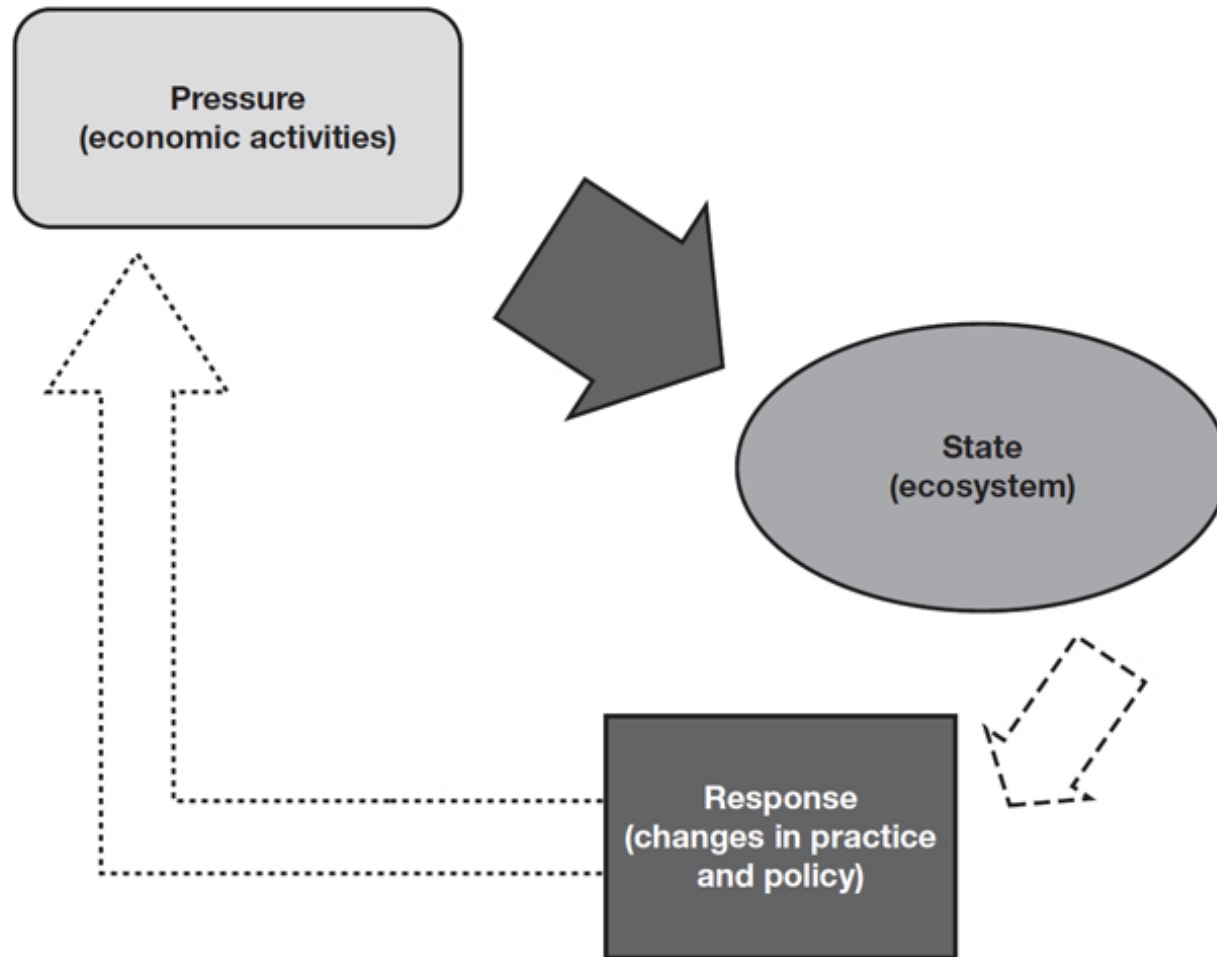


ES7-Geog7 Lecture Week 10

G. Leddy, SMC

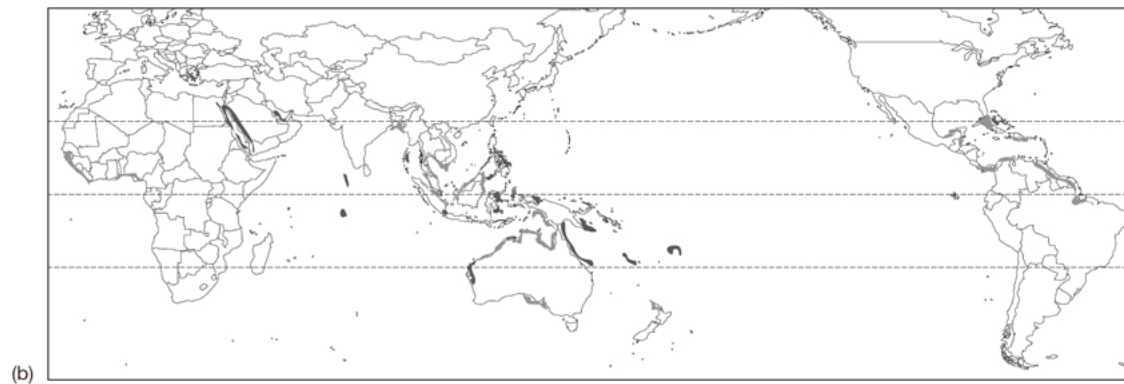
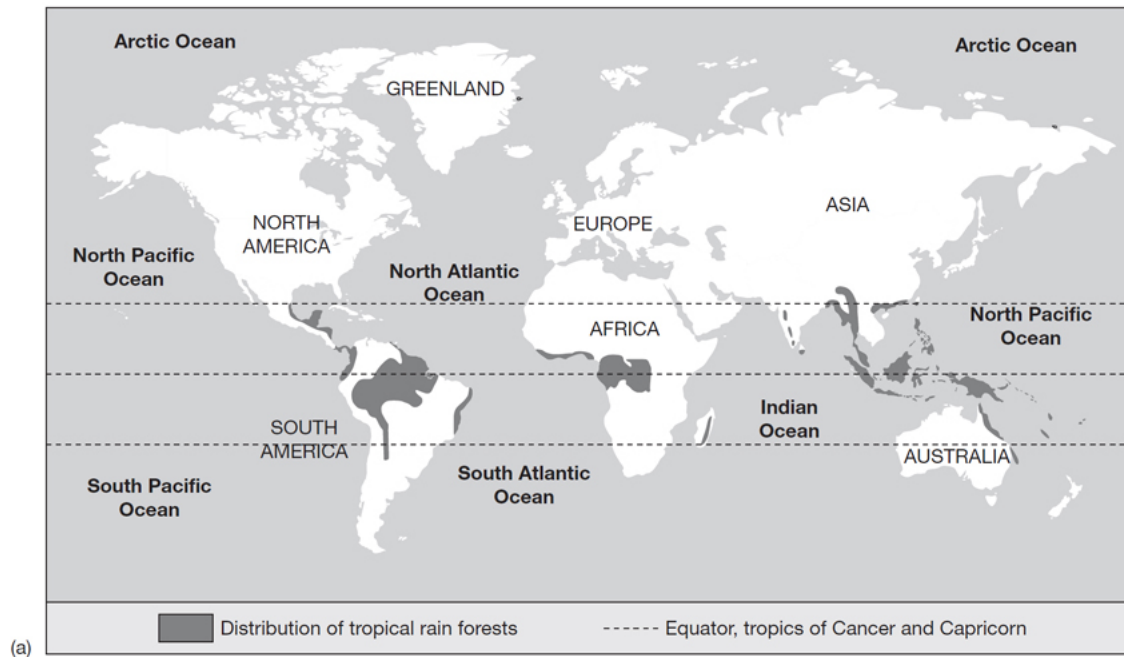


The Pressure/Response Model for Sustainability



(a) The world's biodiversity hotspots

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Coral Reefs and Mangrove of the World





Mangroves and Kelp beds are hot with biodiversity



Ecosystem diversity



Species diversity



Genetic diversity

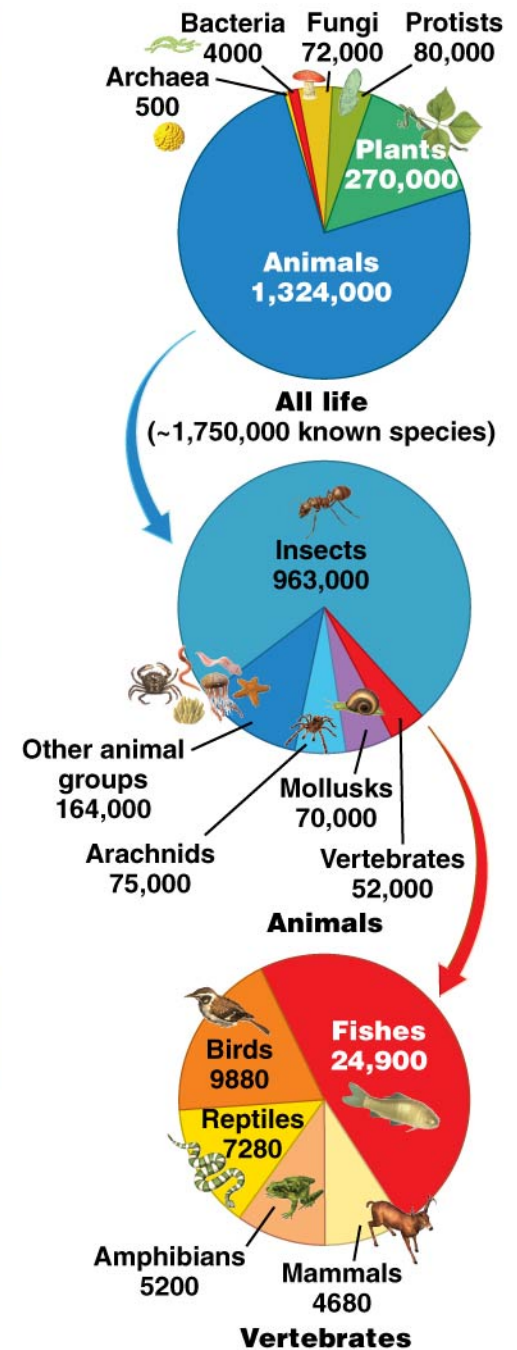


TABLE 8.1 Potential New Food Sources



Amaranth

(three species of *Amaranthus*)

Grain and leafy vegetable; livestock feed; rapid growth, drought resistant



Capybara

(*Hydrochoeris hydrochaeris*)

World's largest rodent; meat esteemed; easily ranched in open habitats near water



Buriti palm

(*Mauritia flexuosa*)

"Tree of life" to Amerindians; vitamin-rich fruit; pith as source for bread; palm heart from shoots



Vicuna

(*Lama vicugna*)

Threatened species related to llama; source of meat, fur, and hides; can be profitably ranched



Maca

(*Lepidium meyenii*)

Cold-resistant root vegetable resembling radish, with distinctive flavor; near extinction



Chachalacas

(*Ortalis*, many species)

Tropical birds; adaptable to human habitations; fast-growing

The wild species shown here are just some of the many plants and animals that could supplement our food supply. Adapted from Wilson, E.O., 1992. The diversity of life. Cambridge, MA: Belknap Press.

TABLE 8.2 Natural Plant Sources of Pharmaceuticals



Pineapple
(*Ananas comosus*)

Drug: Bromelain
Application: Controls tissue inflammation



Pacific yew
(*Taxus brevifolia*)

Drug: Taxol
Application: Anticancer agent (especially ovarian cancer)



Autumn crocus
(*Colchicum autumnale*)

Drug: Colchicine
Application: Anticancer agent



Velvet bean
(*Mucuna deeringiana*)

Drug: L-Dopa
Application: Parkinson's disease suppressant



Yellow cinchona
(several species of *Cinchona*)

Drug: Quinine
Application: Antimalarial agent



Common foxglove
(*Digitalis purpurea*)

Drug: Digitoxin
Application: Cardiac stimulant

Shown are just a few of the many plants that provide chemical compounds of medical benefit.

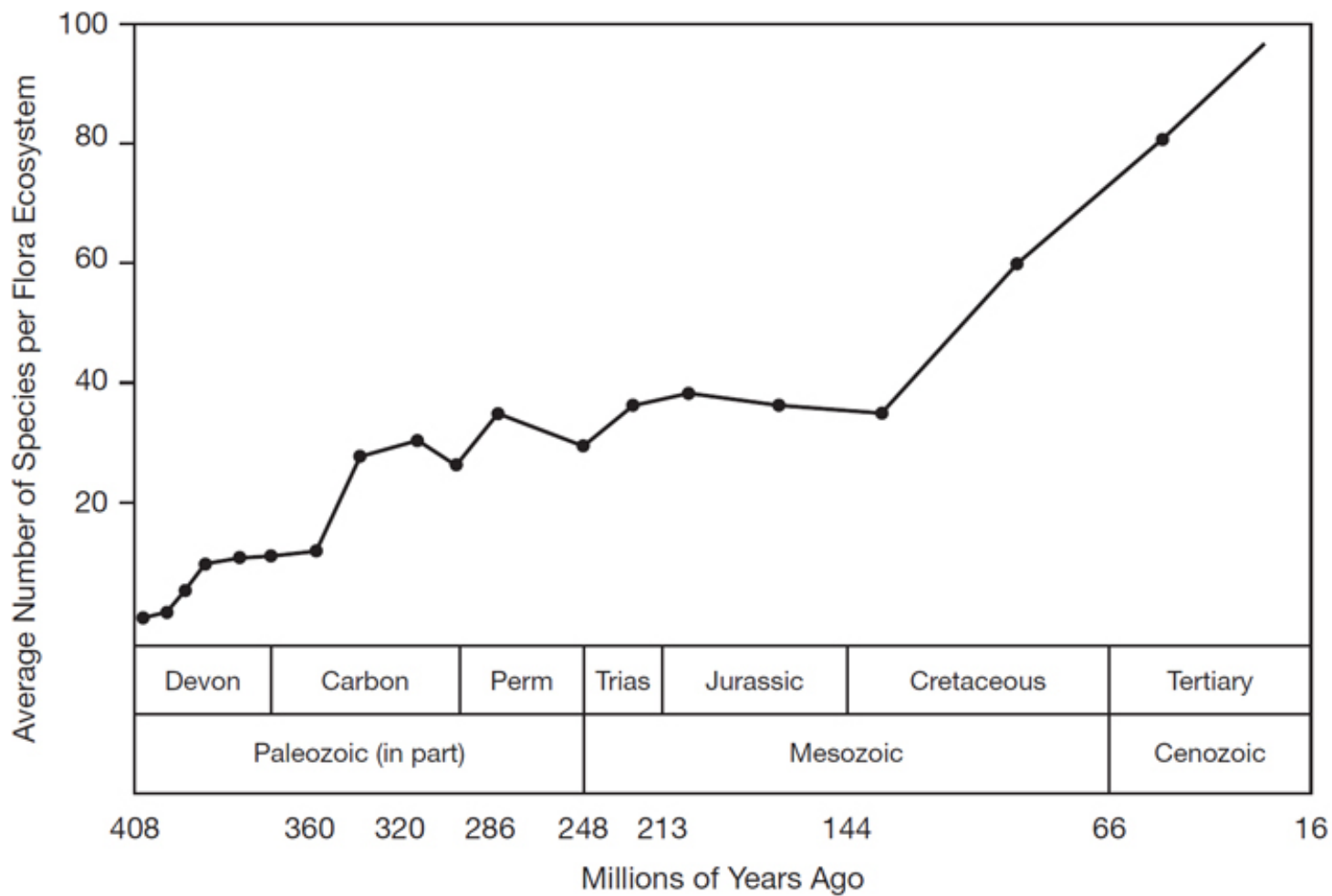
Adapted from Wilson, E. O., 1992. The diversity of life. Cambridge, MA: Belknap Press.

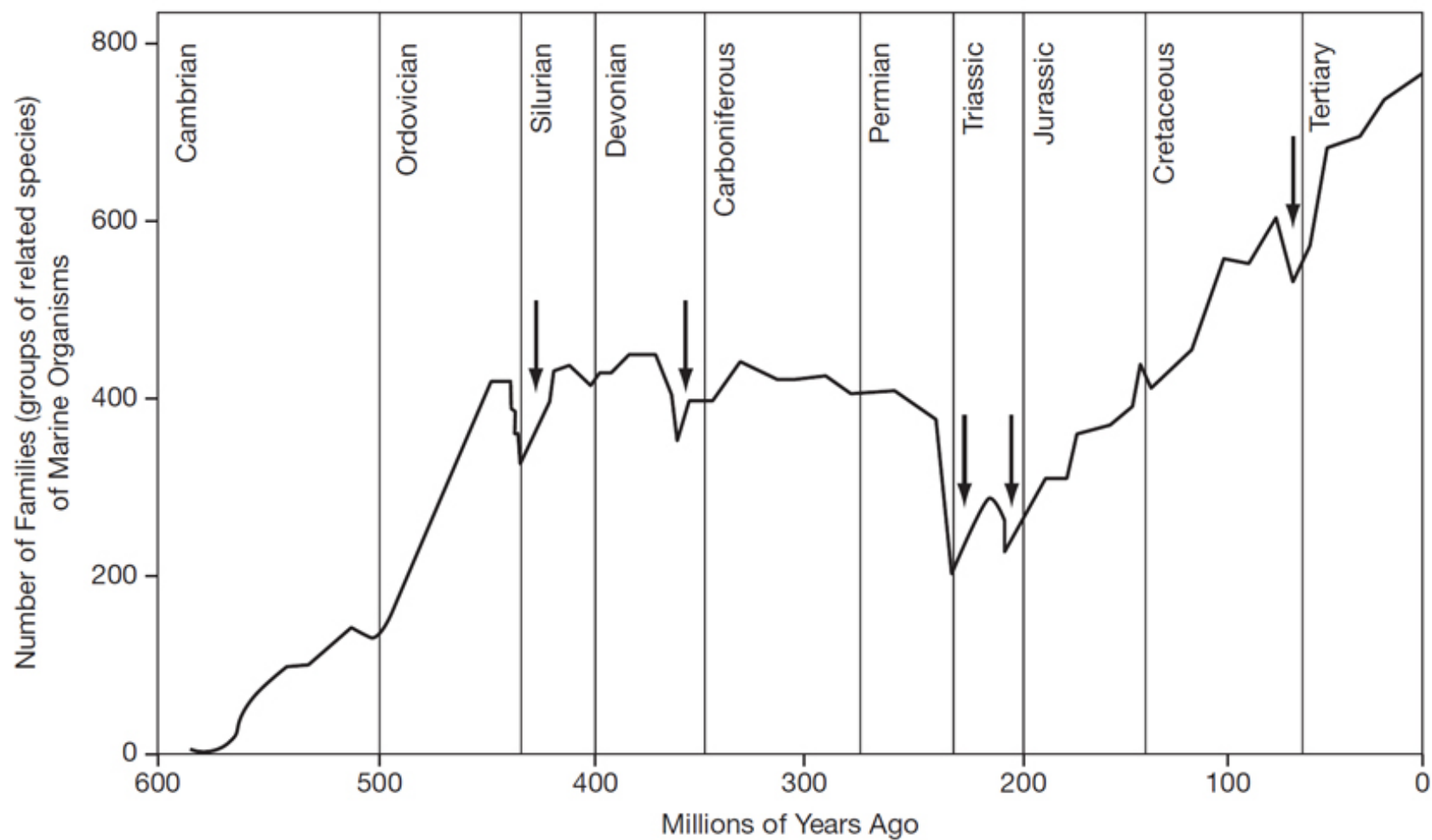
TABLE 8.3 Mass Extinctions

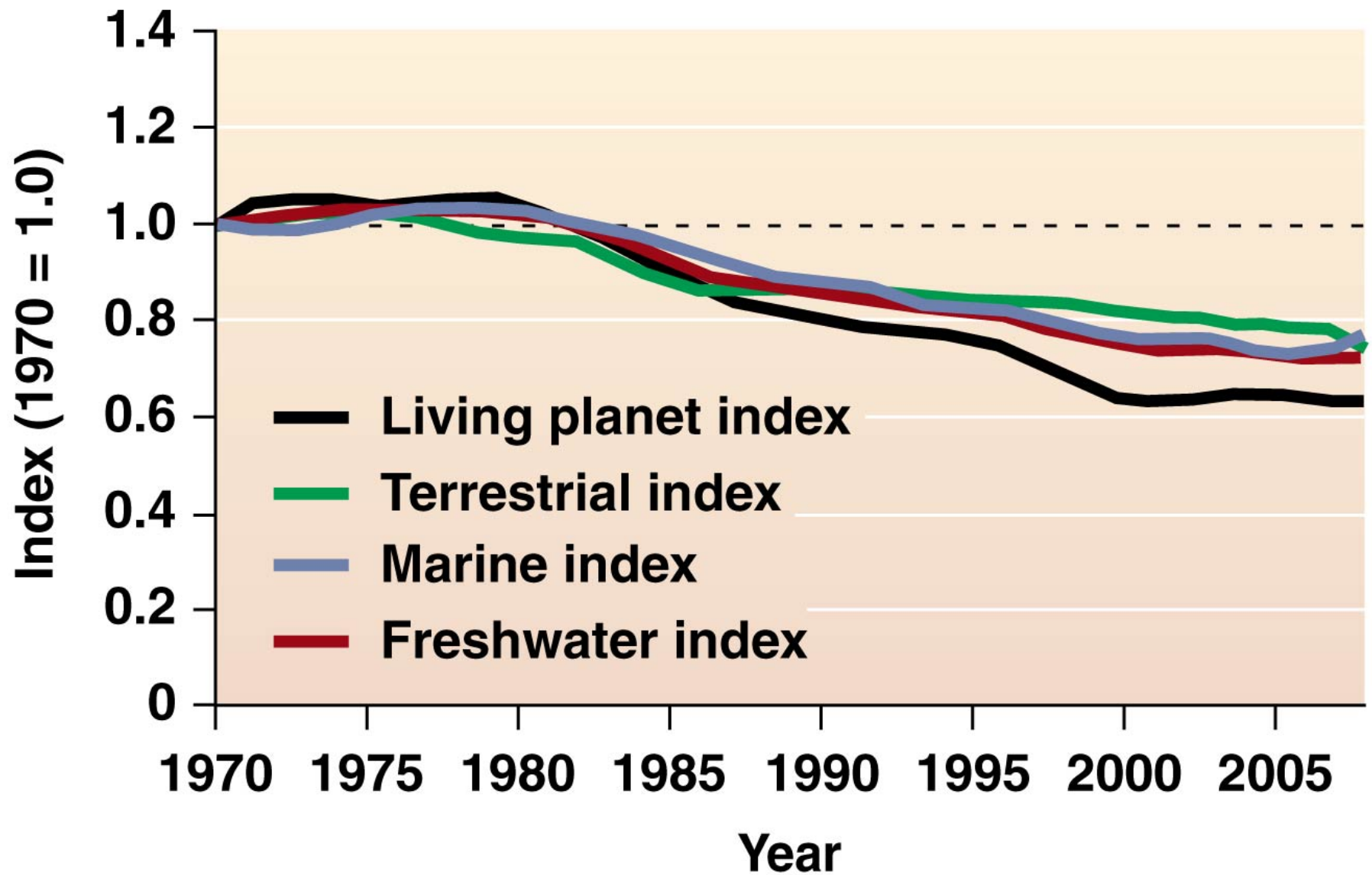
EVENT	DATE (MILLIONS OF YEARS AGO [MYA])	CAUSE	TYPES OF LIFE MOST AFFECTED	PERCENTAGE OF LIFE DEPLETED
Ordovician	440 mya	Unknown	Marine organisms; terrestrial record is unknown	>20% of families
Devonian	360 mya	Unknown	Marine organisms; terrestrial record is unknown	>20% of families
Permo-Triassic	250 mya	Possibly volcanism	Marine organisms; terrestrial record is less known	>50% of families; 80–95% of species
End-Triassic	200 mya	Unknown	Marine organisms; terrestrial record is less known	20% of families; 50% of genera
Cretaceous-Paleogene	66 mya	Likely asteroid impact	Marine and terrestrial organisms, including dinosaurs	5% of families; >50% of species
Current	Beginning 0.01 mya	Human impacts	Large animals, specialized organisms, island organisms, organisms harvested by people	Ongoing

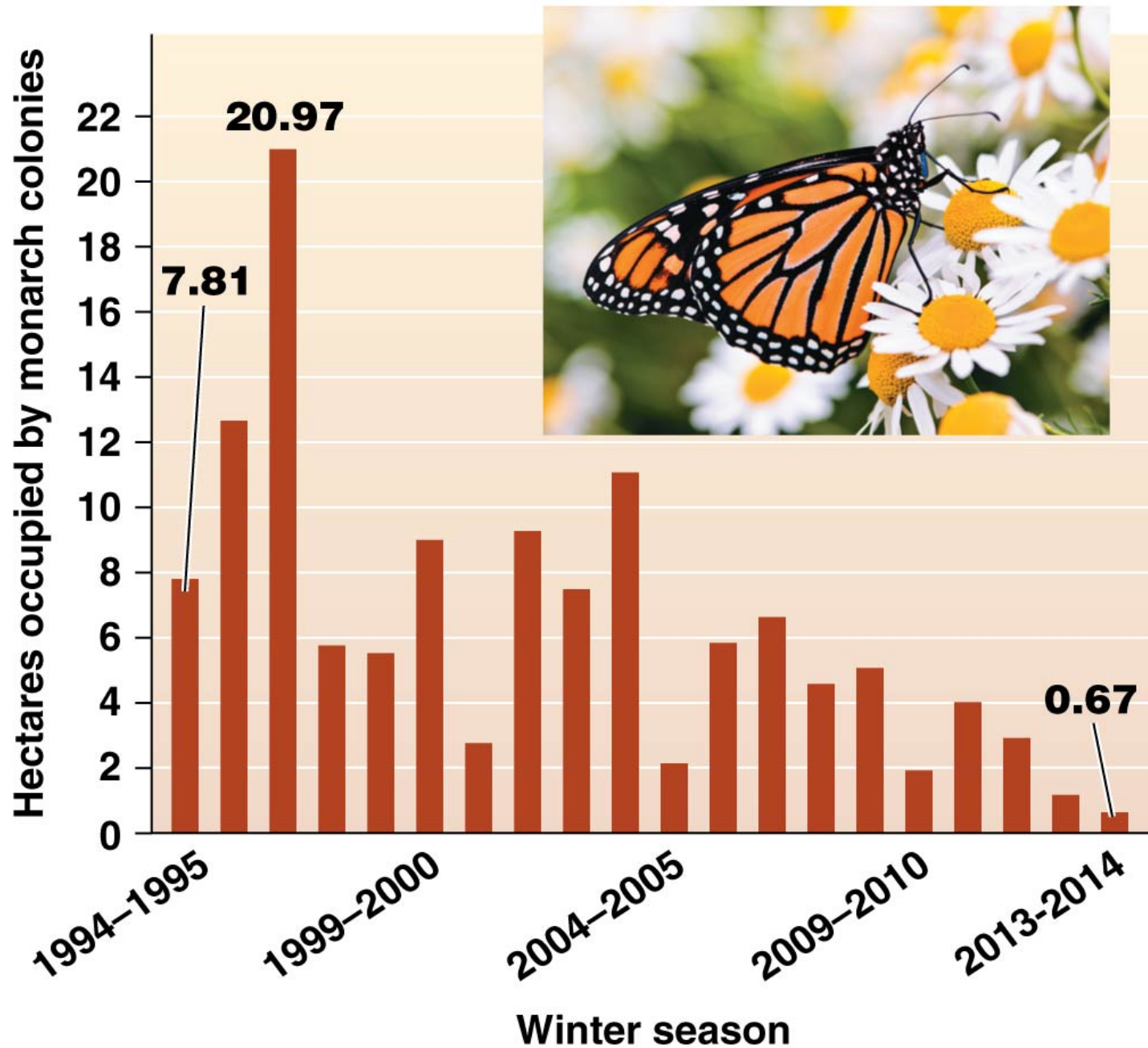
Sixth Largest Mass Extinction





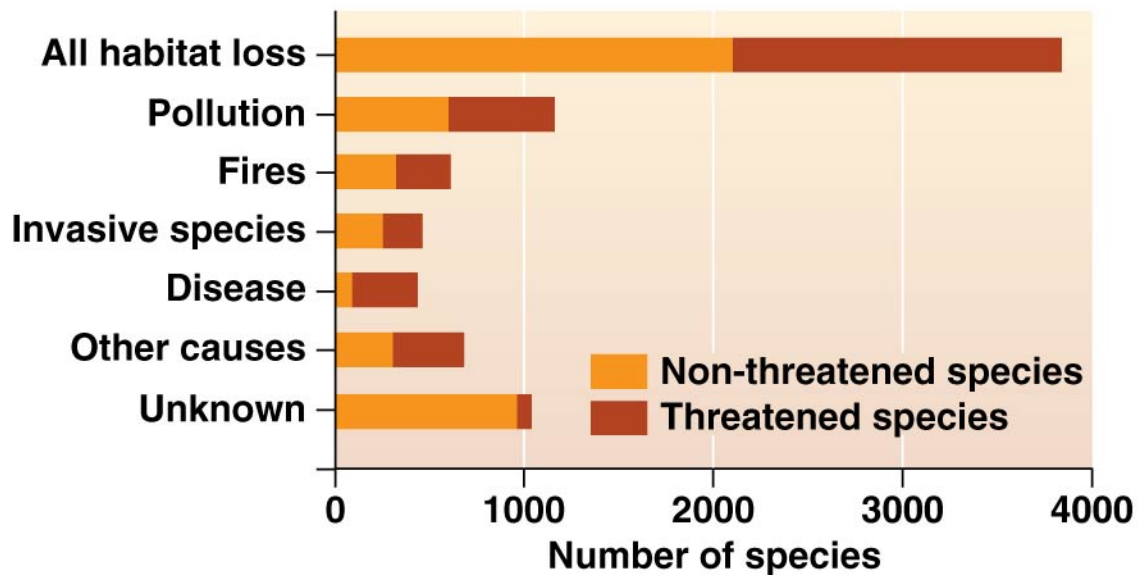








(a) Male golden toad from Monteverde, Costa Rica



(b) Causes of amphibian declines



(a) 1940

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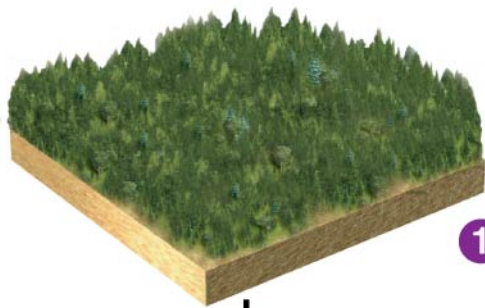
(b) 1987



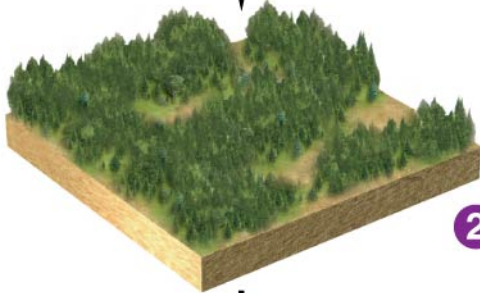
(c) 2005

Forested area

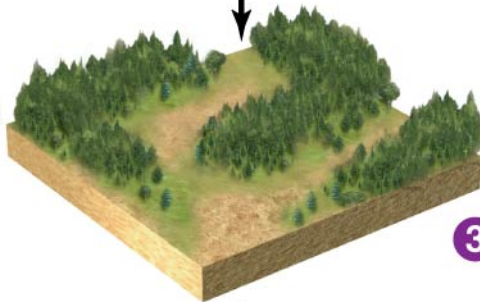




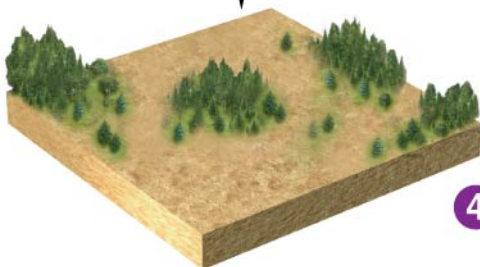
1 Original habitat



2 Gaps form as habitat becomes fragmented

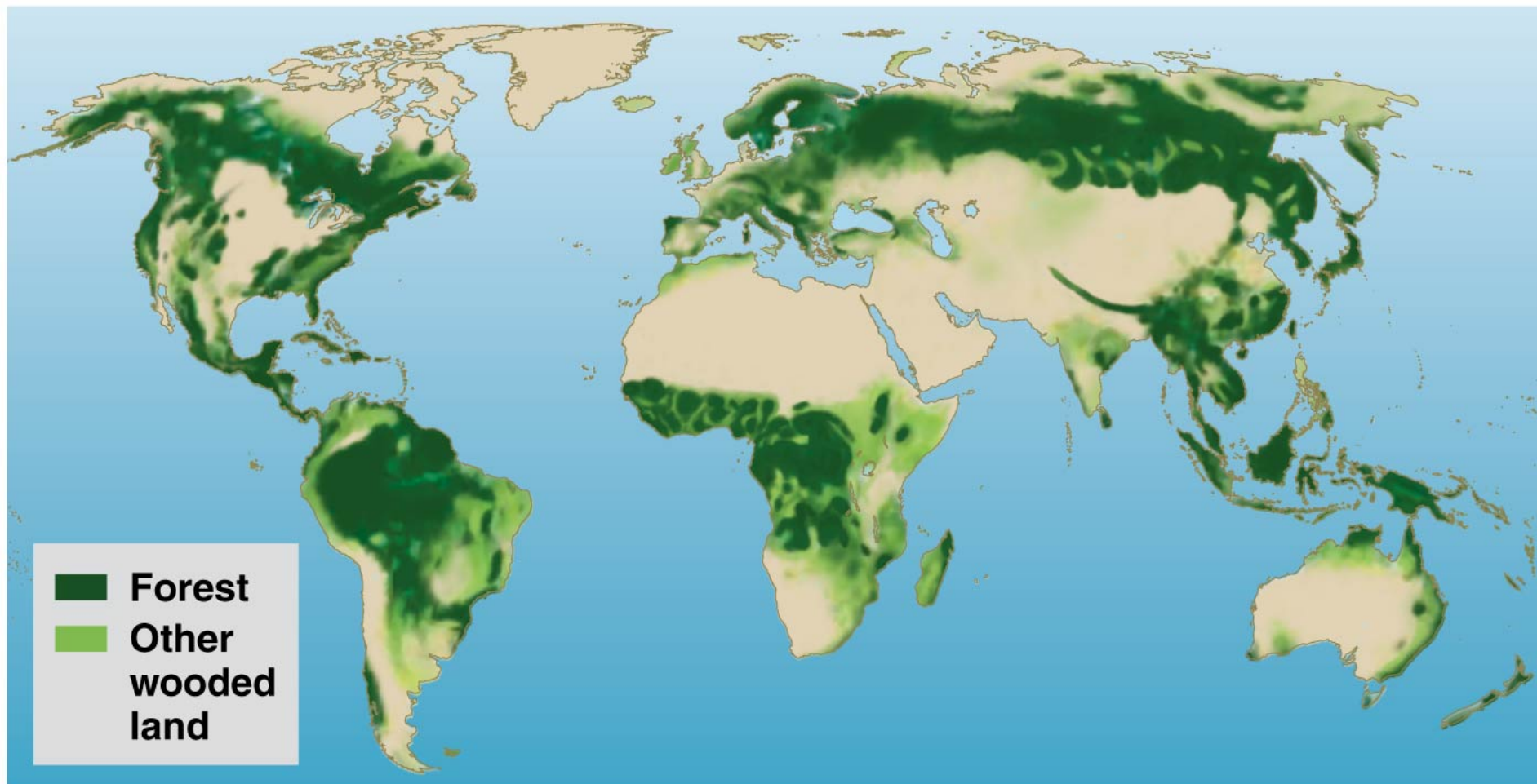


3 Gaps become larger; fragments become smaller and more isolated

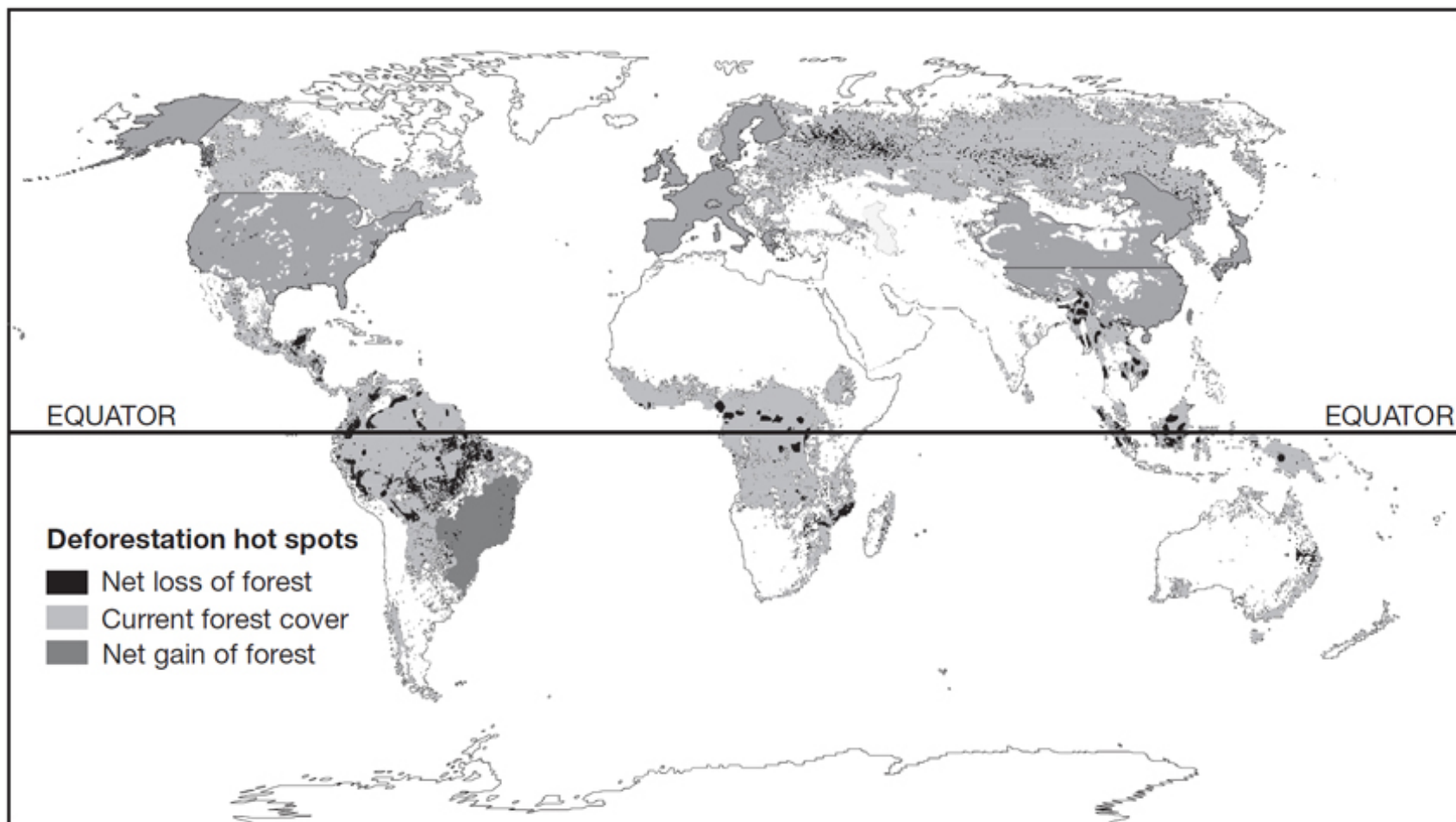


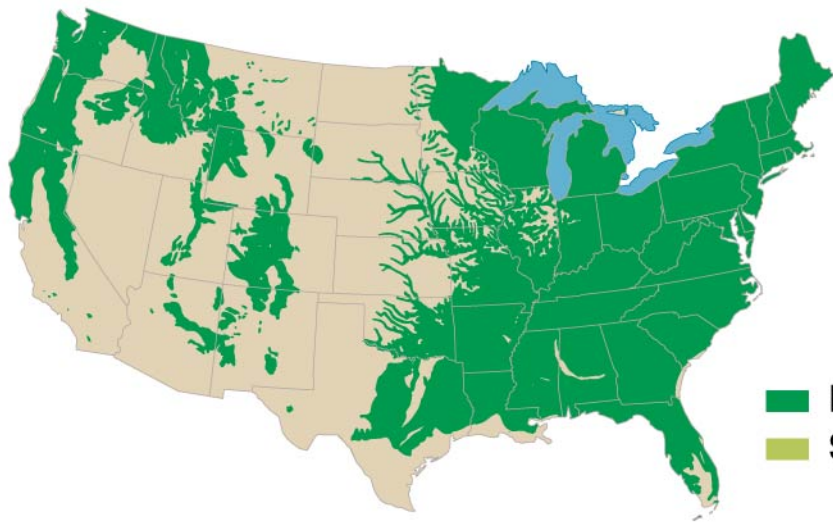
4 Species disappear due to habitat fragmentation

Forest Fragmentation



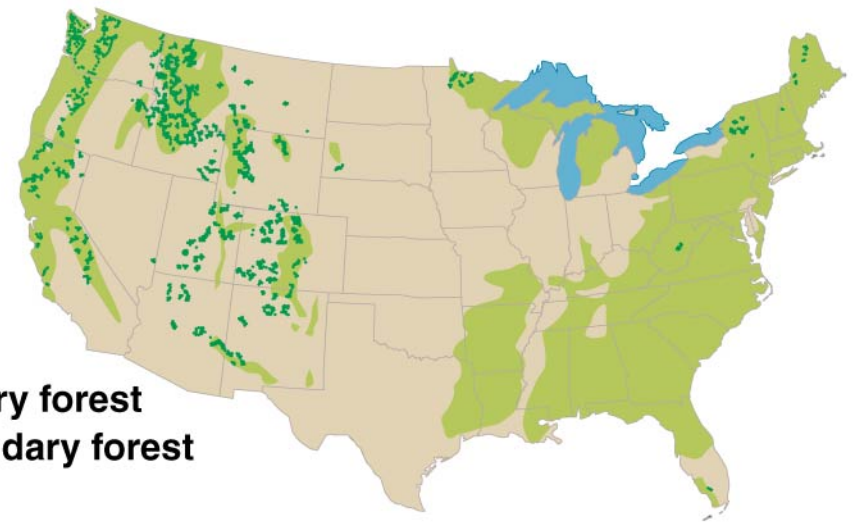




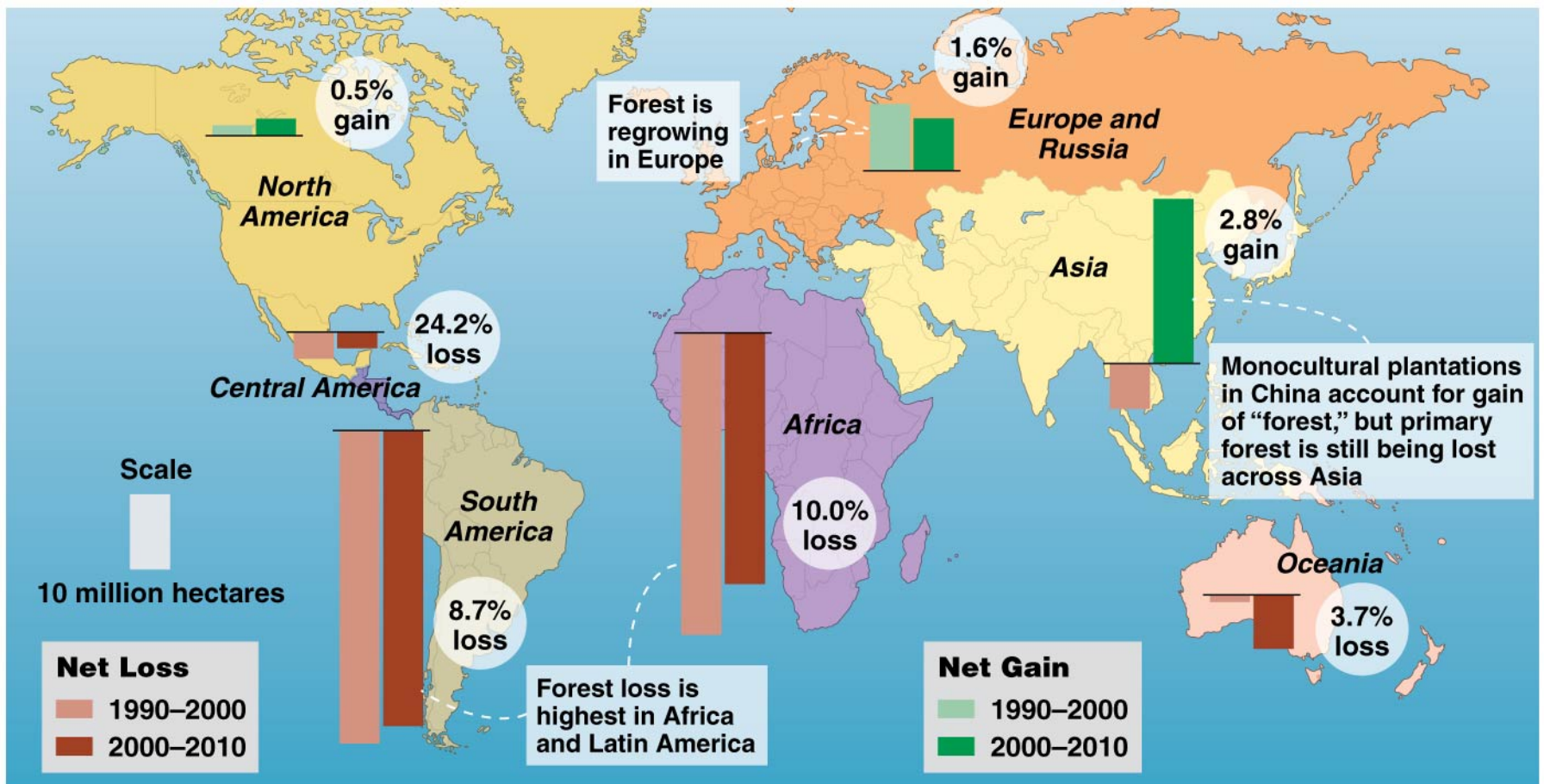


(a) 1620

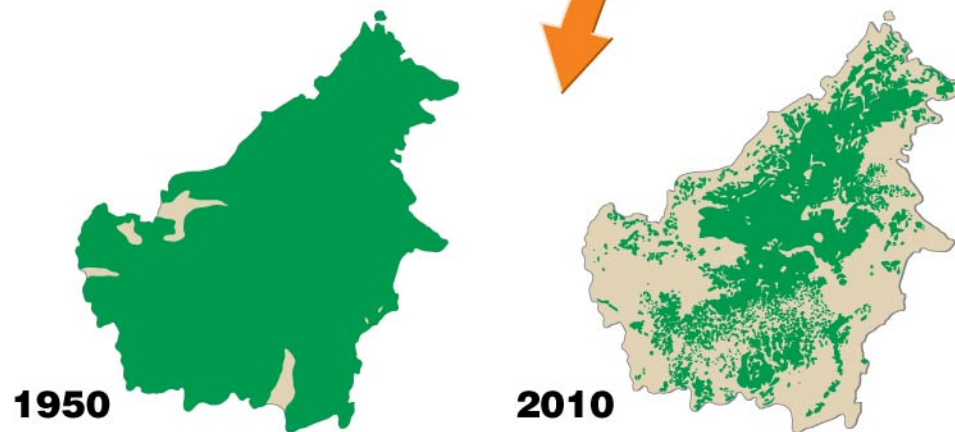
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(b) Today







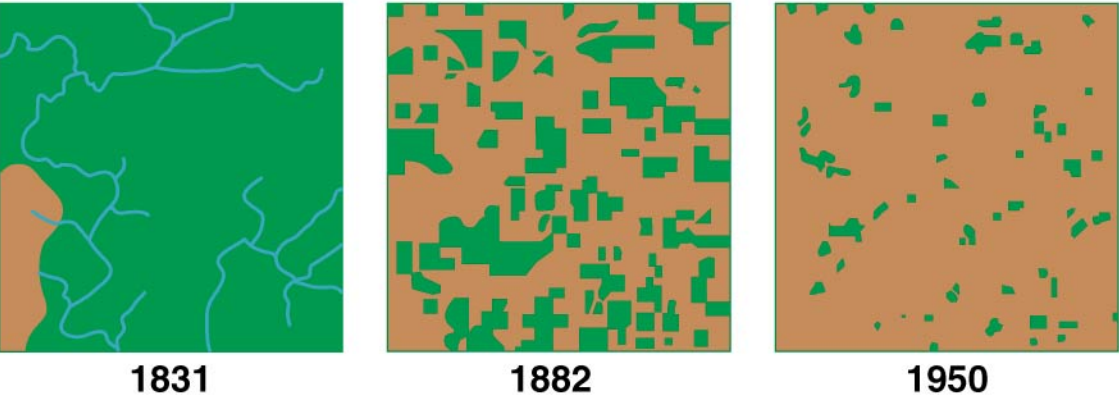




Clearcut Forest



(a) Fragmentation from clear-cuts in Mount Hood National Forest, Oregon



(b) Fragmentation of wooded area (green) in Cadiz Township, Wisconsin



(c) Wood thrush



(a) Sampling insects in Madagascar



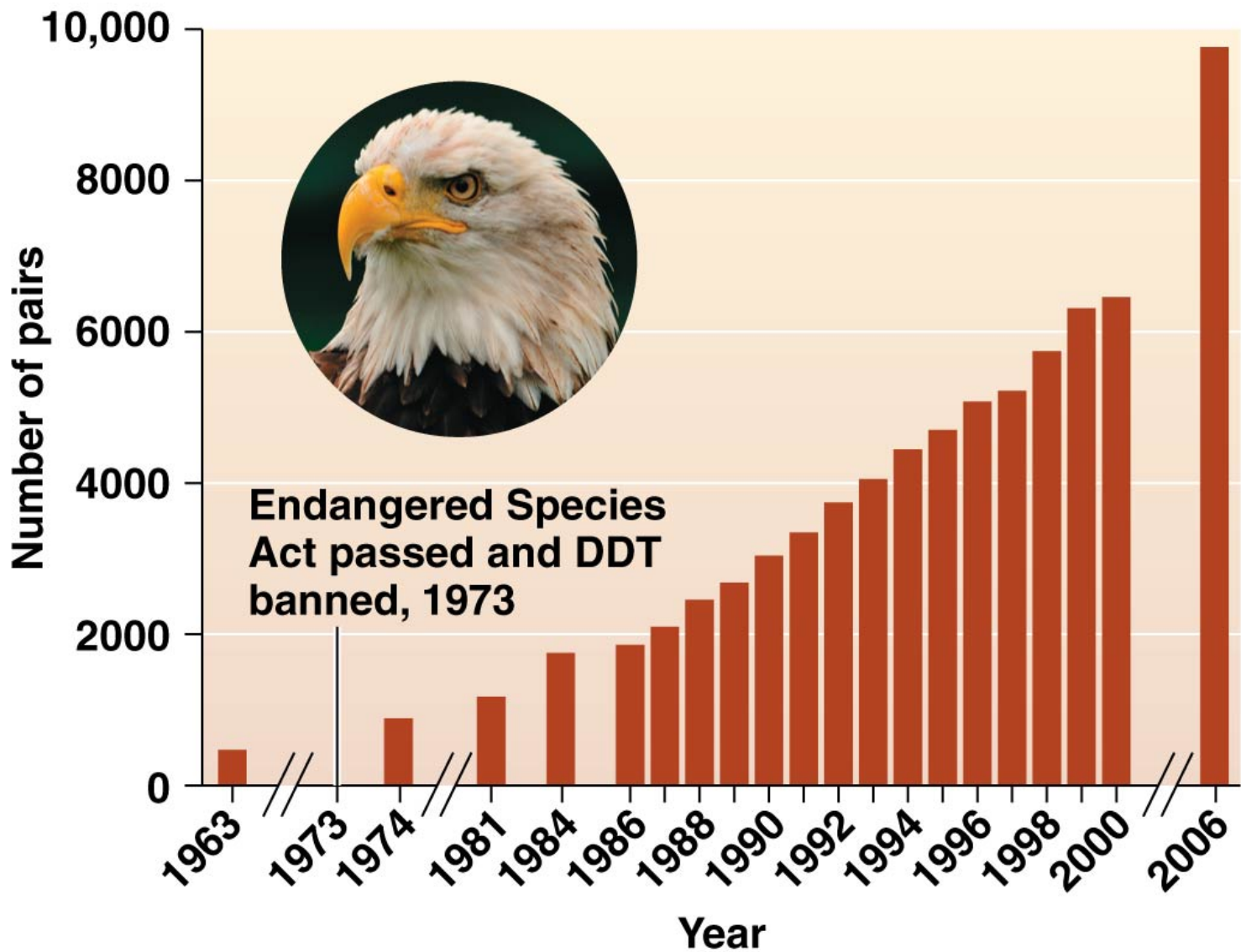
(b) Checking camera traps in Africa



(c) Drawing blood from a Seychelles Magpie Robin



(d) Radiotracking birds in Spain





Sage
Grouse

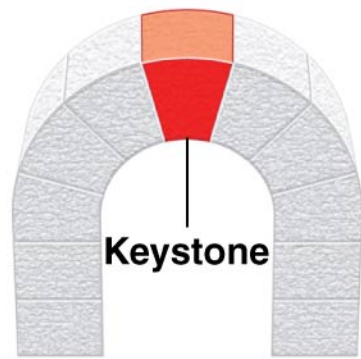


(a) A black rhino is air-lifted into Serengeti National Park

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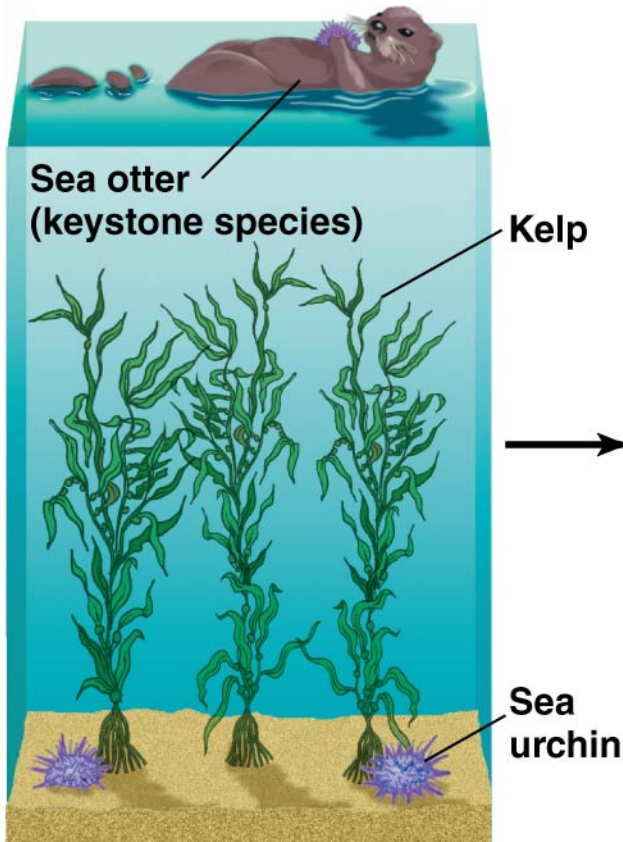
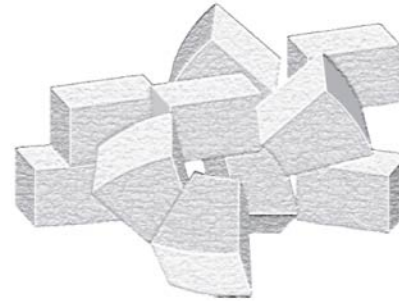
(b) Biologists use hand puppets to nurse condor chicks



Keystone

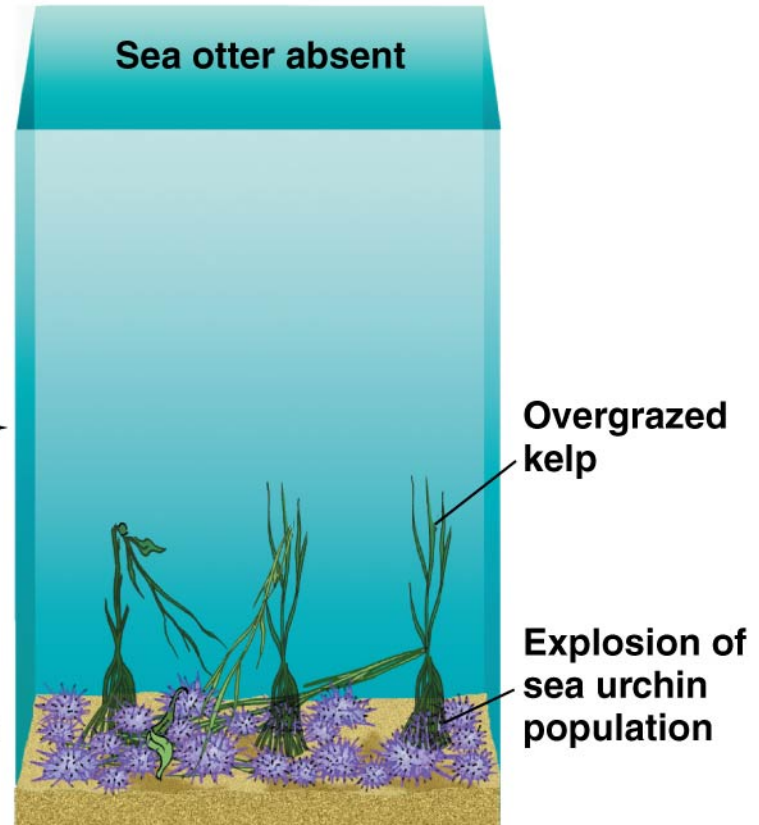
(a) A keystone

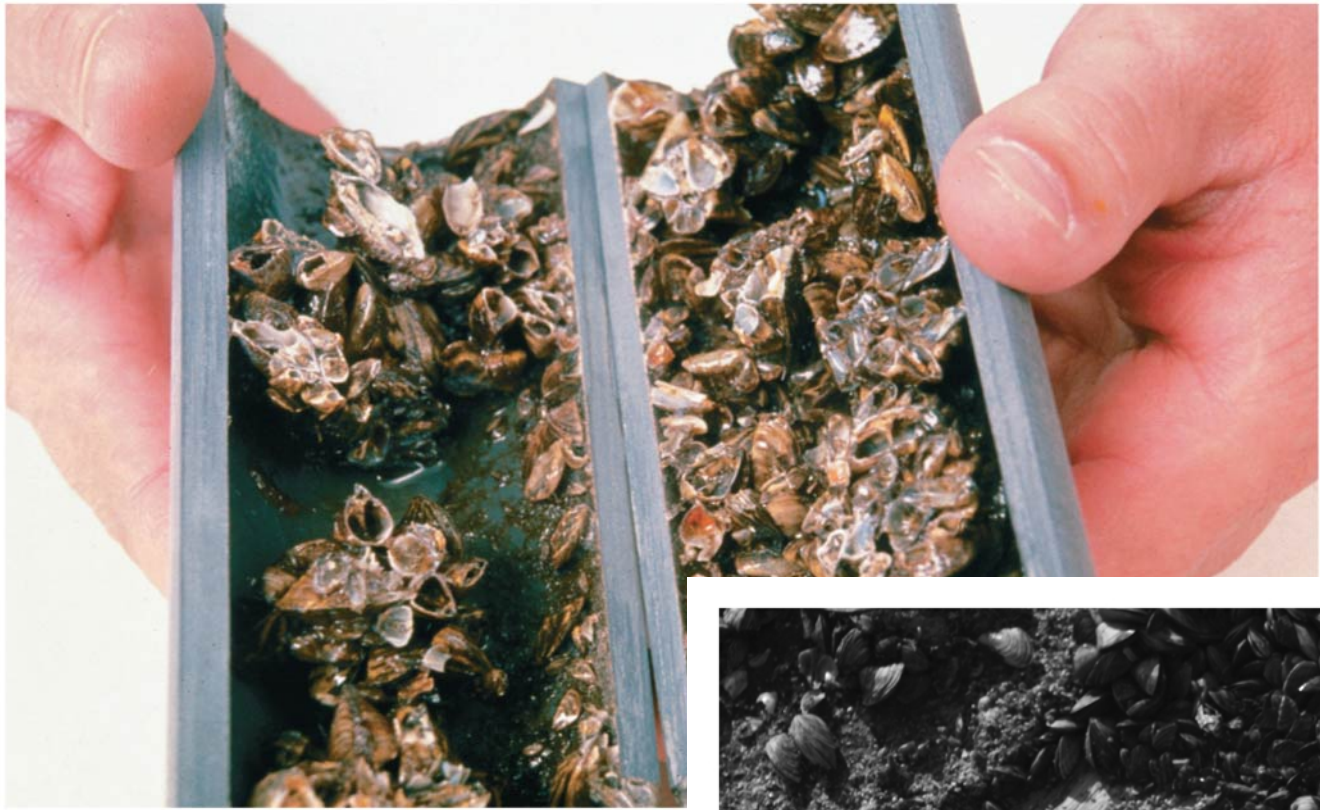
**Keystone
absent**

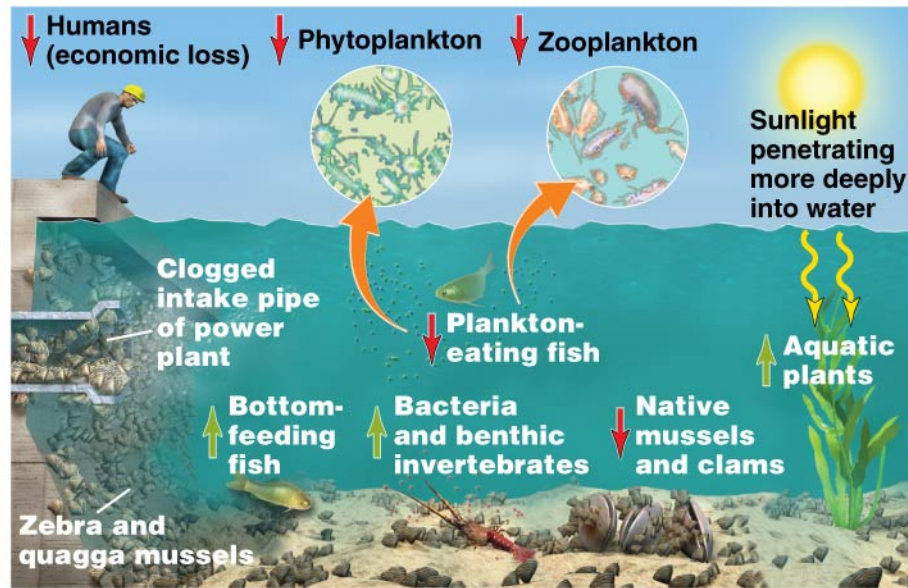


(b) A keystone species

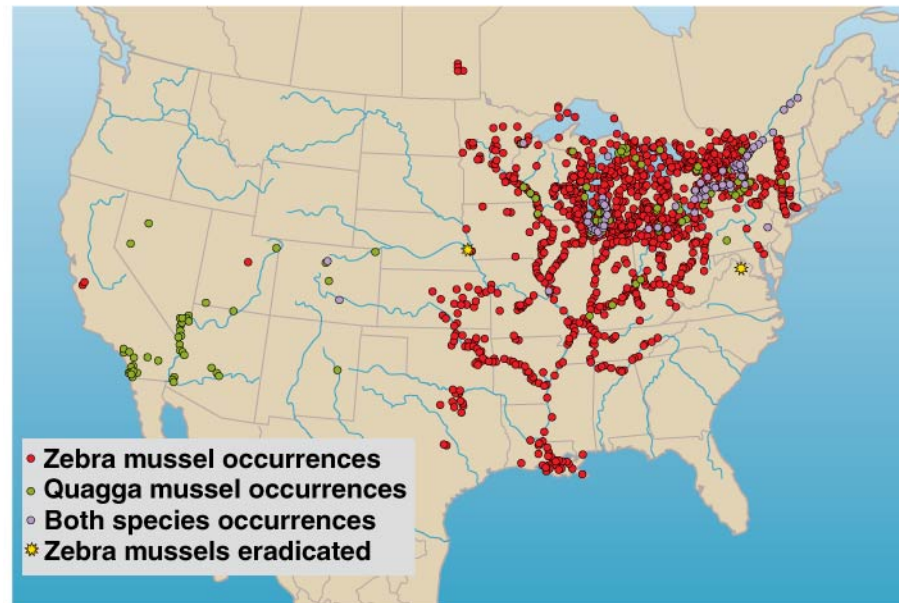
Sea otter absent





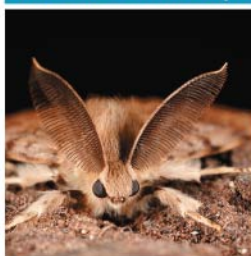


(a) Impacts of zebra and quagga mussels on a Great Lakes nearshore community



(b) Occurrence of zebra and quagga mussels in North America

TABLE 8.4 Invasive Species



European gypsy moth
(*Lymantria dispar*)

Introduced to Massachusetts in the hope it could produce silk. The moth failed to do so, and instead spread across the eastern United States, where its outbreaks defoliate trees over large regions every few years.



Asian long-horned beetle
(*Anoplophora glabripennis*)

Since the 1990s, has repeatedly arrived in North America in imported lumber. These insects burrow into wood and can kill the majority of trees in an area. Chicago, Seattle, Toronto, New York, and other cities have cleared thousands of trees to eradicate these invaders.



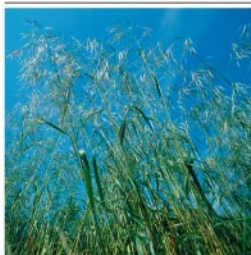
European starling
(*Sturnus vulgaris*)

Introduced to New York City in the 1800s by Shakespeare devotees intent on bringing every bird mentioned in Shakespeare's plays to America. Outcompeting native birds for nest holes, within 75 years starlings became one of North America's most abundant birds.



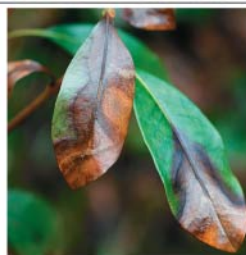
Emerald ash borer
(*Agrilus planipennis*)

Discovered in Michigan in 2002, this wood-boring insect reached 12 U.S. states and Canada by 2010, killing millions of ash trees in the upper Midwest. Billions of dollars will be spent in trying to control its spread.



Cheatgrass
(*Bromus tectorum*)

After introduction to Washington state in the 1890s, cheatgrass spread across the western United States. It crowds out other plants, uses up the soil's nitrogen, and burns readily. Fire kills many native plants, but not cheatgrass, which grows back stronger without competition.



Sudden oak death
(*Phytophthora ramorum*)

This disease has killed over 1 million oak trees in California since the 1990s. The pathogen (a water mold) was likely introduced via infected nursery plants. Scientists are concerned about damage to eastern U.S. forests if it spreads to oaks there.



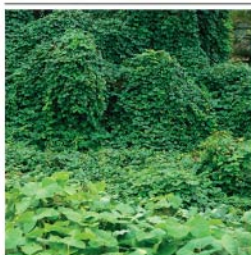
Brown tree snake
(*Boiga irregularis*)

Nearly every native forest bird on the South Pacific island of Guam has disappeared, eaten by these snakes, which arrived from Asia as stowaways on ships and planes after World War II. Guam's birds had not evolved with snakes, and had no defenses against them.



Nile perch
(*Lates niloticus*)

A large fish from the Nile River. Introduced to Lake Victoria in the 1950s, it proceeded to eat its way through hundreds of species of native cichlid fish, driving a number of them extinct. People value the perch as food, but it has radically altered the lake's ecology.



Kudzu
(*Pueraria montana*)

A Japanese vine that can grow 30 m (100 ft) in a single season, the U.S. Soil Conservation Service introduced kudzu in the 1930s to help control erosion. Kudzu took over forests, fields, and roadsides throughout the southeastern United States.



Polynesian rat
(*Rattus exulans*)

One of several rat species that have followed human migrations across the world. Polynesians transported this rat to islands across the Pacific, including Easter Island (pp. 6–7). On each island it caused ecological havoc, and has driven extinct birds, plants, and mammals.



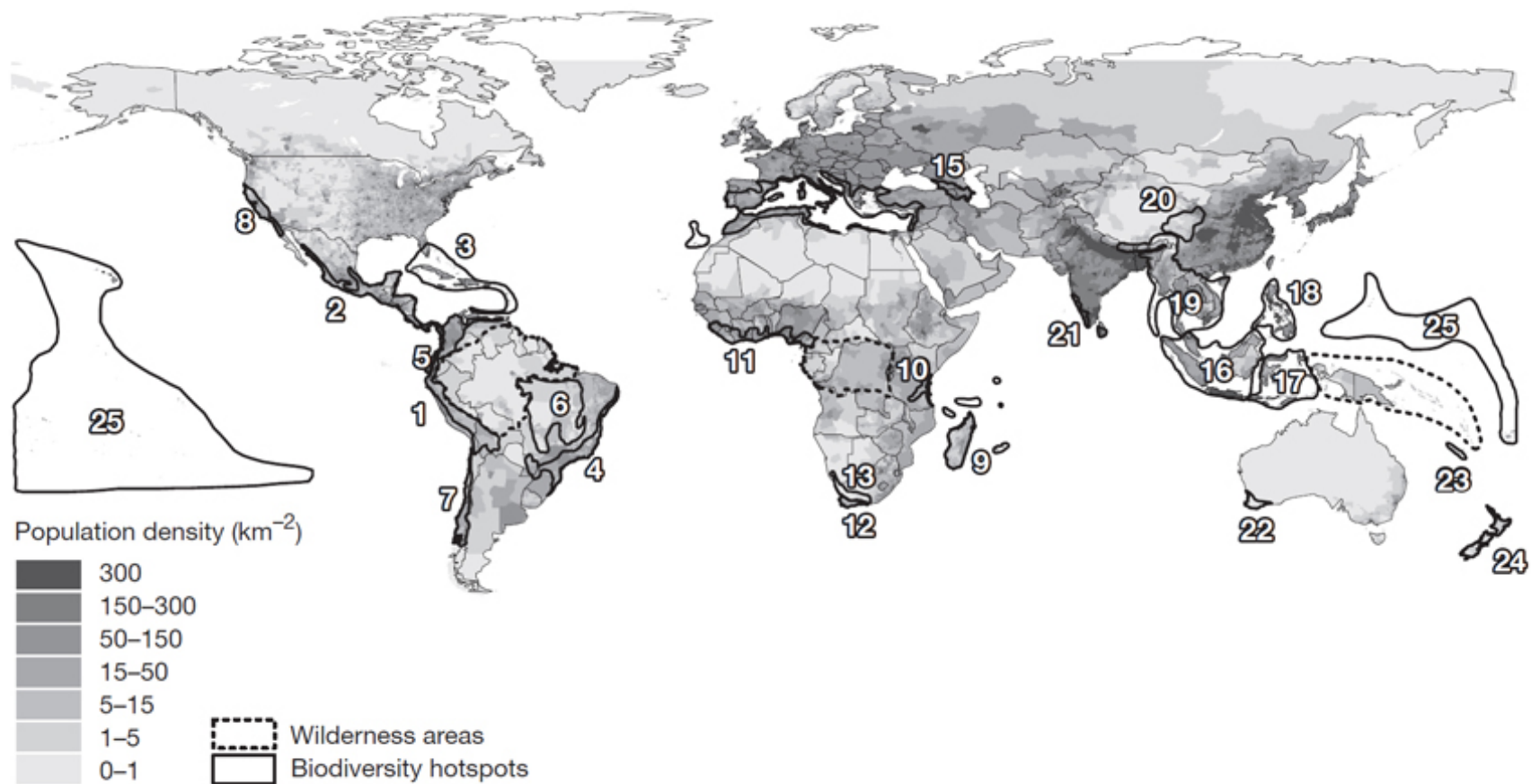
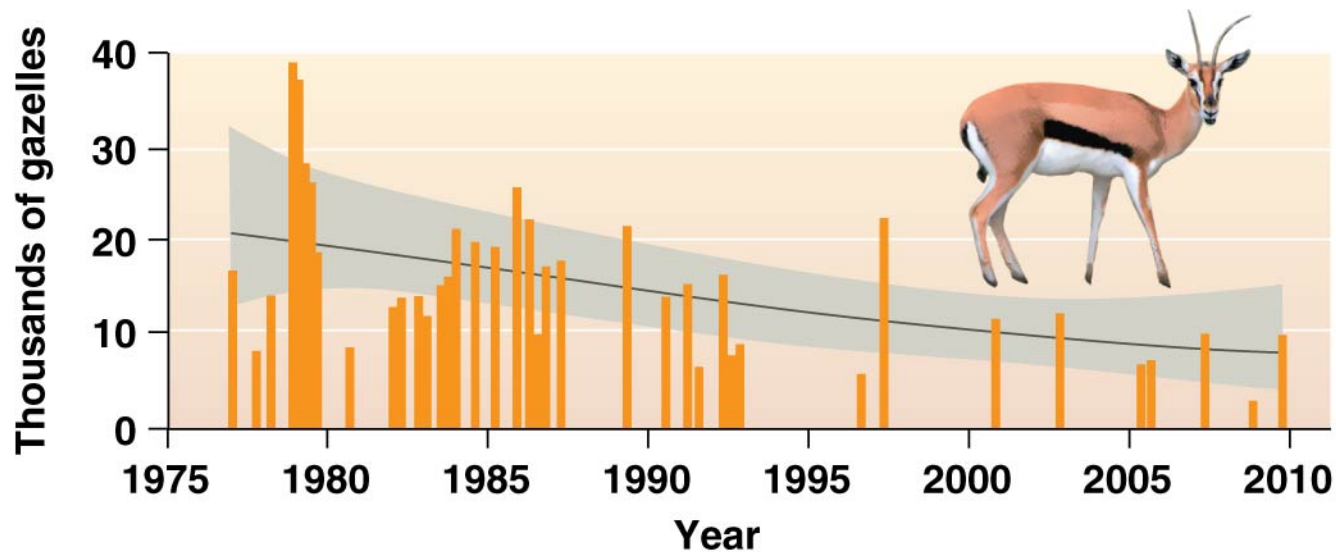


TABLE 9.1 PERCENTAGES OF LAND AND MARINE AREAS DECLARED TO BE PROTECTED BY WORLD GOVERNMENTS, 2010.

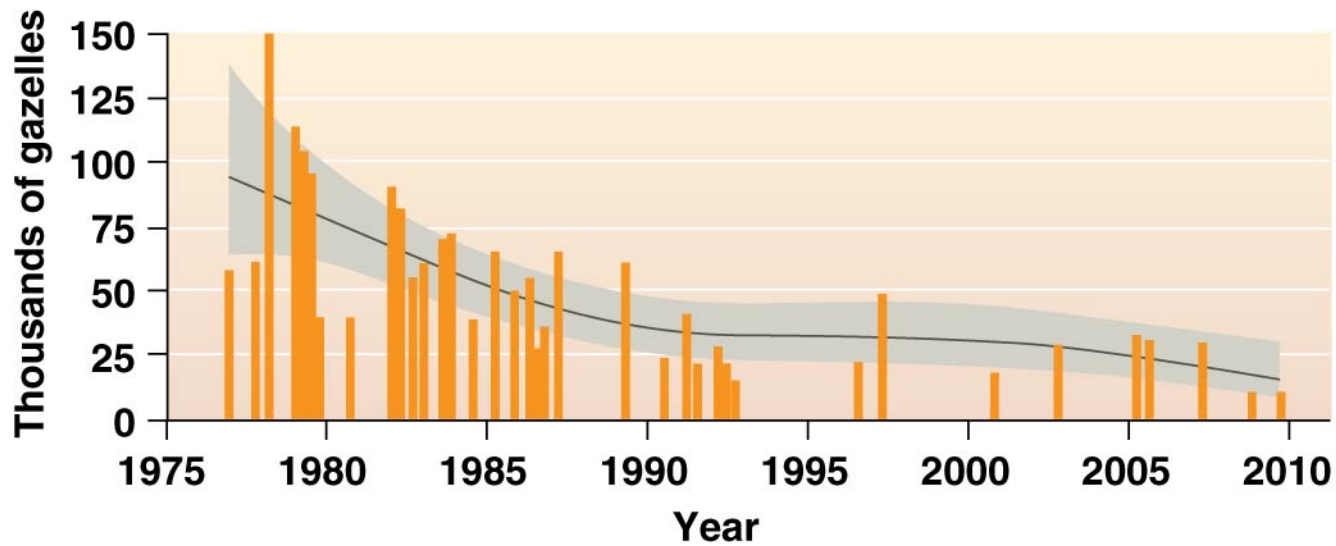
Region	PERCENTAGE OF AREA PROTECTED	
	Land areas	Marine areas
World (outside Antarctica)	12.7	7.2
Developed regions	11.6	11.5
Developing regions	13.3	4.0
Northern Africa	4.0	4.6
Sub-Saharan Africa	11.8	4.0
Latin America and the Caribbean	20.3	10.8
Caucasus and Central Asia	3.0	0.4
Eastern Asia	15.9	1.6
Southern Asia	6.2	1.2
Southeastern Asia	13.8	2.1
Western Asia	15.4	2.2
Oceania	4.9	2.8



Wildebeest Migration

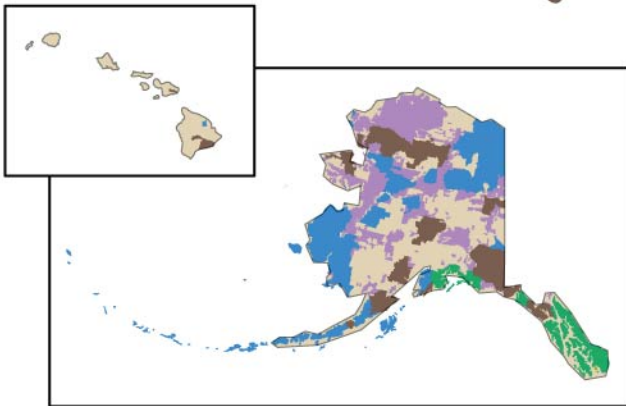
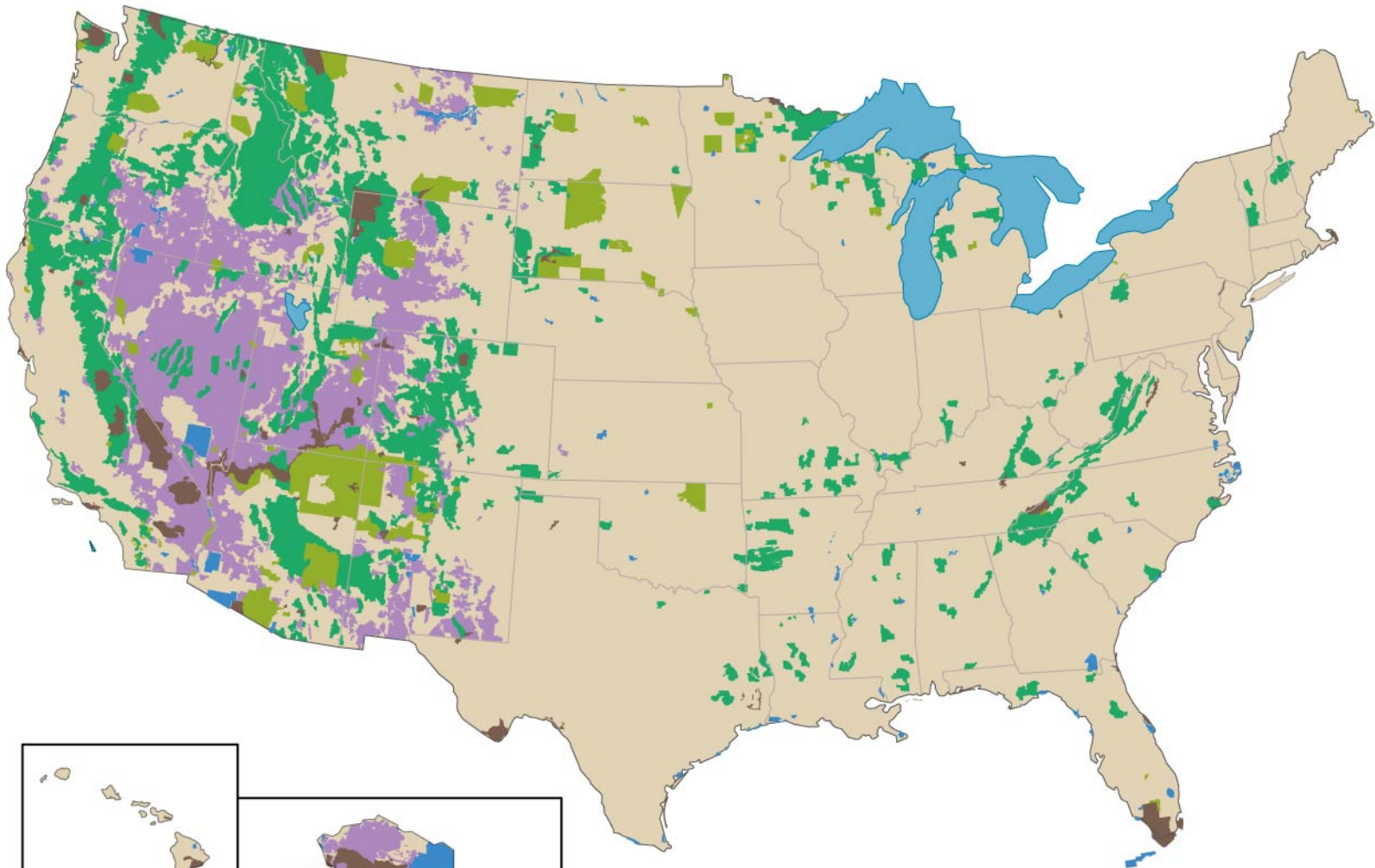


(a) Inside the reserve



(b) Outside the reserve

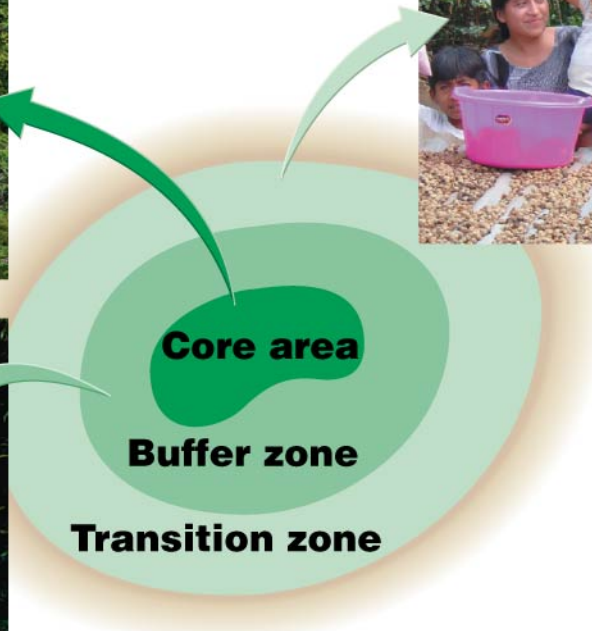




Federal lands by agency

-  Bureau of Indian Affairs
-  Bureau of Land Management
-  Fish and Wildlife Service
-  Forest Service
-  National Park Service





Saving Half the Planet for the Biosphere

| FROM 2005 TO 2010, 77% OF
RELEASED PRISONERS WERE
ARRESTED FOR A NEW CRIME.