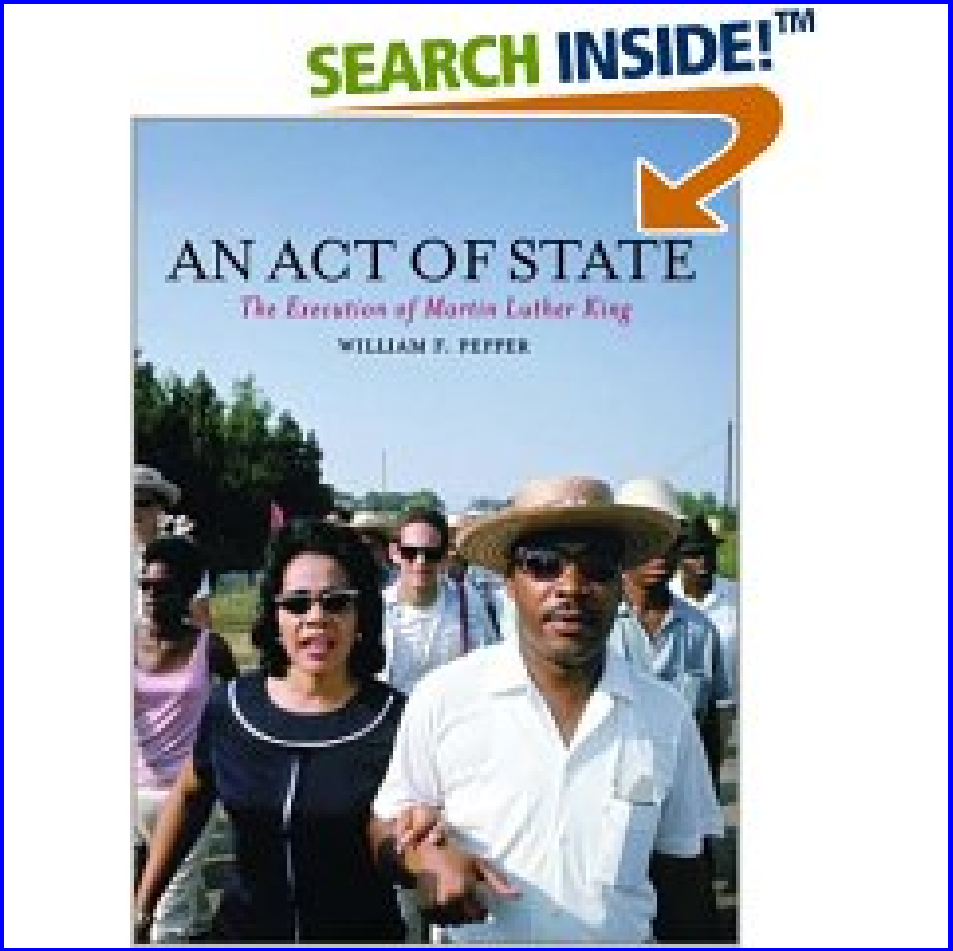
Human Impact on the Environment: Or: What Have They Done to the Rain? (Searchers)

Seekers Variation

In passing: Yesterday, **Congress Honored Martin Luther King Jr.**

Well, if they want to REALLY honor his memory, let them read and answer this book:



In the next 2 lectures, I'll partially follow our text, *EB* 439-462;
Excellent coverage, so, first time in my part of this course, I'm simply going to use a good part of THEIR lecture

The next slide shows just one shocking example of humanity's conduct

Mountaintop removal is used to extract half of Appalachia's Coal

Your text begins with a few scary headlines:

About 12% of all known bird species are endangered.

As an example of exotic or introduced species, Zebra mussels are shown on a shopping cart that could just as well been retrieved form one of our own Great Lakes

Massive Deforestation

Every year, humans destroy an area of **tropical rain forest** equal to the size of West Virginia.

Another example of exotic or introduced species,

In May 2002, a fisher in Maryland caught and released an exotic looking fish, which was identified as the northern snakehead.

(a) The northern snakehead.

Figure 20.1a

- The northern snakehead
  - Is native to eastern Asia.
  - Was accidentally introduced into Maryland.
- Introduced species
  - Can severely disrupt ecosystems.

We mentioned Easter Island: there too, some of the devastation was caused by an introduced species: Your friendly rat! [Not to mention an even more destructive exotic species—homo sapiens!] For example, rats ate pollen of the giant palms.

Many Hawaiian species suffered a similar fate

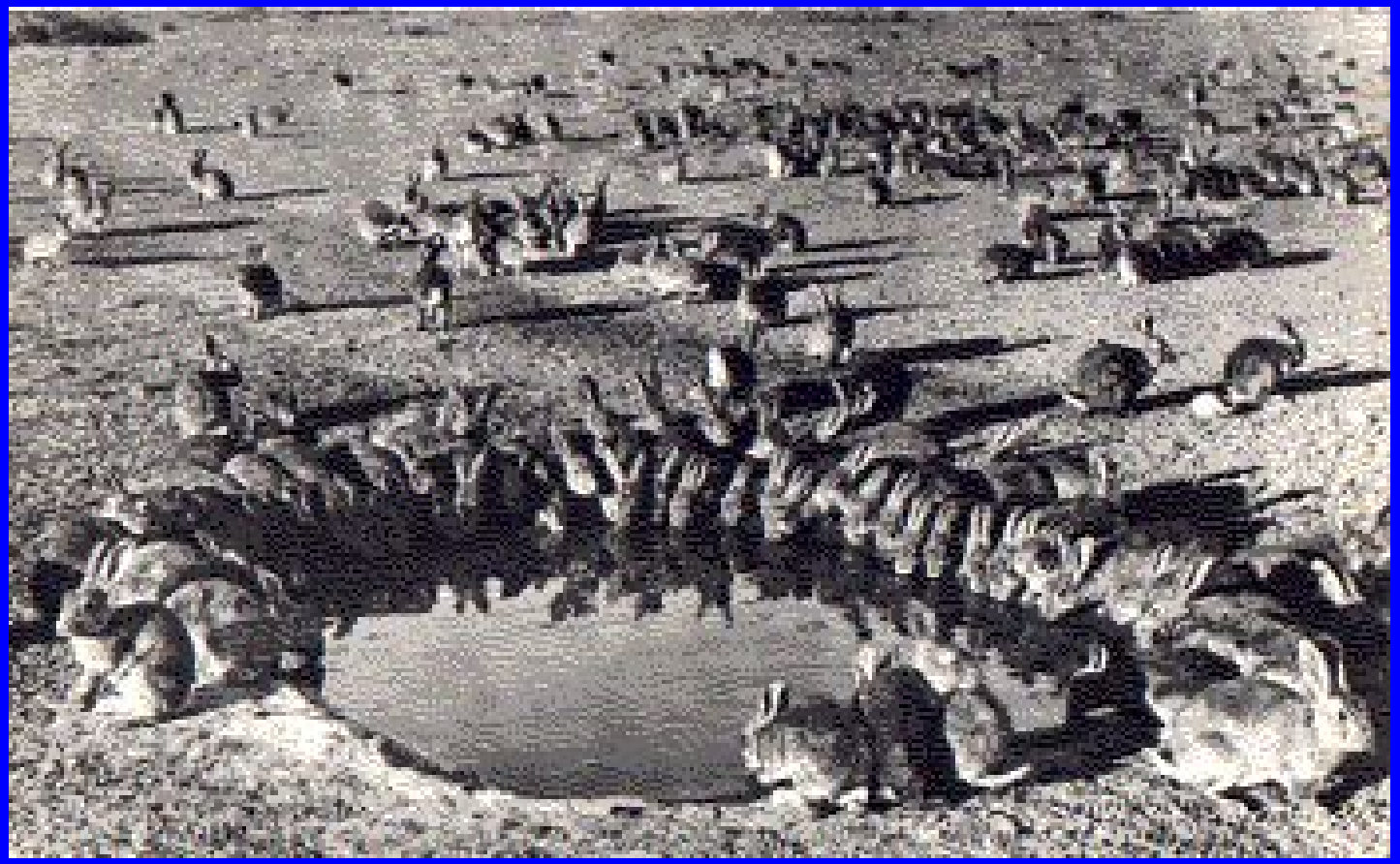
Australia, similarly devastated, e.g.,

Cactus to fence in livestock

In 1859, the European rabbit was introduced into Australia for sport. With no significant predators there, it multiplied explosively. The raising of sheep (another imported species) suffered badly as the rabbits competed with them for forage.

Usually rabbits get their water from the plants they eat. But, with the plants gone, that is what you could see, at the height of the infestation:

Australian rabbits drinking



Human Impact on Biological Communities

- Human disturbance of biological communities is almost always destructive.

Human Disturbance of Communities

Of all animals, humans have the greatest impact on communities worldwide.

The following slide: 2000 ft deep open-pit mine in Montana

Figure 20.2

Introduced or Exotic Species:

A More Famous Example: **Kudzu**

– Kudzu, a Japanese plant

- Was introduced into the United States in 1930 as a means of erosion control.
- Has taken over vast expanses of the southern landscape.

(a) Kudzu

Figure 20.3a

– The European starling

- Was introduced into the United States by a group intent on introducing all the plants and animals mentioned in Shakespeare's plays.
- Has displaced many native songbirds.

(b) European starlings

Figure 20.3b

– Argentine ants

- Were accidentally introduced into the United States.
- Have decimated populations of native ants in California.

(c) Argentine ants ganging up on a native red ant

Figure 20.3c

– The zebra mussel

- Was accidentally introduced into the United States, probably in ballast water from a cargo ship.
- Has caused significant problems and competes with native species.

(d) Zebra mussels

Figure 20.3d

The Release of Toxic Chemicals into Ecosystems

Humans add toxic substances, which often cannot be degraded by microorganisms. 1000s of these chemicals are man-made—never existed before we arrived. What's their effects on living creatures, including you:

Who knows—or cares?

Several factors make the effects of natural or human-made poisons more onerous than you might expect, e.g., **Biological magnification**

Here poisons become more concentrated along the food chain. Following photo shows that, PCBs (a human-made common poison), which exist in the Great Lakes, waters, and microscopic plants in 0.025 ppm concentrations, end up in some fish-eating gulls in a concentration 5,000X higher!

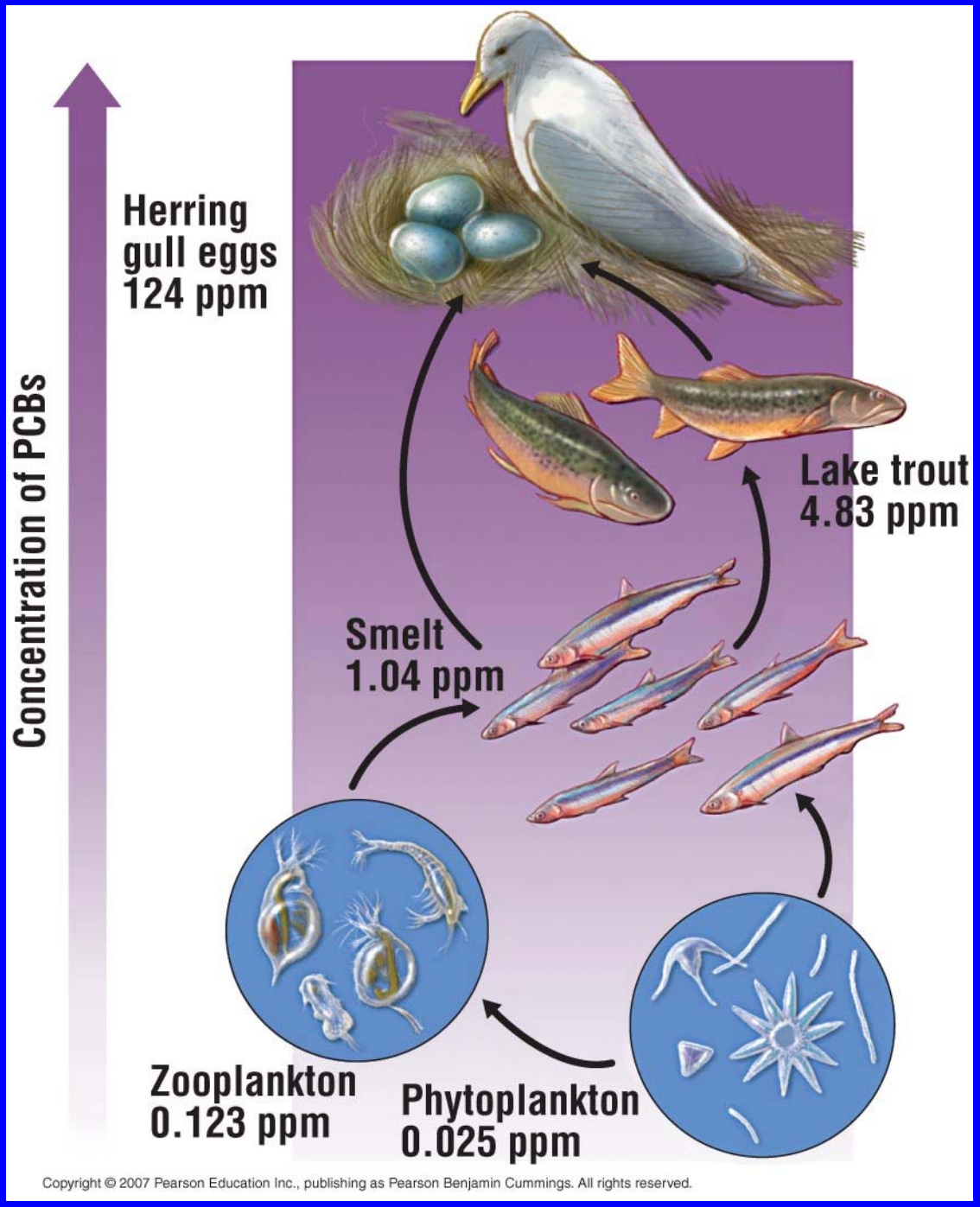


Figure 20.8

There are 1,000 of poisons in the water we shower in, air we breathe, soils we get our foods from, the houses we live in:

e.g., lead, mercury, dioxins, plutonium, PCBs . . .

e.g., lead, some people theorize that it led to the collapse of the Roman Empire

Benjamin Franklin already knew its effect

But: When we ever learn?

Or consider dolphins

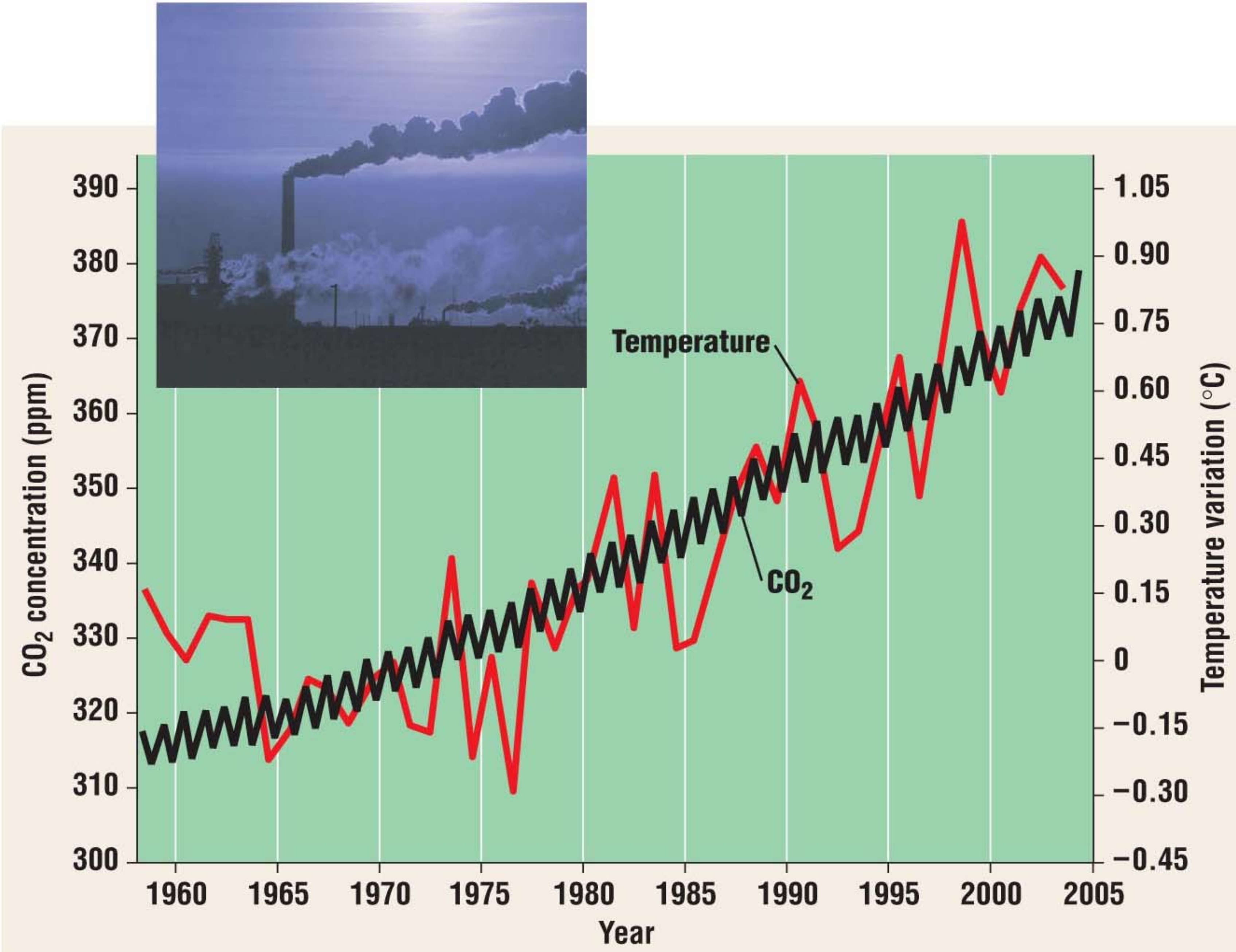
First born, more often than not, dies—getting poisoned by its mother's milk!

Human Impact on the Atmosphere and Climate

Figure 20.9

Carbon Dioxide Emissions, the Greenhouse Effect, and Global Warming (just a reminder)

- Since the Industrial Revolution, the concentration of CO_2 in the atmosphere has been increasing due to the burning of fossil fuels and wood and to deforestation.



- **The greenhouse effect**
  - Retains solar heat in the atmosphere.
  - Is produced by CO_2, water vapor, methane, and other greenhouse gases in the atmosphere.

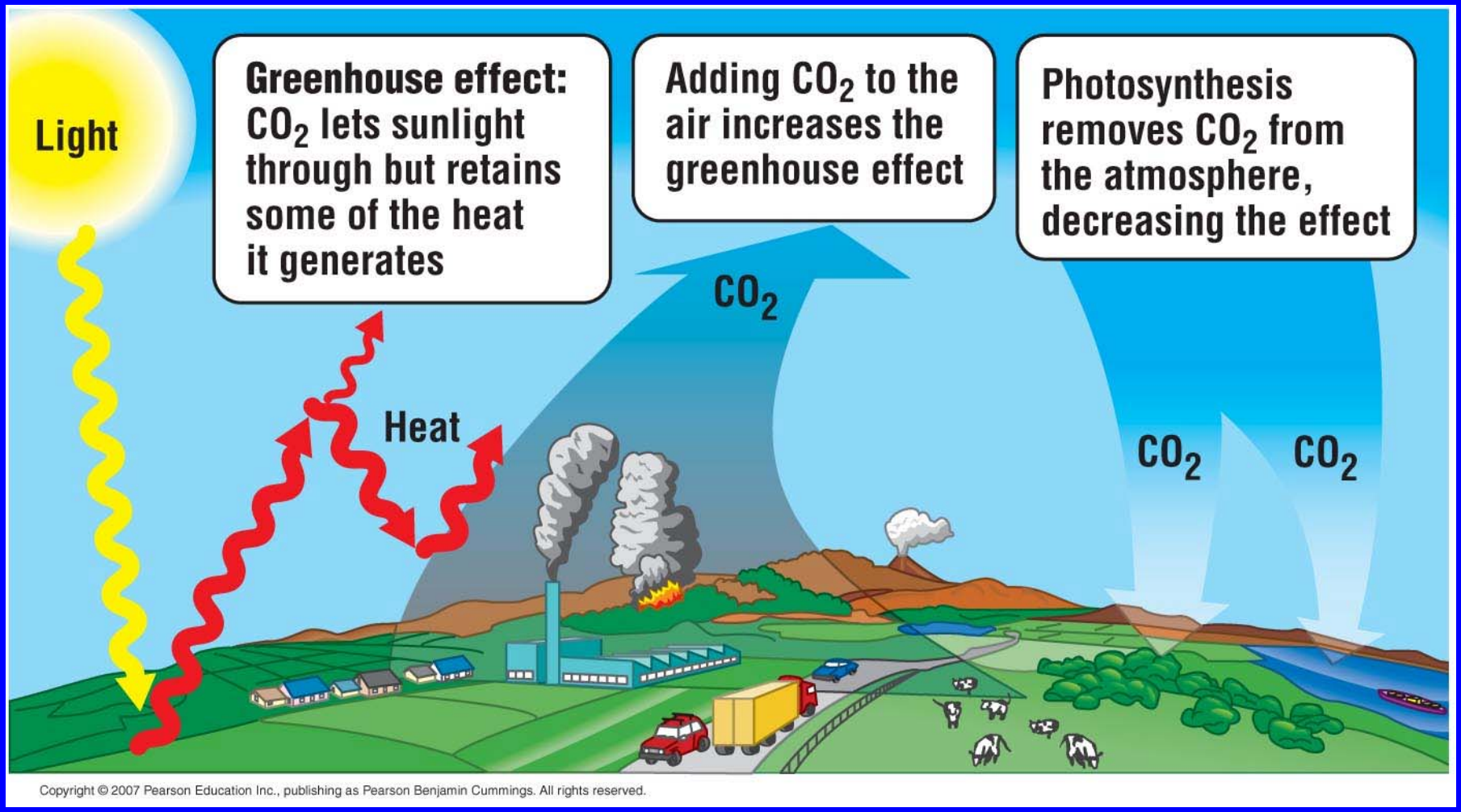


Figure 20.11

– The marked increase in atmospheric CO_2 could cause an increase in global temperatures, with potentially disastrous consequences.

- Developed countries
  - Have the greatest energy consumption.
  - Have the greatest responsibility to reduce energy consumption.

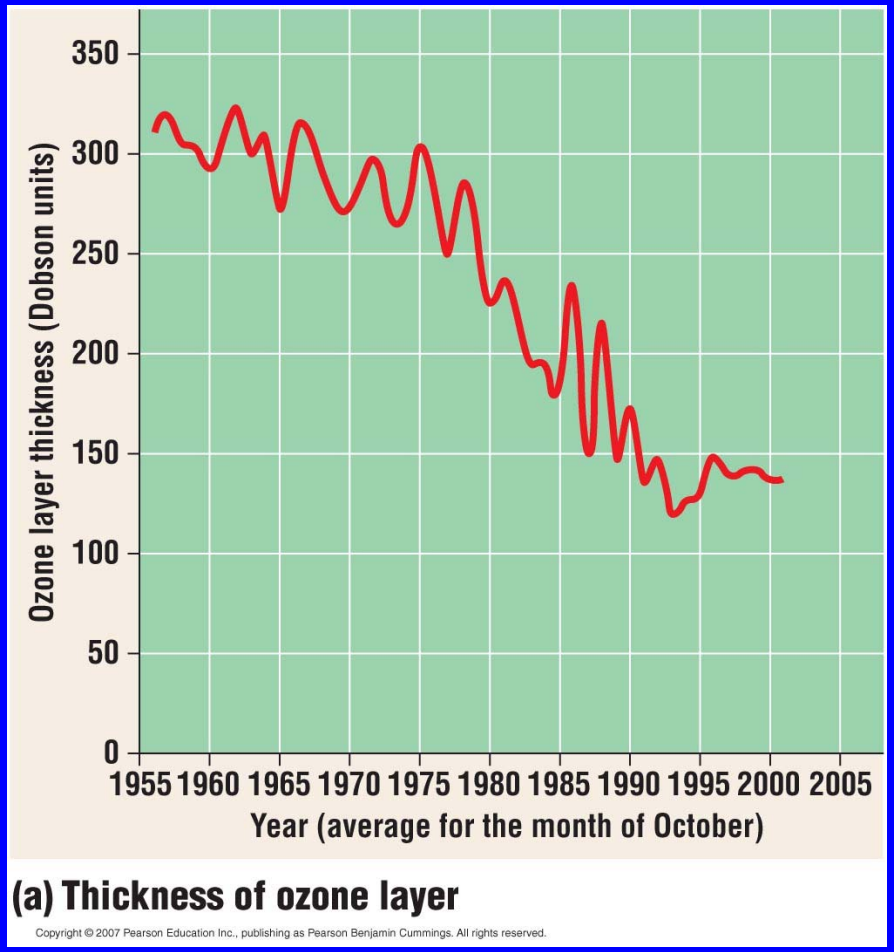
Depletion of Atmospheric Ozone

- The ozone layer
  - Absorbs UV radiation, preventing much of it from contacting organisms in the biosphere.

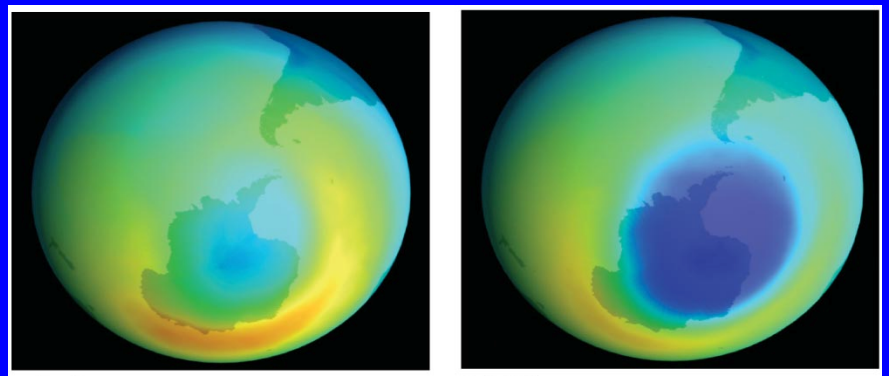
ozone depletion

Ozone—a molecule made up of 3 oxygen atoms. 6-30 miles up, protecting life on land from the sun's UV radiation

- The protective ozone layer
  - Has been thinning since 1975 because of the accumulation of chlorofluorocarbons (CFCs). We use CFCs to spray things, cool things. They are released, drift up to the stratosphere, and break down our safety goggles—O_3. More UV light for everyone—who needs tanning booths? Here is the famous “hole” (in blue)



(a) Thickness of ozone layer



1979 2000

(b) Ozone hole

Consequences of Ozone Depletion (or: Speaking of real terrorists)

- In the next fifty years, 240 million human beings might contract skin cancer as a result of ozone depletion, of which 4 million might die
- Eighty million might develop eye cataracts, of which many might become blind
- Suppression of the immune system
- Threats to the Antarctic food chain
- Damage to ecosystems and agriculture
- Extinctions of some wild species

Worse in Antarctica, but here in the USA too, we shouldn't feel smug: ozone is depleted by about 5%

Main cause of this disaster: Our broken down political system (recall Moore's "*Congressional Pimp*")

So, What Will the Future Bring?

The USA's Answer:

1. Future not ours to see
2. Que Sera Sera (whatever will be, will be)
    1. Partially true
    2. Criminal negligence

The Biodiversity Crisis

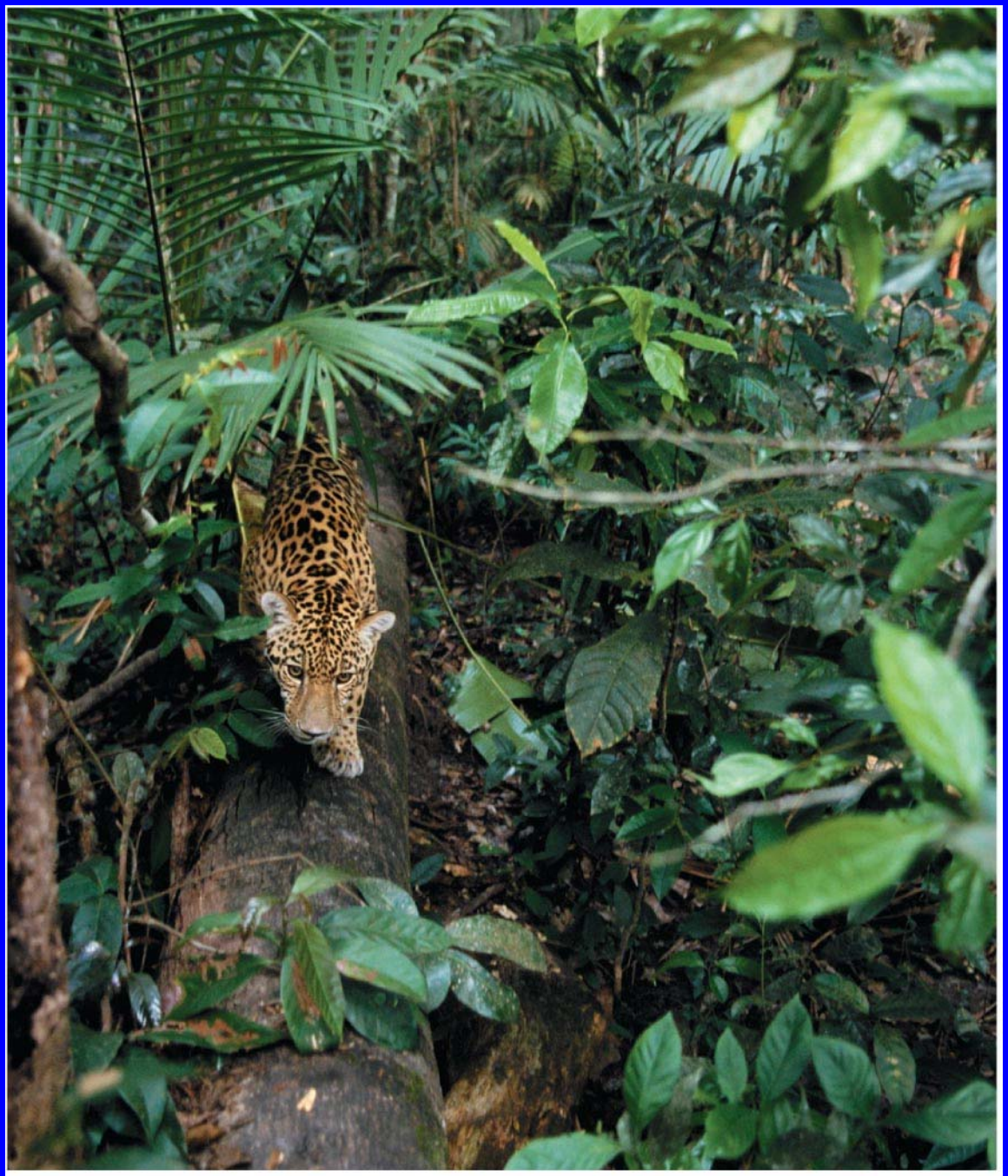
– The effect of human activity on communities and ecosystems is an alarming biodiversity crisis, a precipitous decline in Earth's great variety of life.

The Three Levels of Biodiversity

Biological diversity has three main components:

– The first level is the diversity of ecosystems, e.g., planet has forests, deserts, coral reefs, etc. Many are weakened or destroyed, e.g., coastal fisheries, coral reefs

– The second level is millions of species: rats, cats, maple trees, cockroaches, bacteria . . . The following photo shows a few species of an immensely diverse rain forest



– The third level of biodiversity is the genetic variation within each species.

Text focuses on second level: Loss of species

- The current mass extinctions
  - are being caused by human activity.
  - are broader and faster than other past extinctions.

– We do not know the full scale of the biodiversity crisis.

- However, there are enough signs to know that the biosphere is in deep trouble.
- We may have some 20,000,000 species on earth—and they are going fast.
- Mass extinctions happened before, but now—humanity is the cause

- 12% of the known bird species in the world and 24% of the known mammal species are threatened with extinction.
- Of the 20,000 known plant species in the United States, 200 have become extinct and 730 are endangered or threatened.
- About 20% of the known freshwater fishes in the world have become extinct or are seriously threatened.

- Biologist Edward O. Wilson has compiled the Hundred Heartbeat Club, which includes species of animals that number fewer than a hundred individuals.

(a) Philippine eagle

(b) Chinese river dolphin

(c) Javan rhinoceros

– Several researchers estimate that at the current rate of destruction, over half of all plant and animal species will be gone by the end of the 21st century.

The Three Main Causes of the Biodiversity Crisis

Habitat Destruction

- Human alteration of habitat Poses the single greatest threat to biodiversity throughout the biosphere.
  - We have seen earlier foggy L.A. and mountain coal mining in Appalachia
  - Here is another example: clear cutting of forest

(a) Habitat destruction.

Figure 20.15a

Introduced Species

- Human introduction of exotic species
  - Ranks second behind habitat loss as a cause of species extinction.
  - Can cause rapid extinctions.

Following slide: Nile perch was introduced to Lake Victoria, wiped out 200 native species

(b) Introduced species.

Figure 20.15b

Overexploitation

Overexploitation of wildlife is a third major cause of species extinction:

e.g.,

- Passenger pigeon
- Easter Island: Giant palms, sea birds
- Canada's Newfoundland—Cod.
- Next slide: bluefin tuna. $100 per tuna in Japan: So, it's DOOMED to extinction?

(c) Overexploitation.

Figure 20.15c

Why Biodiversity Matters?

- Ethical dimension: Isn't it a crime to destroy something as beautiful as the passenger pigeon, blue whale?
- Utility: Humans rely on biodiversity for
  - Food (e.g., pinion pines), clothing, shelter (e.g., your house).
  - Oxygen (e.g., grass) , soil fertility (e.g., nitrogen-fixing bacteria), medicinal substances (e.g., quinine).
  - We have no idea which species, and how many species, are totally indispensable to the survival of the biosphere

Just one example:

Madagascar's *Rosy Periwinkle*, is at present a source of anti-cancer drugs

– SO: loss of diversity

- Limits the potential for new discoveries of food and medicine.
- Reflects large-scale changes in the biosphere that could have catastrophic consequences.
- Ethical, aesthetic, catastrophe

Conservation Biology

– Conservation biology: Science of conserving ecosystems, species, genetic diversity.

Biodiversity “Hot Spots”

– A biodiversity hot spot

- Is a relatively small area with an exceptional concentration of species.
- So, makes greater sense to rescue such areas

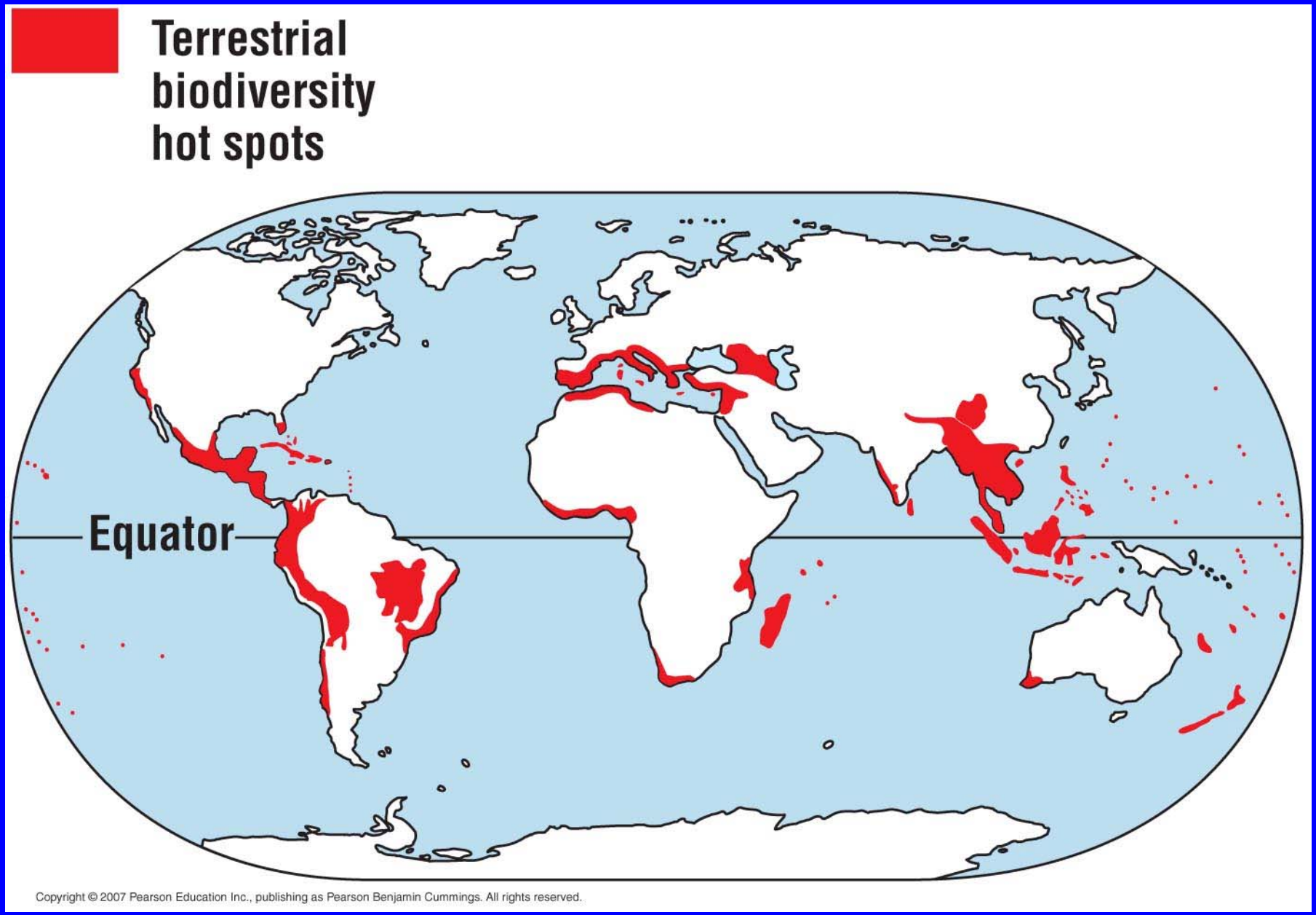


Figure 20.17

- Endemic species
  - Are often found in hot spots.
  - Are highly sensitive to habitat degradation.

- Some biologists
  - Estimate that loss of habitat will cause the extinction of about half the species in hot spots.

Conservation at the Population and Species Levels

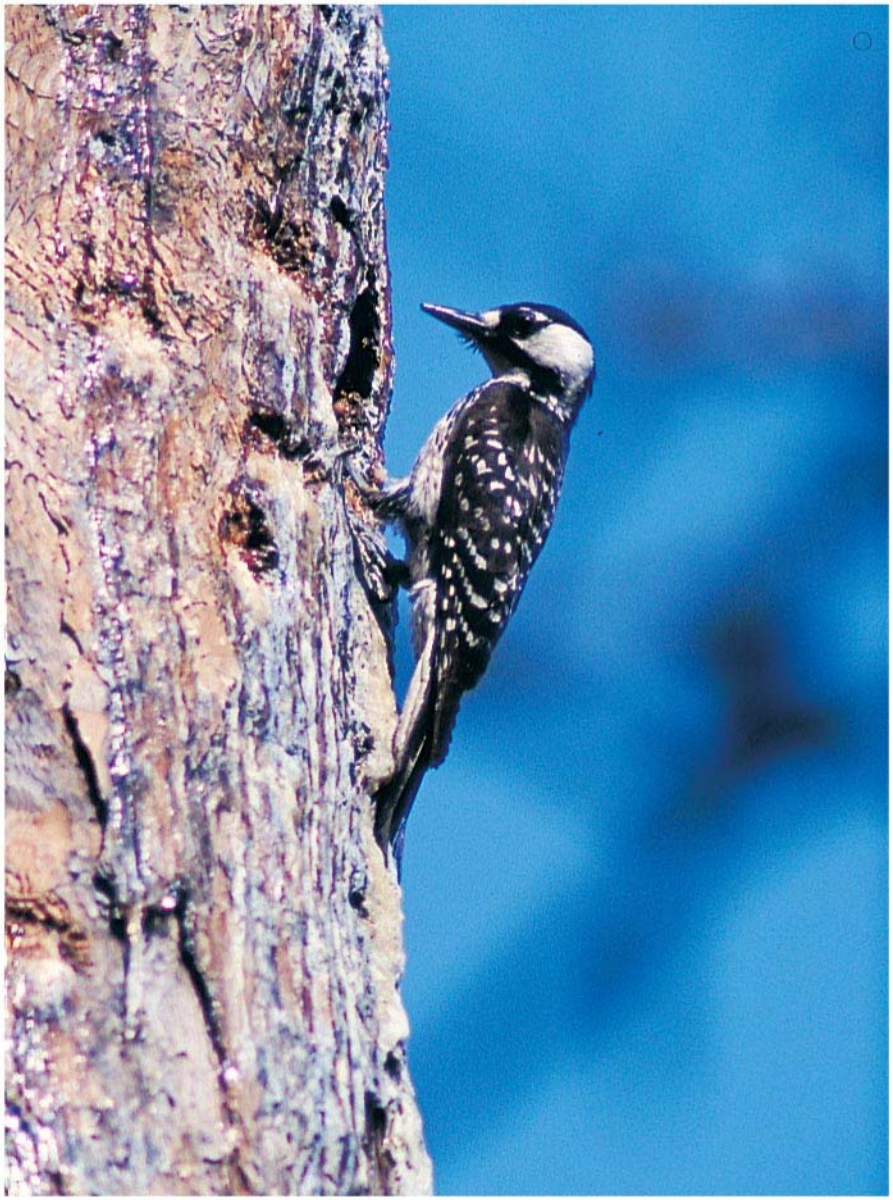
– Much of the discussion of the biodiversity crisis centers on species.

What Makes a Good Habitat?

- Identifying the specific combination of habitat factors that is critical for a species is fundamental to conservation biology.
- To save the world, we'll need to change our way of thinking, doing politics—may remove some lead and mercury from our brains. But in the meantime, if we badly wish to save just a couple of species, science helps. Let's look at one example:

– The red-cockaded woodpecker

- Provides a case study in identifying critical habitat factors.
- Southeastern USA



(a) A red-cockaded woodpecker perches at the entrance to its nest site in a long-leaf pine tree

Figure 20.19a

- Certain habitat factors are necessary for these birds:
  - Mature pines and low growth of plants

(b) Forest habitat with low undergrowth sustains red-cockaded woodpeckers

Figure 20.19b

– Scientists found that when a habitat has a thick and tall undergrowth, the numbers of this woodpecker go down, and its future it bleak.

(c) High, dense undergrowth impedes the wood-peckers' access to feeding grounds

Figure 20.19c

– Such careful studies of the red-cockaded woodpecker's habitat requirements have led to its partial recovery from near-extinction

Conservation at the Ecosystem Level

Saving one species at a time is important, but it is not going to get us out of the mess our psychopathic politicians and businessmen created for us.

So, conservation biology is partially shifting its focus to sustaining the biodiversity of entire communities and ecosystems, and even the biosphere as a whole.

One Option: Wilderness areas

Once upon a time, the USA was a pioneer: John Muir, Teddy Roosevelt, FDR: Creation of a network of areas where humans can only visit—on foot, canoe, or horseback.

[I have hiked and canoe by now in about 1/4 of the American ones—worth a try! Again, the ad men are depriving us of even decent vacations!]

But more seriously, wilderness is important for conservation biology! Another example:

(a)

- In Costa Rica, The areas surrounding wilderness areas:
  - Your text: “Continue to be used to support the human population, but they are protected from extensive alteration.”
  - I’d believe it—had I not spent a couple of months and talked to many people in Costa Rica. The government there *talks* about conservation. The reality is that they turn a blind eye to the ongoing destruction.
  - [It’s an old trick—we say the USA is a democracy, by the same token—but it clearly isn’t]

Humanity's Goal Should be: Sustainable Development

- Sustainable development focuses on the **long-term** prosperity of humans and other living organisms and on the ecosystems that support them.

- Some ways to promote sustainability

Table 20.1 Some Important Ways You Can Promote Sustainability

Reduce consumption
- Buy less.
- Avoid excess packaging.
- Avoid products made from nonrenewable resources.
- Fix things rather than discarding them.

Be more energy efficient
- Bike, walk, or take public transportation instead of driving.
- Share rides.
- Purchase efficient appliances and vehicles.

Promote recycling
- Recycle at home and at work.
- Purchase products made from recycled materials.

Take political action
- Vote for pro-environment policymakers.
- Approve ecologically sound ballot measures.
- Join an environmental advocacy group.
- Write letters in support of environmental causes.
- Run for political office yourself.

Promote research and education
- Talk about environmental issues with friends and family to raise their awareness.
- Sponsor environmental initiatives on your campus or in your workplace.
- Serve as a role model through your actions.

Think long term
- Realize that addressing environmental problems sometimes has short-term costs but long-term benefits.
- Support policymakers and businesses that promote long-term environmental thinking.

Table 20.1

To this list I'd add:

Have one or zero children

Stop the war on yellow flowers!

Eat organic food / Filter your water / Clean your home

Educated yourself—not for a piece of paper, but to improve yourself and help save humanity

Become a critical thinker

Let go of your TV, newspapers—they lie—read good books instead, go to alternative internet media

Bring genuine democracy (=people power) to America and the world—so that the people can decide, and so that we have leaders, not Congressional, Judiciary, and White House "Pimps" and –what was the word—Hoes?