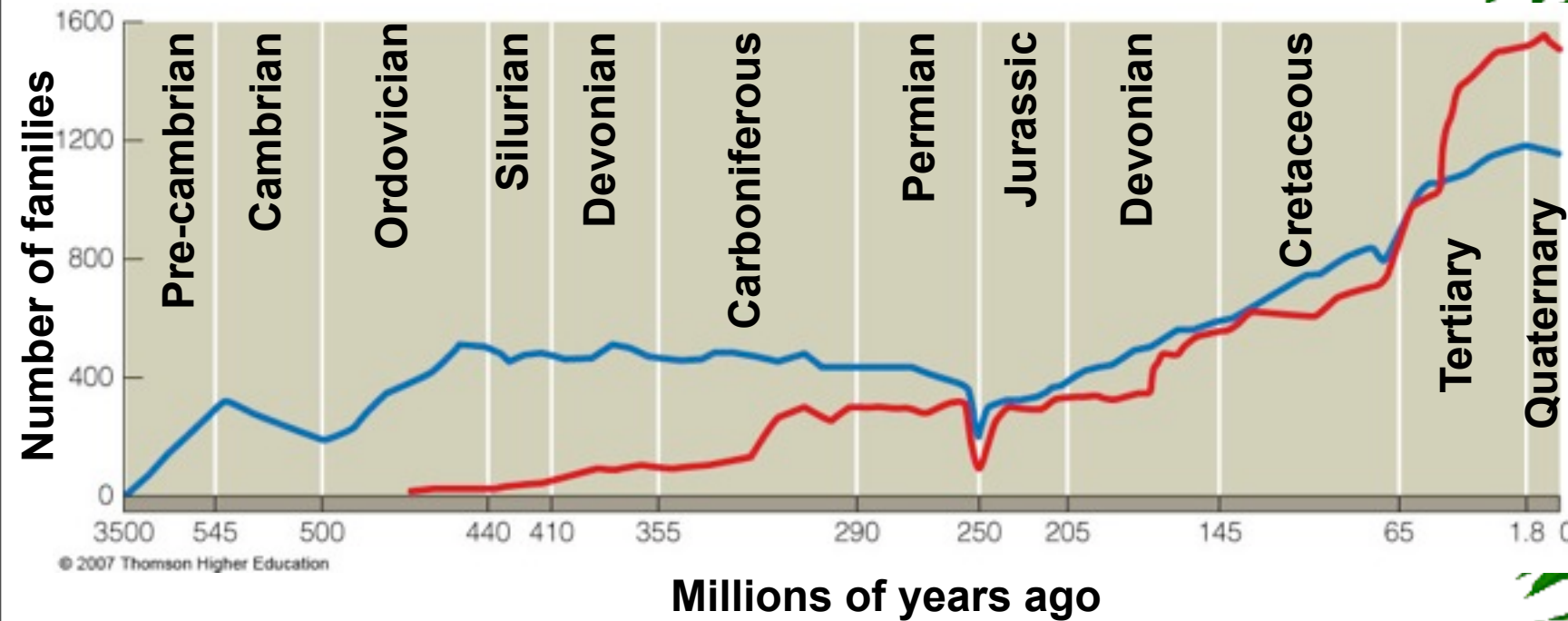


Effects of Humans on



- ★ The scientific consensus is that human activities are decreasing the earth's biodiversity.

Figure 4-13



Terrestrial organisms

Marine organisms

Fig. 4-13, p. 94

Endangered Species

History of Extinctions

★ Extinctions have existed long before humans had an influence

However:



•The current extinction crisis is the first to be caused by a single species- US!

. This is happening faster than ever; a few decades versus thousands to millions of years.

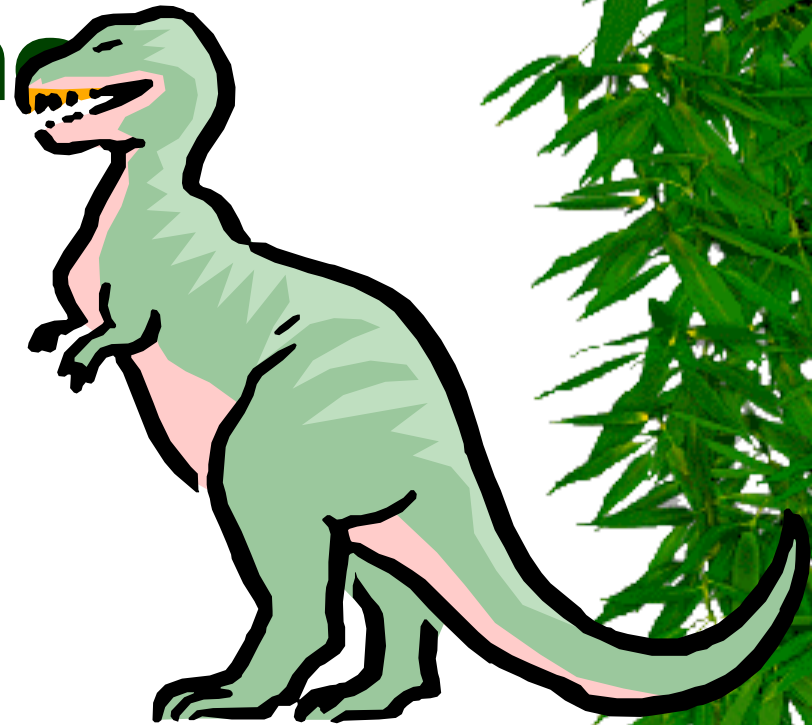
Humans are eliminating not only the species but, the



VOCABULARY:

Extinct-

**Complete
disappearance of a
species from the
earth.**



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
- mass extinction**: extinction of many species in a relatively short amount of time. (we have had 5)



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.
 - **Globally (biologically)**: Species is no longer found on the earth.



Global Extinction



Passenger pigeon



Great auk



Dodo



Dusky seaside sparrow



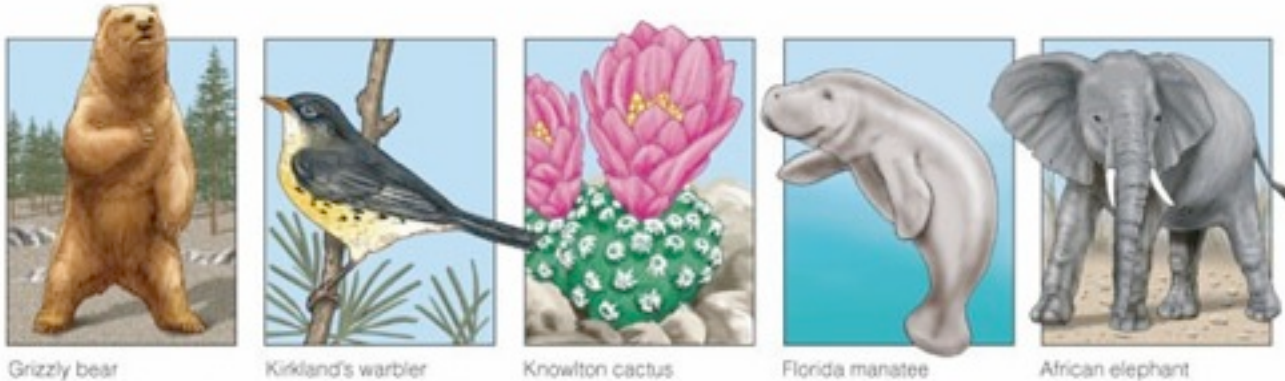
Aepyornis
(Madagascar)

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- ★ Some animals have become prematurely extinct because of human activities.

Figure 11-2

Endangered and Threatened Species: Ecological Smoke



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- ★ ***Endangered species***: 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.

Figure 11-3



Grizzly bear



Kirkland's warbler



Knowlton cactus



Florida manatee



African elephant



Utah prairie dog



Swallowtail butterfly



Humpback chub



Golden lion tamarin



Siberian tiger



Giant panda



Black-footed ferret



Whooping crane



Northern spotted owl



Blue whale



Mountain gorilla



Florida panther



California condor



Hawksbill sea turtle



Black rhinoceros

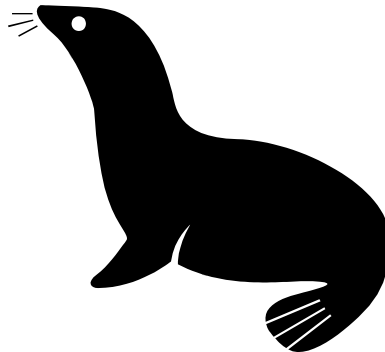


Endangered-
Species with so few
survivors that the
species could soon
become extinct



Threatened/Vulnerable

Wild species that is still abundant in its natural range but is likely to become endangered because of a decline in numbers.



Rare

**A noticeable decline
in a species.**

Ex: African Violet &



Vulnerable Species

- ★ Low Reproductive Rate
- ★ Specialized Feeding Habits
- ★ Feed at high trophic levels
- ★ Large size
- ★ Specialized nesting or breeding areas
- ★ Found only in one place or region

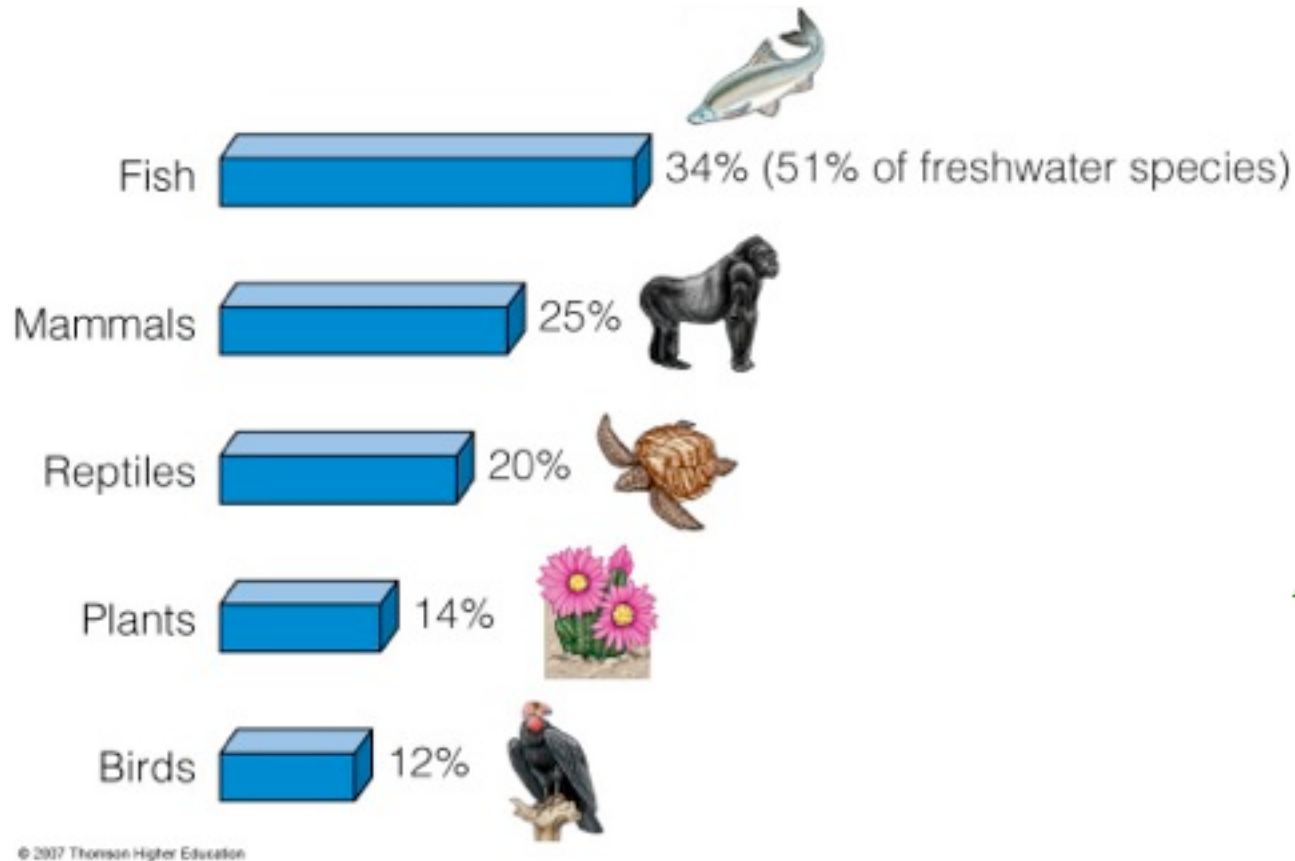


SPECIES EXTINCTION

- ★ Scientists use measurements and models to estimate extinction rates.
 - The International Union for the Conservation of Nature and Natural Resources (IUCN) publishes an annual Red List, listing the world's threatened species.
 - The 2004 Red List contains 15,589 species at risk for extinction.

Figure 11-5

SPECIES EXTINCTION



- ★ Percentage of various species types threatened with premature extinction from human activities.

Figure 11-5

HABITAT LOSS, DEGRADATION, AND

- ★ Conservation biologists summarize the most important causes of premature extinction as “HIPPCO”:
 - Habitat destruction, degradation, and fragmentation
 - Invasive species
 - Population growth



Causes of Endangerment

- ★ **Habitat Loss**- people moving in (the number one reason for endangerment!)
- ★ **Biotic pollution**- polluted air, water, etc
- ★ **Over-Hunting**
- ★ **Commercial Harvest**- sold for profit



Location Where Endangerment is a

- ★ United States- California, Hawaii, Texas and Southeastern states like Florida
- ★ Worldwide- Places that don't control poaching and starving countries that need the food. Ex. Africa, Asia, Middle East.



Methods used to help **Endangered Species:**

Conservation Biology-
Multidisciplinary science
that deals with the crisis
of diversity and how to
maintain the earth's



In situ vs. ex situ:

In Situ:

- ★ Leaving the animal where it lives but protecting it.
- ★ Ex. Elephants; make laws that prevent poaching and have people to enforce it.
- ★ Ex. Marine turtles are protected-escape nets must be used on all fishing nets so the turtles can get

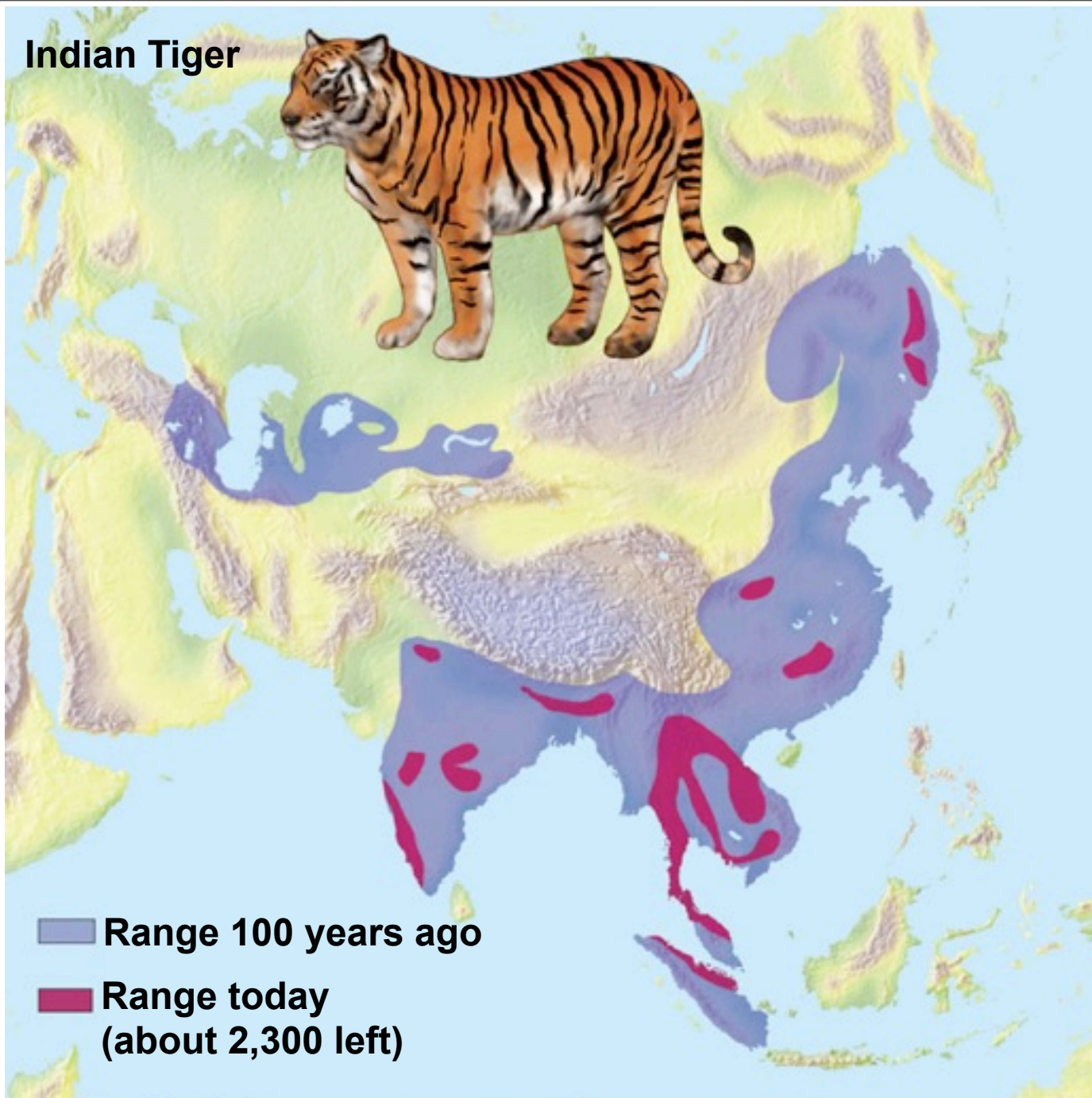


Ex Situ:

- ★ Taking the animal out of its habitat & protecting it.
- ★ Ex. Zoo's
- ★ 2 types:
 - egg pulling -collecting wild eggs laid by critically endangered bird species and then hatching them in zoos or research centers
 - captive breeding, wild individuals of a



Indian Tiger

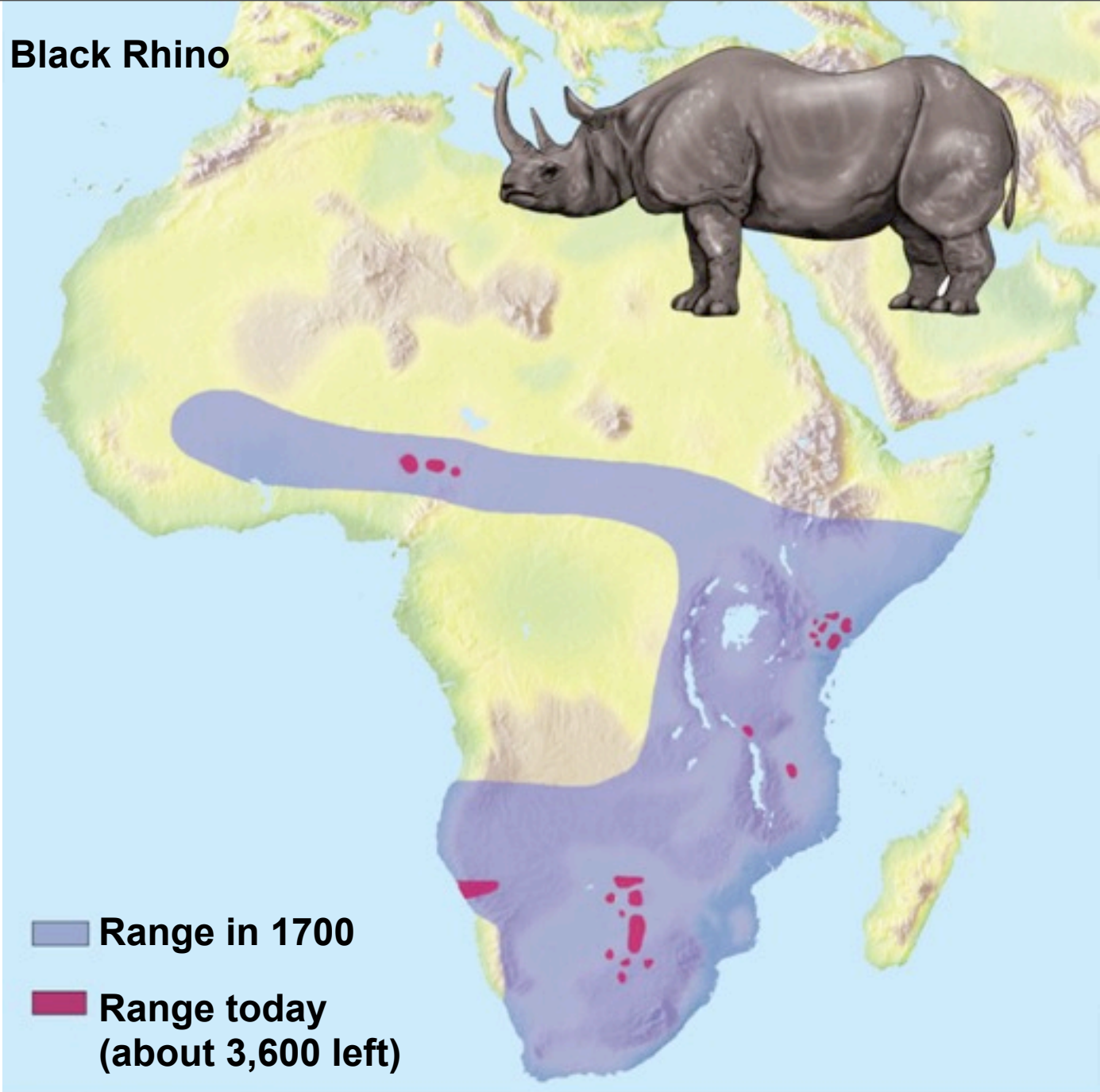


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Fig. 11-8a, p. 230



Black Rhino

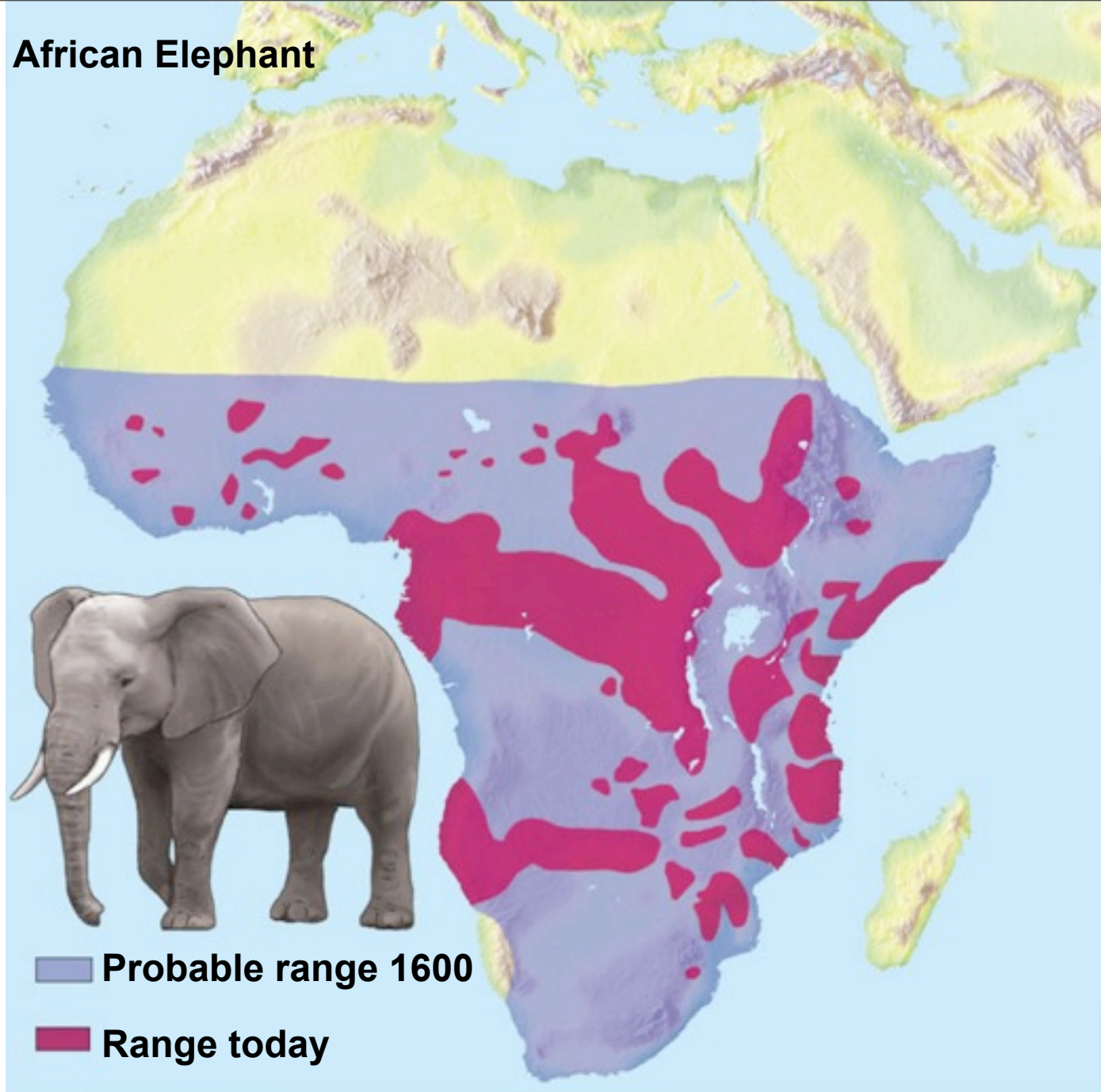


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Fig. 11-8b, p. 230



African Elephant



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Fig. 11-8c, p. 230



Asian or Indian Elephant

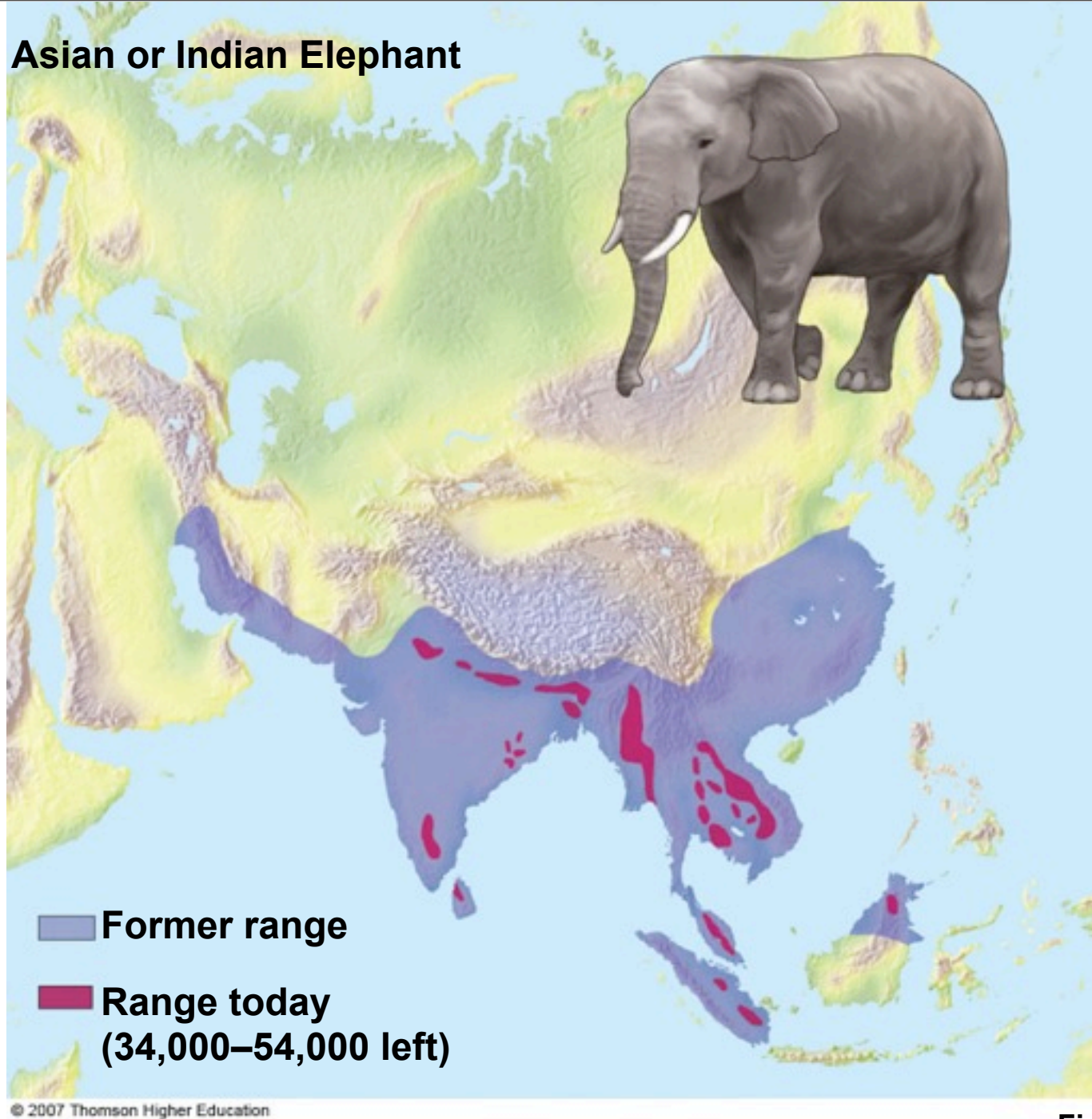


Fig. 11-8d, p. 230

INVASIVE SPECIES



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Kudzu vine was introduced in the southeastern U.S. to control erosion. It has taken over native species habitats.

- ★ Many nonnative species provide us with food, medicine, and other benefits but a few can wipe out native species, disrupt ecosystems, and cause large economic losses.

Figure 11-A

INVASIVE SPECIES

Deliberately Introduced Species



Purple loosestrife



European starling



African honeybee
("Killer bee")



Nutria



Salt cedar
(Tamarisk)



Marine toad
(Giant toad)



Water hyacinth



Japanese beetle



Hydrilla



European wild boar
(Feral pig)

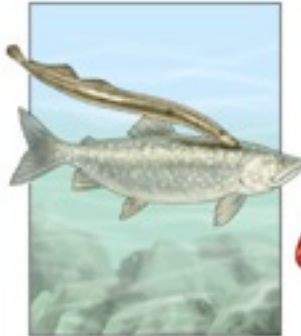
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- ★ Many invasive species have been introduced intentionally.

Figure 11-11

INVASIVE SPECIES

Accidentally Introduced Species



Sea lamprey
(attached to lake trout)



Argentina fire ant



Brown tree snake



Eurasian ruffe



Common pigeon
(Rock dove)



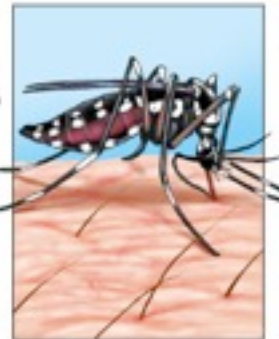
Formosan termite



Zebra mussel



Asian long-horned beetle



Asian tiger mosquito



Gypsy moth larvae

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- ★ Many invasive species have been introduced unintentionally.

Figure 11-11

INVASIVE SPECIES



- ★ The Argentina fire ant was introduced to Mobile, Alabama in 1932 from South America.
 - Most probably from ships.
 - No natural predators.



Figure 11-12

What Can You Do?

Invasive Species

- Do not allow wild animals to escape.
- Do not spread wild plants to other areas.
- Do not dump the contents of an aquarium into waterways, wetlands, or storm drains.
- When camping use wood near your campsite instead of bringing firewood from somewhere else.
- Do not dump unused bait into the water.
- After dogs visit woods or the water brush them before taking them home.
- After each use clean your vehicle, mountain bike, surfboard, kayaks, canoes, boats, tent, hiking boots, and other gear before heading for home.
- Empty all water from canoes, kayaks, dive gear, and other outdoor equipment before heading home.
- Plant a variety of trees, shrubs, and other plants in your yard to reduce losses from invasive species.
- Do not buy plants from overseas or swap them with others using the Internet.

Characteristics of Successful Invader Species

- **High reproductive rate, short generation time (r-selected species)**
- **Pioneer species**
- **Long lived**
- **High dispersal rate**
- **Release growth-inhibiting chemicals into soil**
- **Generalists**
- **High genetic variability**

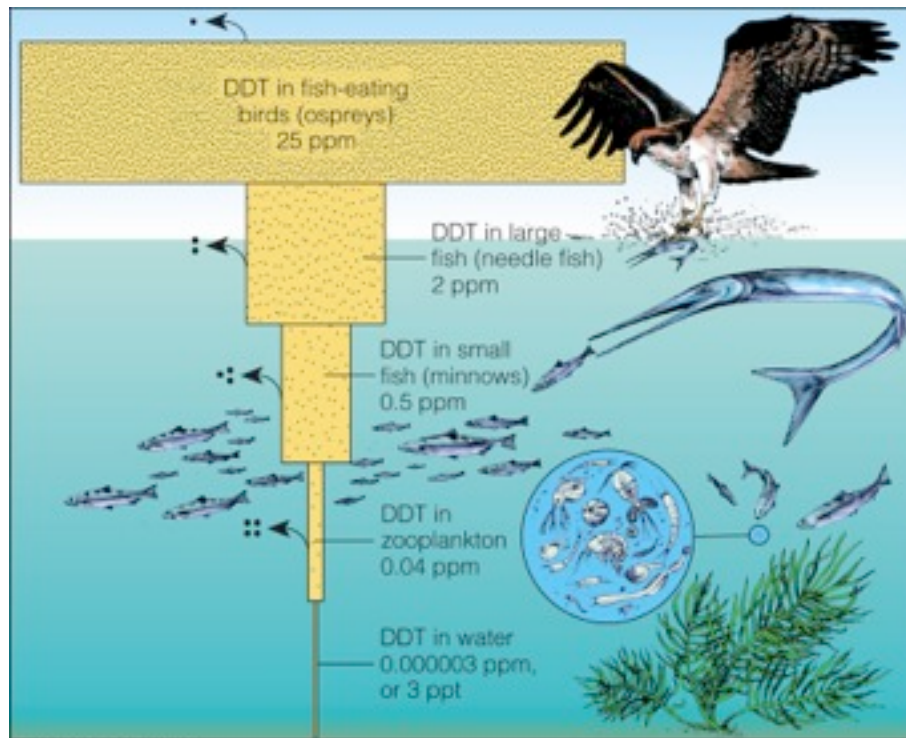
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Characteristics of Ecosystems Vulnerable to Invader Species

- **Climate similar to habitat of invader**
- **Absence of predators on invading species**
- **Early successional systems**
- **Low diversity of native species**
- **Absence of fire**
- **Disturbed by human activities**

Fig. 11-13, p. 236

Pollution



Example of biomagnification of DDT in an aquatic food chain.

- ★ Each year pesticides:
 - Kill about 1/5th of the U.S. honeybee colonies.
 - 67 million birds.
 - 6 -14 million fish.
 - Threaten 1/5th of the U.S.'s endangered and threatened species.

Figure 11-15

OVEREXPLOITATION

- ★ Some protected species are killed for their valuable parts or are sold live to collectors.
- ★ Killing predators and pests that bother us or cause economic losses threatens some species with premature extinction.
- ★ Legal and illegal trade in wildlife



Zoos, aquaria, gardens, etc.

Breeding programs,
protection, teach public
about the animals/
plants so they will want
to conserve them.



Conservation

Some are severe like
Greenpeace- bomb
whaling vessels, etc.,
others send money or try
to pass laws.



Policy & Laws:

Endangered Species

- ★ One of the world's toughest environmental laws.
- ★ It is illegal for Americans to import or trade in any product made from an endangered or threatened species unless it is used for an approved scientific purpose or to enhance the survival of the species.
- ★ Authorizes the Marine Fishery Service and the U.S. Fish and Wildlife Service to identify and list all other endangered & threatened species.
- ★ These species cannot be hunted, killed,



Case Study:

- ★ One of the world's most far-reaching and controversial environmental laws is the 1973 U.S. Endangered Species Act (ESA).
 - ESA forbids federal agencies (besides defense department) to carry out / fund projects that would jeopardize an endangered species.
 - ESA makes it illegal for Americans to engage in commerce associated with or hunt / kill / collect endangered or threatened species.



times step into the burrows and break



OVEREXPLOITATION



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- ★ Rhinoceros are often killed for their horns and sold illegally on the black market for decorative and medicinal purposes.

Figure 11-16

Case Study:

Rising Demand for



- ★ Bushmeat hunting has caused the local extinction of many animals in West Africa.
- ★ Can spread disease such as

Figure 11-17



Figure 22-21 Bushmeat, such as this gorilla head, is consumed as a source of protein by local people in parts of West Africa and sold in the national and international marketplace. You can find bushmeat on the menu in Cameroon and the Congo in West Africa as well as in Paris, France, and Brussels, Belgium. (©Karl Ammann, Biosynergy Institute)



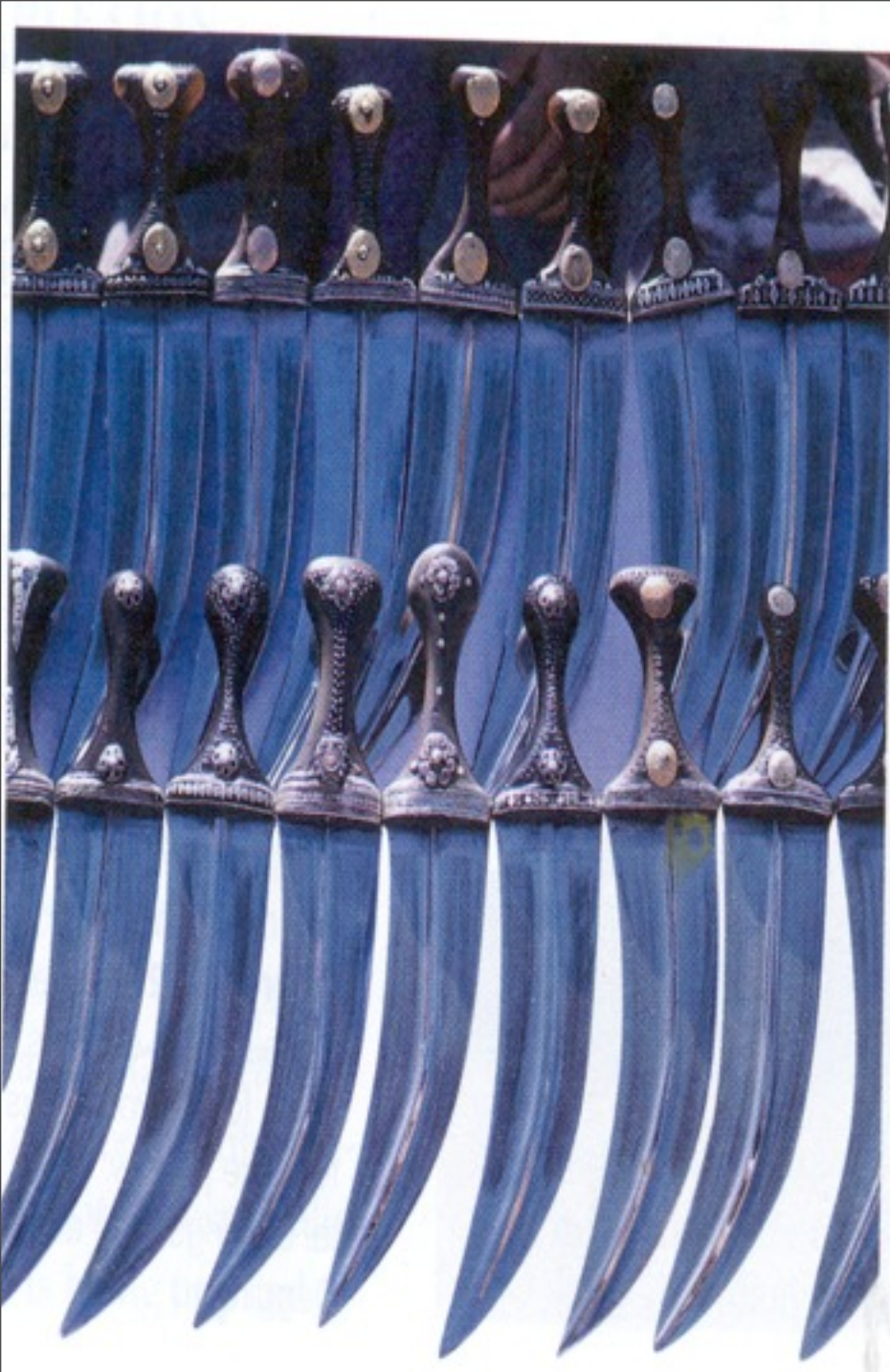


Figure 22-20 Rhinoceros horns are carved into ornate dagger handles that sell for \$500–12,000 in Yemen and other parts of the Middle East. In China and other parts of Asia, powdered rhino horn is used for medicinal purposes, particularly as a proven fever reducer and occasionally as an alleged aphrodisiac. All five rhinoceros species are threatened with extinction because of poachers (who kill them for their horns) and habitat loss. Between 1973 and 1998 the population of African black rhinos (Figure 22-14) dropped from approximately 63,000 to about 2,400. (R. F. Porter/Ardea London)



Endangered Species



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- ★ Because of scarcity of inspectors, Figure 11-19 probably no more than 1/10th of the illegal wildlife trade in the U.S. is discovered.

Endangered Species

- ★ Congress has amended the ESA to help landowners protect species on their land.
- ★ Some believe that the ESA should be weakened or repealed while others believe it should be strengthened and modified to focus on protecting ecosystems.
- ★ Many scientists believe that we should focus on protecting and sustaining biodiversity and ecosystem function as the best way to protect species.



PROTECTING WILD SPECIES: LEGAL AND

- ★ International treaties have helped reduce the international trade of endangered and threatened species, but enforcement is difficult.
 - One of the most powerful is the 1975 Convention on International Trade of Endangered Species (CITES).
 - ★ Signed by 169 countries, lists 900 species that cannot be commercially traded.



CITIES Treaty

- ★ Convention on International Trade in Endangered Species of Wild Fauna and Flora
- ★ Banned all international trade in elephant products to protect elephant populations that were being decimated by poachers.
- ★ Signed by 152 countries and lists more than 800 species that cannot be commercially traded as live specimens or wildlife products because they are in danger of extinction and 29,000 other species whose international trade is monitored because they are at risk of becoming threatened.



What Can You Do?

Sustaining Terrestrial Biodiversity

- **Adopt a forest.**
- **Plant trees and take care of them.**
- **Recycle paper and buy recycled paper products.**
- **Buy sustainable wood and wood products.**
- **Choose wood substitutes such as bamboo furniture and recycled plastic outdoor furniture, decking, and fencing.**
- **Restore a nearby degraded forest or grassland.**
- **Landscape your yard with a diversity of plants natural to the area.**
- **Live in town because suburban sprawl reduces biodiversity.**



What Can You Do?

Protecting Species

- **Do not buy furs, ivory products, and other materials made from endangered or threatened animal species.**
- **Do not buy wood and paper products produced by cutting remaining old-growth forests in the tropics.**
- **Do not buy birds, snakes, turtles, tropical fish, and other animals that are taken from the wild.**
- **Do not buy orchids, cacti, and other plants that are taken from the wild.**
- **Spread the word. Talk to your friends and relatives about this problem and what they can do about it.**

