ESSENTIAL

ENVIRONMENT

THE SCIENCE BEHIND THE STORIES

SECOND EDITION

9

Cities, Forests, and Parks: Land Use and Resource Management

PowerPoint® Slides prepared by
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This lecture will help you understand:

- Urbanization and sprawl
- Planning and land-use strategies
- Environmental consequences of urban centers
- Resource management approaches
- Roles of forests
- Timber harvesting and forest management approaches
- Parks and preserves
- U.S. land management agencies and the areas they administer

Central Case: Managing Growth in Portland, Oregon

- In 1973, Portland experienced development pressure.
- Oregon Senate Bill 100 required jurisdictions to draw up land-use plans in line with statewide guidelines.
- Plans focused growth in urban centers, preserved outlying rural areas, and encouraged walking and mass transit.

Urban growth boundary

- In Oregon, **urban growth boundaries (UGBs)** separate the urban core from rural areas where development is restricted.
- Many Portlanders see their UGB as key to maintaining quality of life.
- To others, it is an elitist and intrusive government regulatory tool.
- Recent passage of a measure that would undermine such controls may reshape land use in Oregon, with consequences for the rest of the nation.

Our urbanizing world

- We live at a turning point.
- Beginning in about 2007, for the first time in human history, more people will live in urban areas than in rural areas.
- But cities depend on rural and undeveloped areas for resources, giving the way we manage natural resources increasing importance.

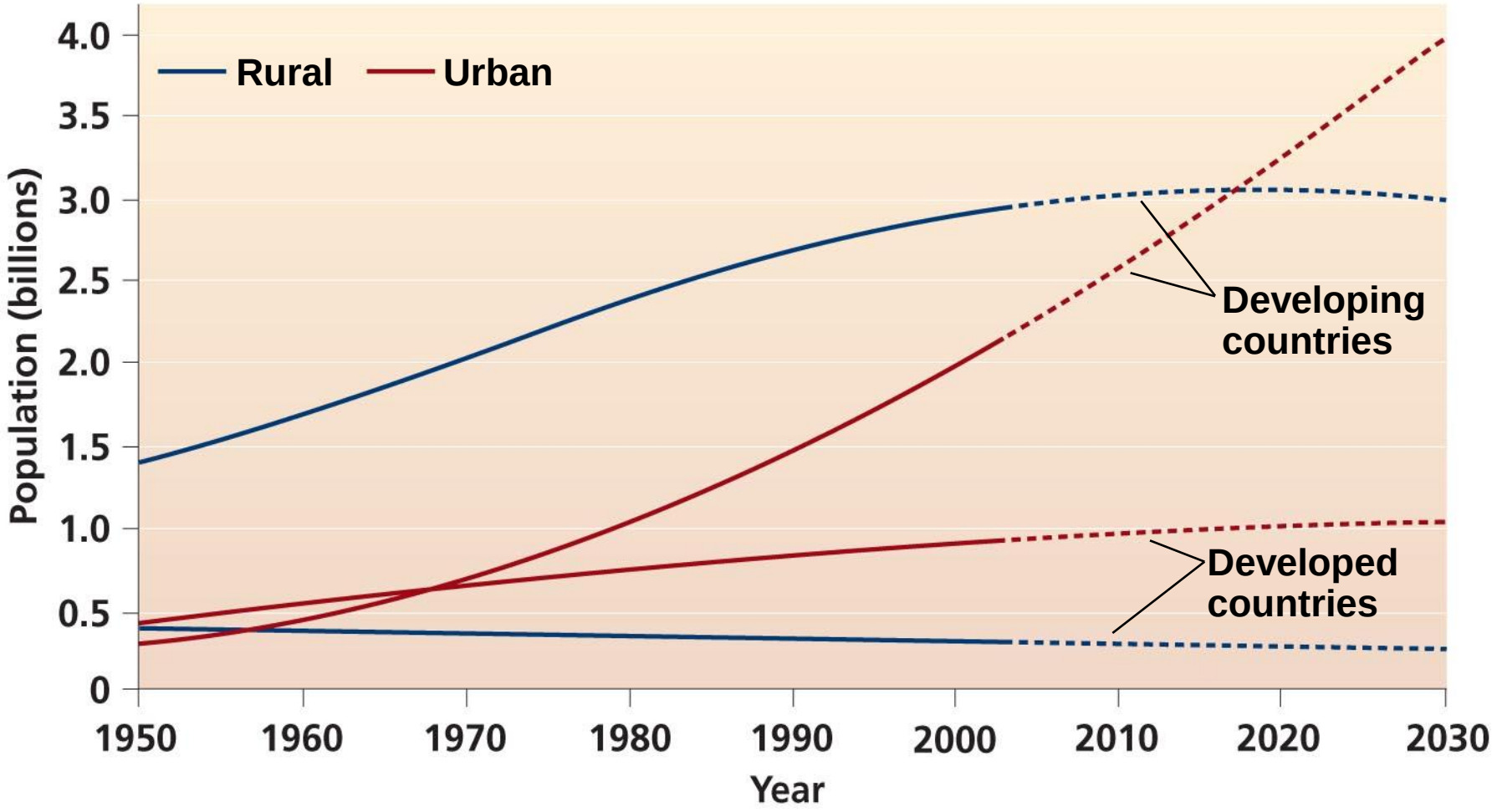
Urban centers are growing rapidly

- Worldwide, 20 cities hold more than 10 million people.
- Most people live in smaller cities and their suburbs.
- Urban populations are growing because:
  - More people are moving from farms to cities than from cities to farms.
  - The population overall is growing.
  - In many developing nations such as India and China, rural people are moving en masse into cities.

Urbanization

Urban populations are growing and rural populations are shrinking, especially in the developing world.

LE 9-1



Urbanization

Most fast-growing cities are in the developing world.

Table 9.1 Metropolitan Areas with 10 Million Inhabitants or More

City	Millions of people
Tokyo, Japan	35.0
Mexico City, Mexico	18.7
New York, United States	18.3
Sao Paulo, Brazil	17.9
Mumbai (Bombay), India	17.4
Delhi, India	14.1
Calcutta, India	13.8
Buenos Aires, Argentina	13.0
Shanghai, China	12.8
Jakarta, Indonesia	12.3
Los Angeles, United States	12.0
Dhaka, Bangladesh	11.6
Osaka-Kobe, Japan	11.2
Rio de Janeiro, Brazil	11.2
Karachi, Pakistan	11.1
Beijing, China	10.8
Cairo, Egypt	10.8
Moscow, Russian Federation	10.5
Metro Manila, Philippines	10.4
Lagos, Nigeria	10.1

Source: United Nations Population Division. 2004. *World urbanization prospects: The 2003 revision.* New York: UNPD

Well-situated cities have grown rapidly

- Successful cities tend to be located in places that give them economic advantages.
- Portland, for example, sits at the junction of two rivers, making it ideal for trade and travel.
- In recent years, many southern and western U.S. cities have grown quickly as people have moved south and west seeking more space and warmer climates.

Suburbanization and sprawl

- Beginning in the 1950s, many people in developed countries moved from crowded cities out to suburbs.
- They wanted more space, better economic opportunities, cheaper real estate, less crime, and better schools.
- Suburban growth has spread human impact across the landscape.
- **Sprawl:** the spread of low-density urban or suburban development outward from an urban center.

Sprawl in the Nevada desert

In Las Vegas, population increased more than fivefold, and developed area increased more than threefold from 1972–2002.

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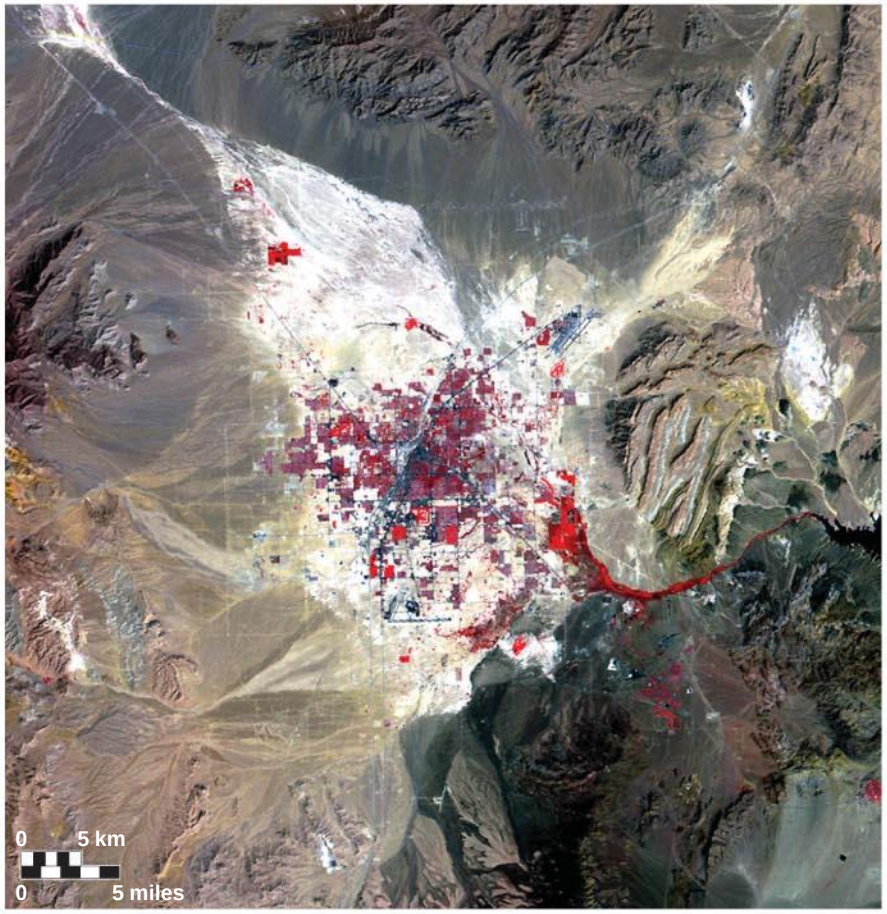
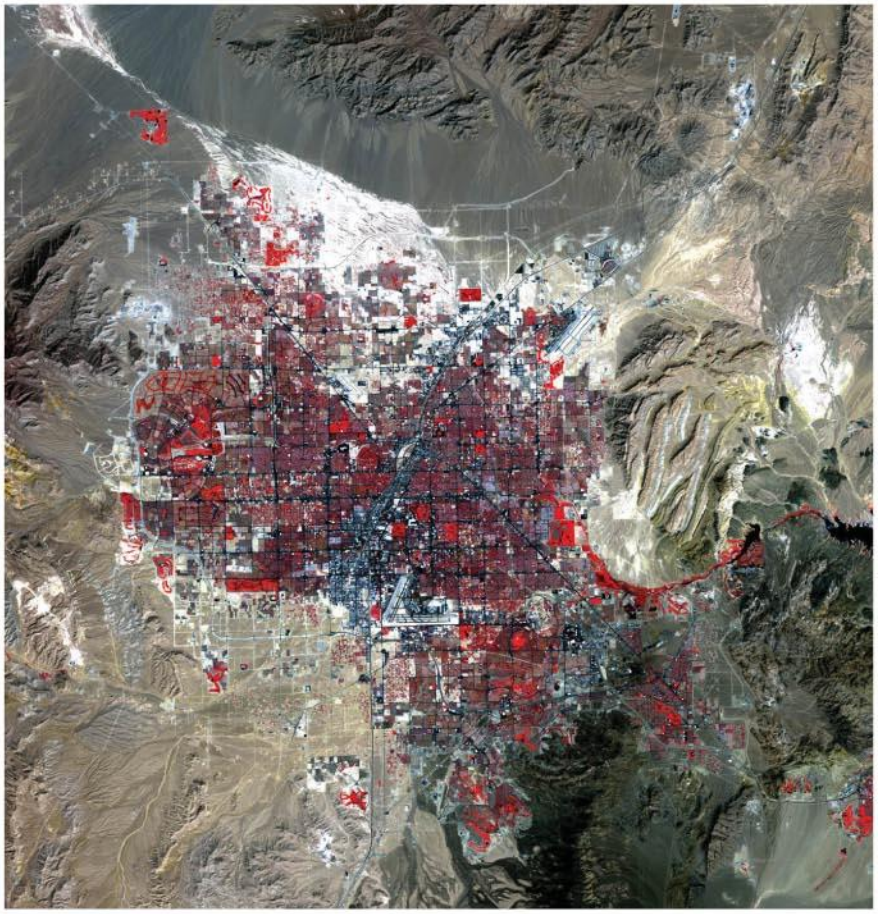


(a) Las Vegas, Nevada, 1972



(b) Las Vegas, Nevada, 2002

Causes of sprawl

Two main components of sprawl:

- Human population growth
- Per capita land consumption—each person takes up more land. Reasons:
  - Telecommunications have moved business from cities
  - Most people like space and privacy
  - People assume that growth is good

... But this assumption is increasingly being challenged.

Uncentered commercial strip development

Businesses are arrayed in a long strip along a roadway, and no attempt is made to create a centralized community.

LE 9-3a

(a) Uncentered commercial strip development

Low-density single-use development

Homes are located on large lots in residential tracts far away from commercial amenities.

LE 9-3b

(b) Low-density single-use development

Scattered (leapfrog) development

Developments are created far from a city center and are not integrated.

LE 9-3c

(c) Scattered, or leapfrog, development

Sparse street network

Roads are far enough apart that areas go undeveloped but too close together for these areas to remain natural.

LE 9-3d

(d) Sparse street network

Problems with sprawl

- **Transportation:** Sprawl forces people to drive cars.
- **Pollution:** Increased driving causes increased air and water pollution.
- **Health:** Sprawl promotes physical inactivity because driving replaces walking during daily errands.
- **Land use:** More land is developed and less is left as forests, fields, farmland, or ranchland.
- **Economics:** Sprawl funnels tax dollars into infrastructure (e.g., roads) for new development.

Measuring the impacts of sprawl

Key findings of the study:

- Residents of the most sprawling areas drove more each day and used public transportation less.
- Surprisingly, there was no significant difference in commute time between sprawling and less-sprawling areas.
- The most sprawling area in the United States was Riverside–San Bernadino in California.

Sprawl and American urban areas

The 10 Most-Sprawling American Urban Areas

Rank	Metropolitan Region
1	Riverside–San Bernardino, CA
2	Greensboro–Winston-Salem–High Point, NC
3	Raleigh–Durham, NC
4	Atlanta, GA
5	Greenville–Spartanburg, SC
6	West Palm Beach–Boca Raton–Delray Beach, FL
7	Bridgeport–Stamford–Norwalk–Danbury, CT
8	Knoxville, TN
9	Oxnard–Ventura, CA
10	Fort Worth–Arlington, TX

1 = most sprawling, 10 = less sprawling.

The 10 Least-Sprawling American Urban Areas

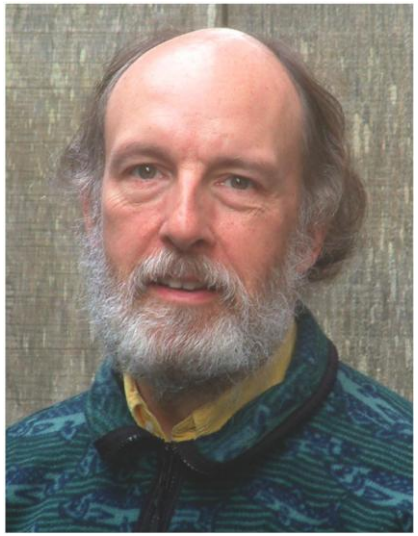
Rank	Metropolitan Region
83	New York, NY
82	Jersey City, NJ
81	Providence–Pawtucket–Woonsocket, RI
80	San Francisco, CA
79	Honolulu, HI
78	Omaha, NE-IA
77	Boston–Lawrence–Salem–Lowell–Brockton, MA
76	Portland, OR
75	Miami–Hialeah, FL
74	New Orleans, LA

83 = least sprawling, 74 = more sprawling.

Source: Ewing, R., et al. 2002. *Measuring sprawl and its impact.* Washington, D.C.: Smart Growth America.

From *The Science behind the Story*

Viewpoints: Suburban sprawl



Randal O'Toole

"Instead of attempting to impose their lifestyle preferences on others, city officials should simply ensure that people pay the full costs of whatever lifestyle they prefer."

Jeff Speck

"Motor vehicles, the lifeblood of sprawl, are the single greatest contributor to global warming… Unless we quickly make the change to nonpolluting vehicles, global warming will remain the strongest argument against sprawl."

City planning

Parks, greenways, and efficient transportation played a key role in early **city planning,** the professional pursuit that attempts to design cities so as to maximize their efficiency, functionality, and beauty.

Regional planning

- In today's world of sprawling metropolitan areas, **regional planning** has become just as important.
- Regional planners work on broader geographic scales and must coordinate with multiple governments.
- In some places, regional planning has been institutionalized within governmental bodies (e.g., the Portland region).

Zoning

Zoning is the practice of classifying areas for different types of development and land use.

- It restricts areas to one use or allows a mix of uses (e.g., residential and commercial).
- It allows home and business owners to know in advance what types of development can be located nearby.
- It represents a top-down constraint on personal property rights.

Urban growth boundaries

- Urban growth boundaries (UGBs) have been adopted in many communities across the United States.
- They help maintain farms and natural areas, and appear to reduce infrastructure costs as compared to sprawl.
- But they also seem to increase housing costs within their boundaries.

Smart growth

Smart growth aims to guide the rate, placement, and style of development such that it serves the environment, the economy, and the community.

Table 9.2 Ten Principles of "Smart Growth"

- Mix land uses
- Take advantage of compact building design
- Create a range of housing opportunities and choices
- Create walkable neighborhoods
- Foster distinctive, attractive communities with a strong sense of place
- Preserve open space, farmland, natural beauty, and critical environmental areas
- Strengthen and direct development towards existing communities
- Provide a variety of transportation choices
- Make development decisions predictable, fair, and cost-effective
- Encourage community and stakeholder collaboration in development decisions

Source: U.S. Environmental Protection Agency, 2005.

New urbanism

The **new urbanism** seeks to design neighborhoods on a walkable scale, with homes, businesses, schools, and other amenities all close together for convenience.

This plaza is part of a new urbanist community in Florida.

Transportation

- *Transit-oriented development* arrays compact, new urbanist communities around the stops on a major rail transit line.

- Livable cities provide multiple transportation options (public buses, trains, subways, light rail).

- Mass transit is cheaper, more energy-efficient, and cleaner than roadways choked with cars.

Energy consumption for different modes of transit

Rail tends to be most energy efficient.

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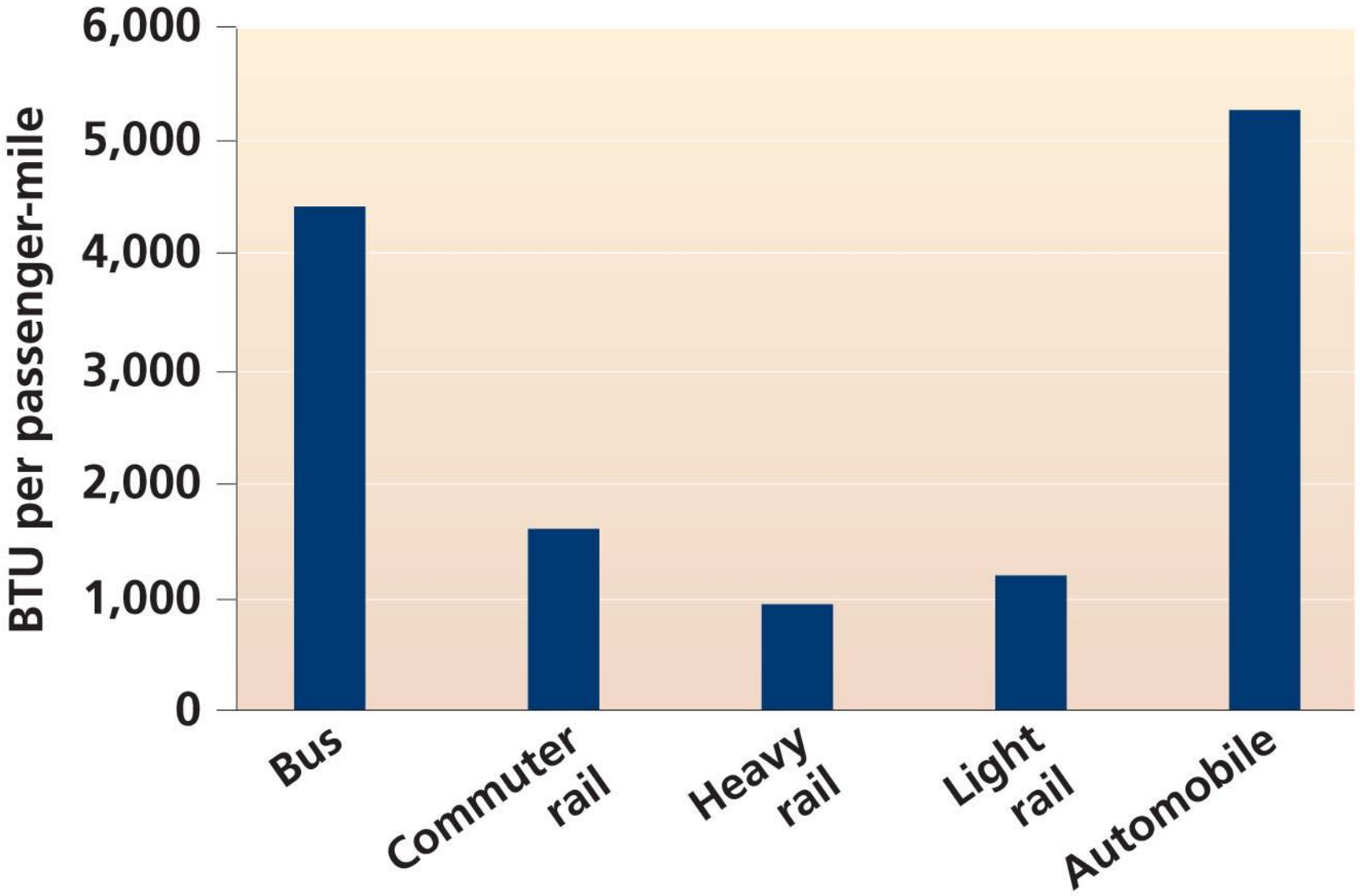
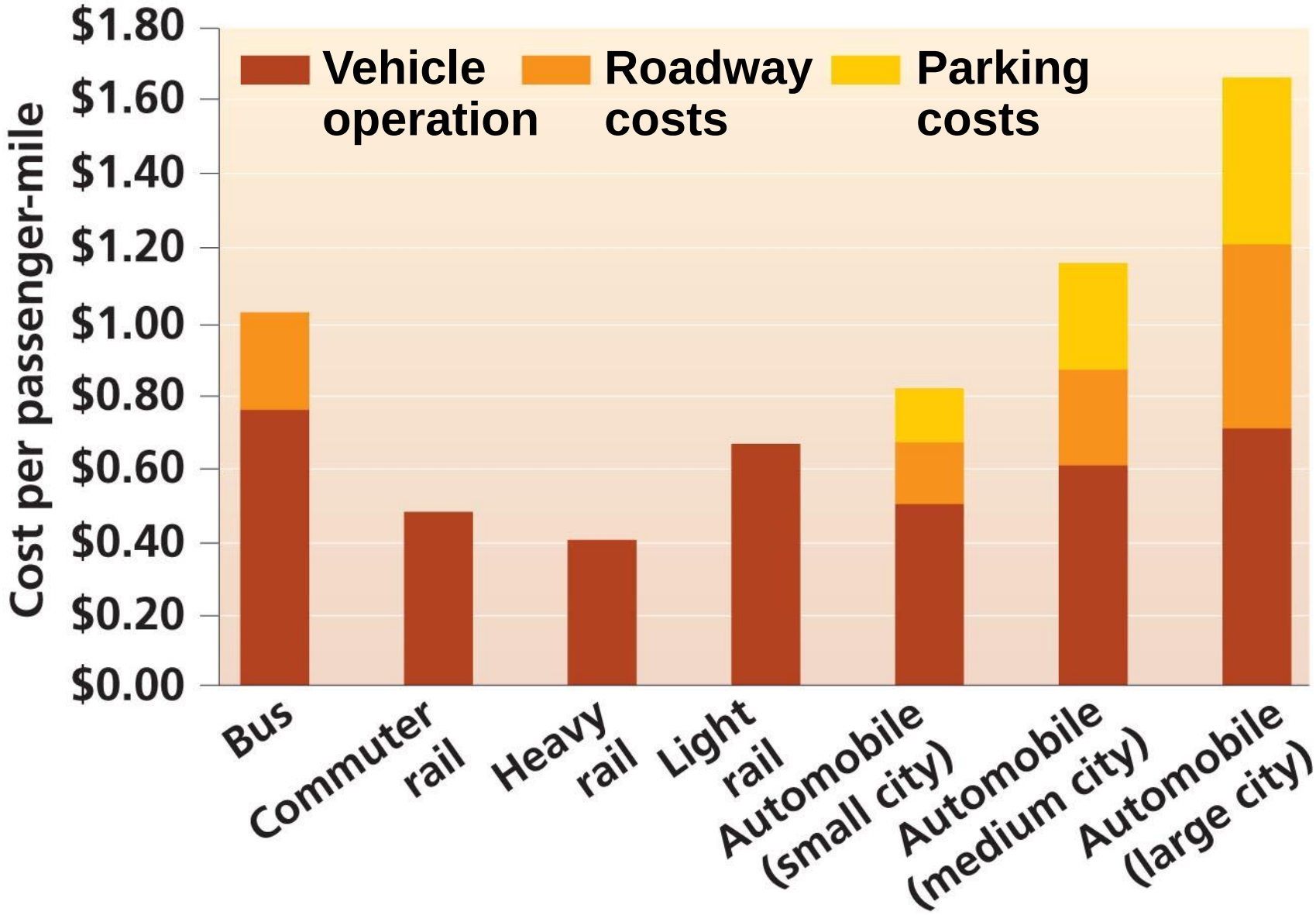


(a) Energy consumption for different modes of transit

Operating costs for different modes of transit

Rail tends to be most cost efficient.

LE 9-6b



(b) Operating costs for different modes of transit

Transportation successes

- Portland, Oregon, and Curitiba, Brazil, are two success stories in creating livable cities.

- Key components are:
  - Strong public transportation
  - Pedestrian- and bike-friendly
  - Zoning to limit sprawl
  - Environmental education
  - Self-sufficient neighborhoods

Public transport in Portland

Parks and open space

- City parks were widely established at the turn of the last century.
- They used aesthetic ideals borrowed from European parks: lawns, shaded groves, and curved pathways.
- Landscape architect Frederick Olmsted was influential in many cities.

Public spaces

- Small public spaces can contribute to a healthy urban environment.
- Community gardens allow people to grow their own vegetables and flowers in a neighborhood setting.
- *Greenways* provide access to nature, boost property values, and serve as wildlife corridors.

Urban centers have mixed consequences

- **Resource consumption:** Cities are sinks for resources, having to import almost all their basic needs. But they can minimize consumption by maximizing the efficiency of use and distribution.
- **Land preservation:** Densely packed urban populations leave more undeveloped land outside cities.
- **Pollution:** Just as cities import resources, they export wastes. Urban residents are also exposed to high levels of toxicants that remain in cities.
- **Innovation:** The vibrant culture of urban life promotes research, education, and inventiveness.

Urban sustainability

Urban ecology applies ecosystem ecology and systems science to urban areas.

Urban sustainability advocates suggest that cities:

- Maximize efficient use of resources
- Recycle as much as possible
- Develop environmentally friendly technologies
- Account fully for external costs
- Offer tax incentives for sustainable practices
- Use locally produced resources
- Use organic waste and wastewater
- Encourage urban agriculture

Resource management

- We need to manage the resources we use because many of them are limited.
- **Resource management** is the practice of harvesting potentially renewable resources without depleting them.
- Vital natural resources include:
  - Timber
  - Soils
  - Freshwater
  - Wildlife, fisheries, and rangeland
  - Minerals

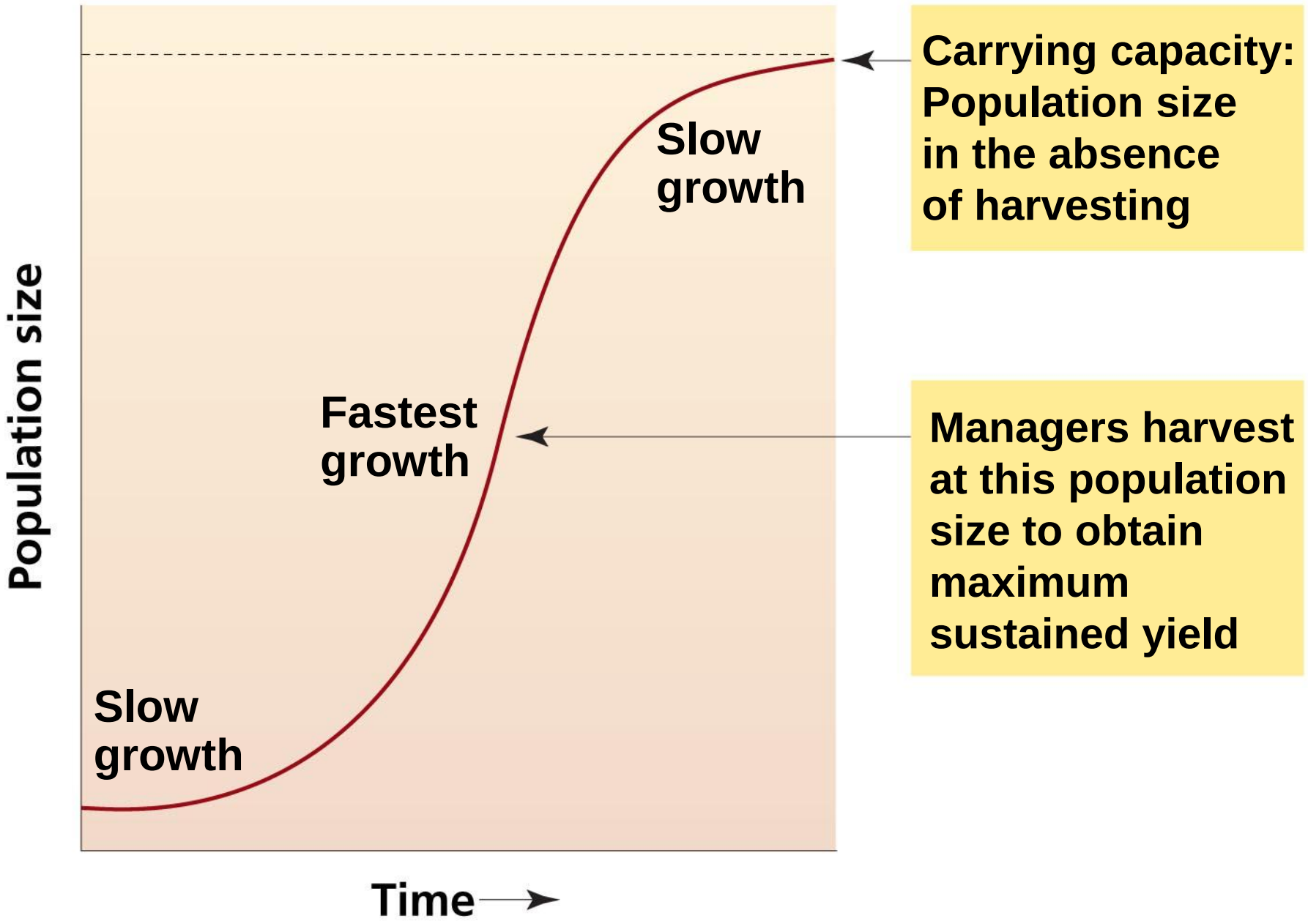
Principles of resource management

- The aim of **maximum sustainable yield** is to extract the maximum amount of the resource without depleting it.
- **Ecosystem-based management** attempts to minimize impact on ecosystems and ecological processes.
- **Adaptive management** involves testing and refining different management approaches.

Maximum sustainable yield

Achieving maximum sustainable yield involves harvesting a maximum but sustainable amount of the resource.

LE 9-10



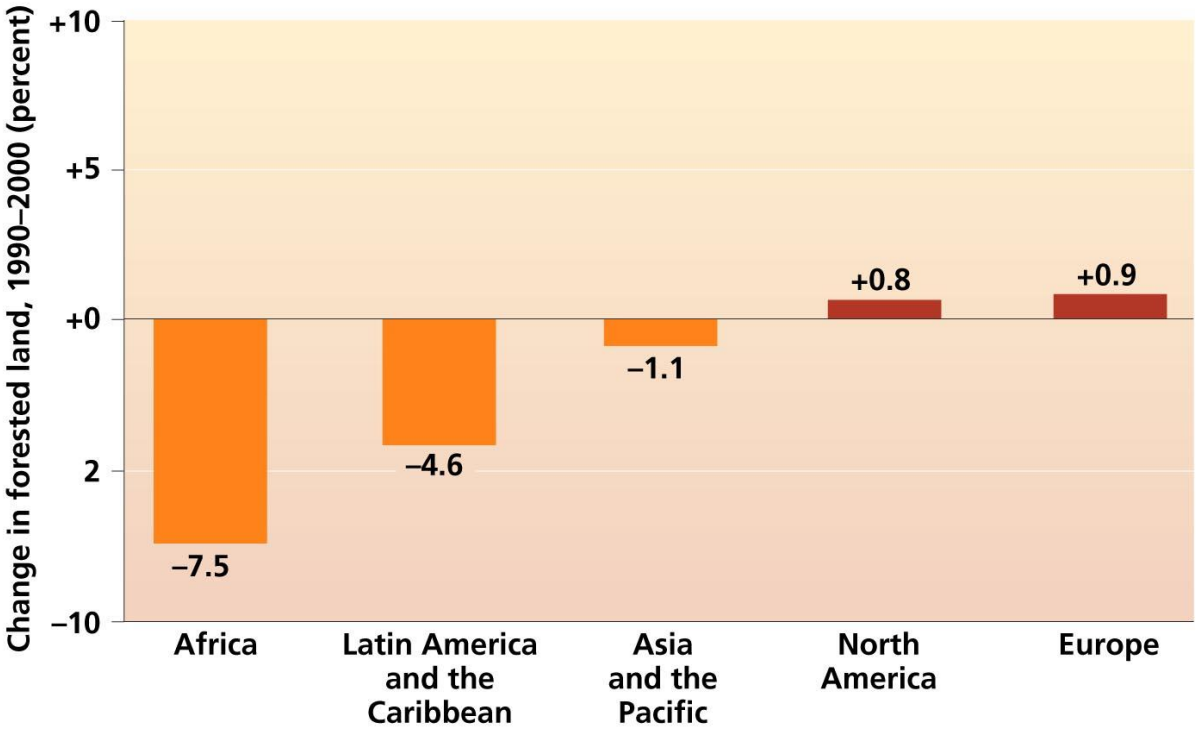
Forest management

- Through the practice of **forestry,** managers must balance the importance of forests as ecosystems with demand for wood products.

- Forests are ecologically and economically valuable.

Forests and deforestation

Demand for wood products, and for open land for agriculture, has led to **deforestation,** the clearing and loss of forests, throughout the world.



Africa and Latin America are losing their forests most quickly.

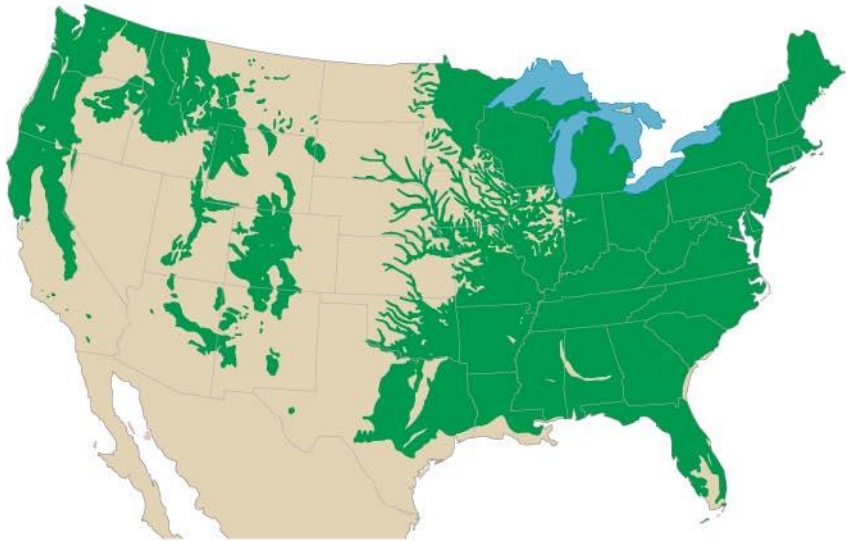
Forests are starting to grow back in North America and Europe after centuries of deforestation.

Deforestation in North America

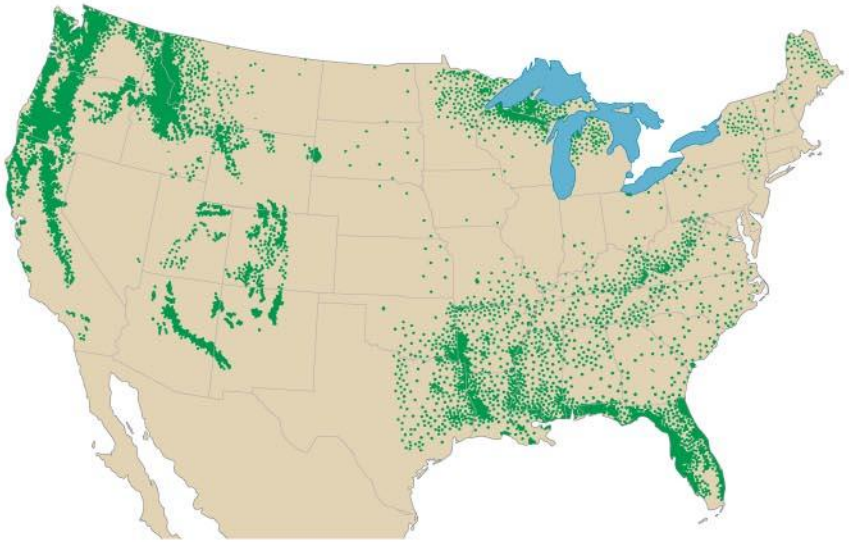
Over three centuries, Americans denuded most of their forests (green).

Even in the green areas mapped, very few large virgin trees remained; nearly all forests are second growth.

LE 9-12



(a) Areas of natural forest, 1620



(b) Areas of natural forest, 1920

Deforestation in developing countries

- Some uncut tropical forests still remain in many developing countries, such as Brazil and Indonesia.
- Advanced technologies have enabled these countries to exploit these resources even more quickly.
- Often their timber is extracted by foreign companies that pay government fees, or a **concession,** to cut down trees. There is often little or no incentive to manage forest resources sustainably.

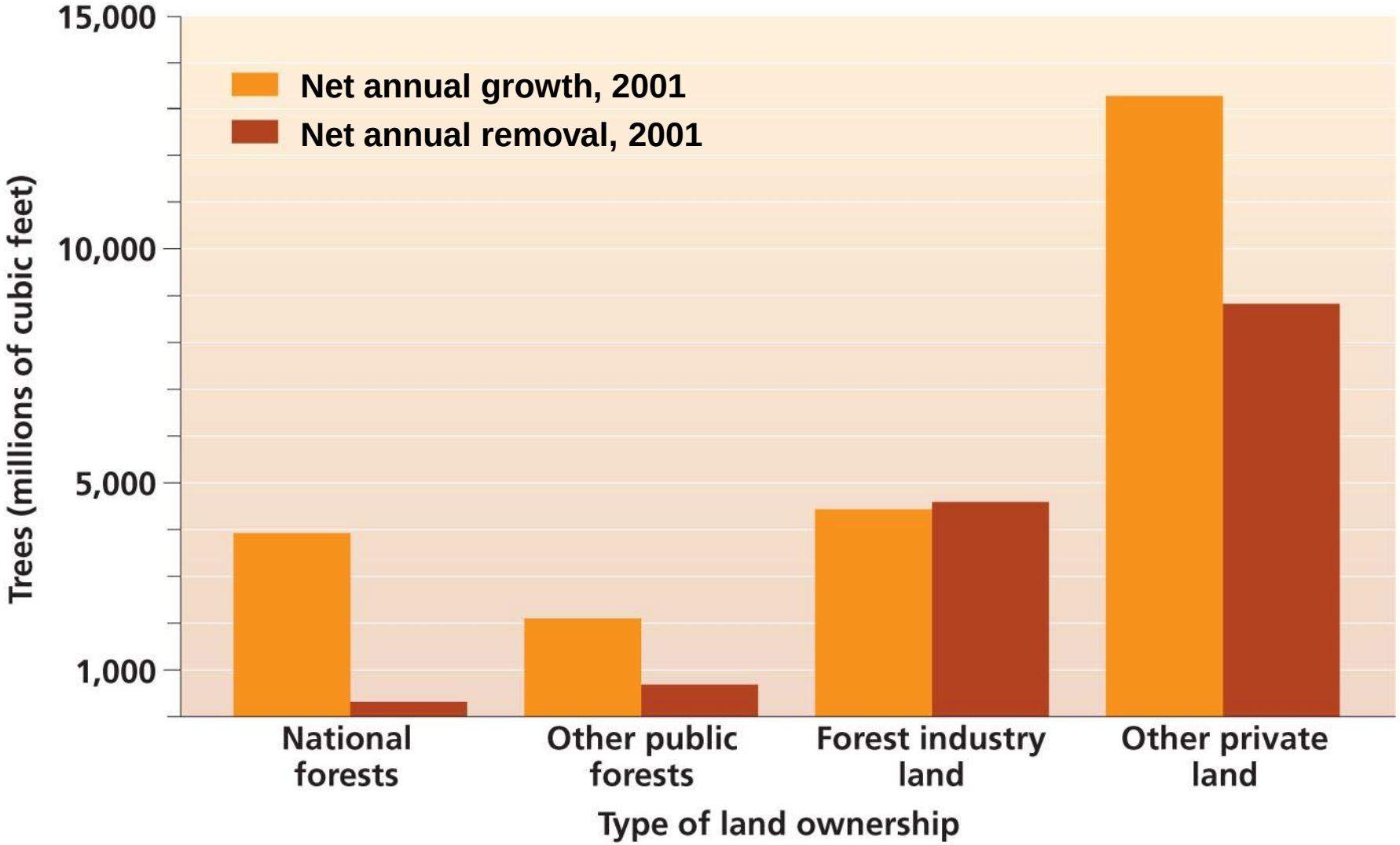
Timber harvesting

- Most timber harvesting in the United States takes place on private land, especially land owned by timber companies.
- But much timber harvesting takes place on public land—**national forests.**
- The U.S. National Forest system was established at the turn of the last century, and the Forest Service manages forests for sustainable timber yield, and, increasingly, recreation and ecosystem health.

Growth and removal of timber

Forests are growing back faster than they are being cut on all types of land except timber company land.

LE 9-14

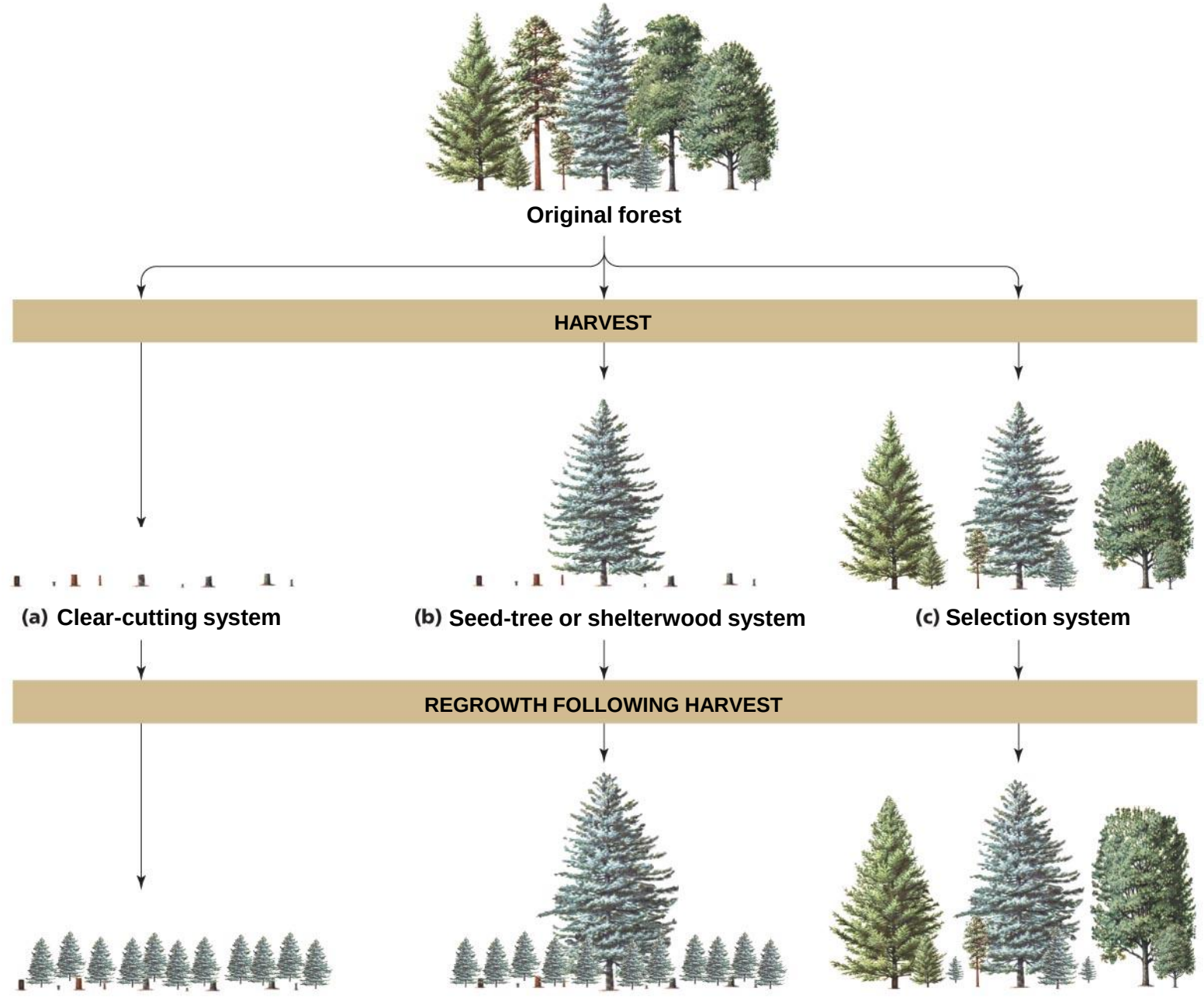


Methods of logging

Methods of logging

- *Clear-cutting* = all trees cut, leaving only stumps; most cost-efficient, but most environmentally damaging
- *Even-aged* = cutting farmed, single-species stands after a certain number of years
- *Uneven-aged stands* = some harvesting methods aim to maintain a mix of ages and tree species, making the stand more similar to a natural forest

LE 9-16



Managing forests

- Forest management is guided by **multiple use** policy, for recreation, wildlife habitat, mineral extraction, and so forth.
- The **National Forest Management Act** mandated plans for renewable resource management for all national forests.
- Timber harvesting has been brought more in line with ecosystem-based management goals.

Management for forest fires

- Fire is a natural phenomenon that can renew forests.
- But decades of human fire suppression allowed lots of combustible debris to accumulate in forests.
- So when fires occur, they often are damaging.

Management for forest fires

- Foresters have used **prescribed** or **controlled burns** to reduce fuel loads and restore ecosystems.
- **Salvage logging** is the removal of dead trees, or *snags*, following a natural disturbance.
- Economically, salvage logging may seem to make sense.
- But ecologically, snags have immense value as food sources and habitat, and salvage logging damages soils.

Sustainable forestry

- Several organizations provide **sustainable forestry certification** to products using approved methods.

- Consumer demand for sustainable wood has been high, and many businesses now sell sustainable wood.

Why create parks, reserves, and wildlands?

Why set aside land and voluntarily refrain from developing and exploiting its resources?

- To protect enormous, beautiful, unusual landscape features (*monumentalism*)
- For recreational use for outdoor activities
- For utilitarian benefits (e.g., watershed protection for drinking supply)
- To make use of sites that have little economic value otherwise
- To preserve biodiversity

Why create parks, reserves, and wildlands?

"Monumentalism":

- 19th-century landscape painters raised great interest in the American West's scenery—and its new national parks.
- Here, Bridalveil Falls in Yosemite, by Albert Bierstadt

U.S. national parks

- 1872—Yellowstone National Park becomes the world's first national park: "a public park or pleasuring-ground for the benefit and enjoyment of the people."
- Today, the U.S. national park system includes 388 sites and receives 277 million visits each year.
- It is managed by the National Park Service.

U.S. national wildlife refuges

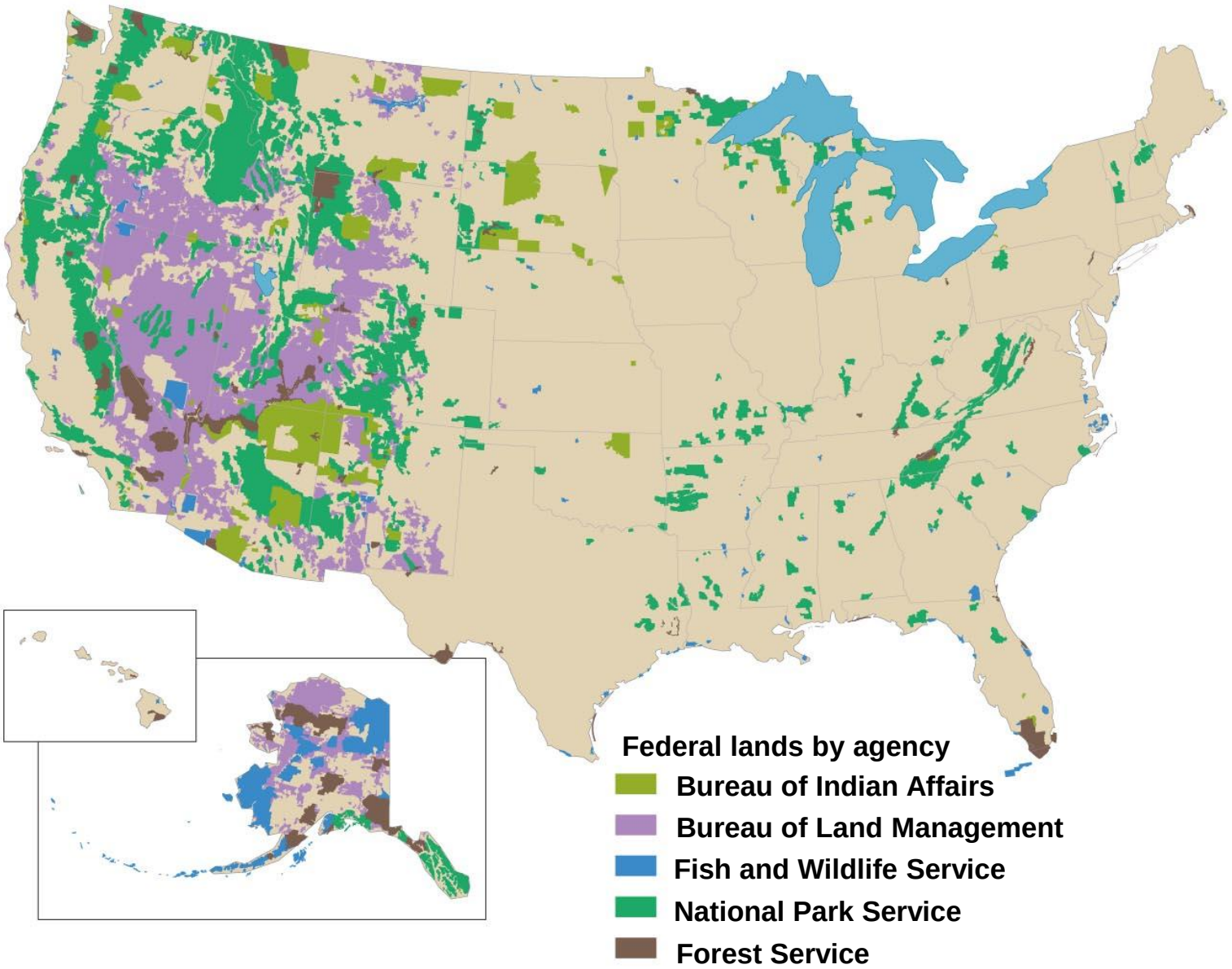
- 1903—President Theodore Roosevelt begins system of **national wildlife refuges.**
- Today, 541 sites are managed by the Fish and Wildlife Service: *"from preservation to active manipulation of habitats and populations."*
- Hunting, fishing, and other recreation are allowed; policies vary from refuge to refuge.

Wilderness areas

- 1964—Congress passes Wilderness Act
- **Wilderness areas** can be designated within existing federal lands.
- They are open to public recreation but not exploitative development.

Map of publicly owned federal lands

LE 9-13



Opposition to land set-asides

- Restriction of activities in wilderness areas has generated opposition from some quarters.

- State governments of Western states would like to have control over more land within their borders.
    - *Nevada = 80% of land federally owned*
    - *ID, OR, UT = 50%+ of land federally owned*

Opposition to land set-asides

Wise-use movement = loose confederation of individuals and industries that extract resources, who oppose advances of environmental advocacy, and:

- Want to protect private property rights
- Oppose government regulation
- Want federal lands transferred to state, local, or private hands
- Want more motorized vehicle recreation on public lands

Land trusts

In addition to federal and state governments, private nonprofit groups called **land trusts** also set aside land for protection from development.

- Local or regional organizations
- 900 in United States own 437,000 acres and have helped preserve an additional 2.3 million acres

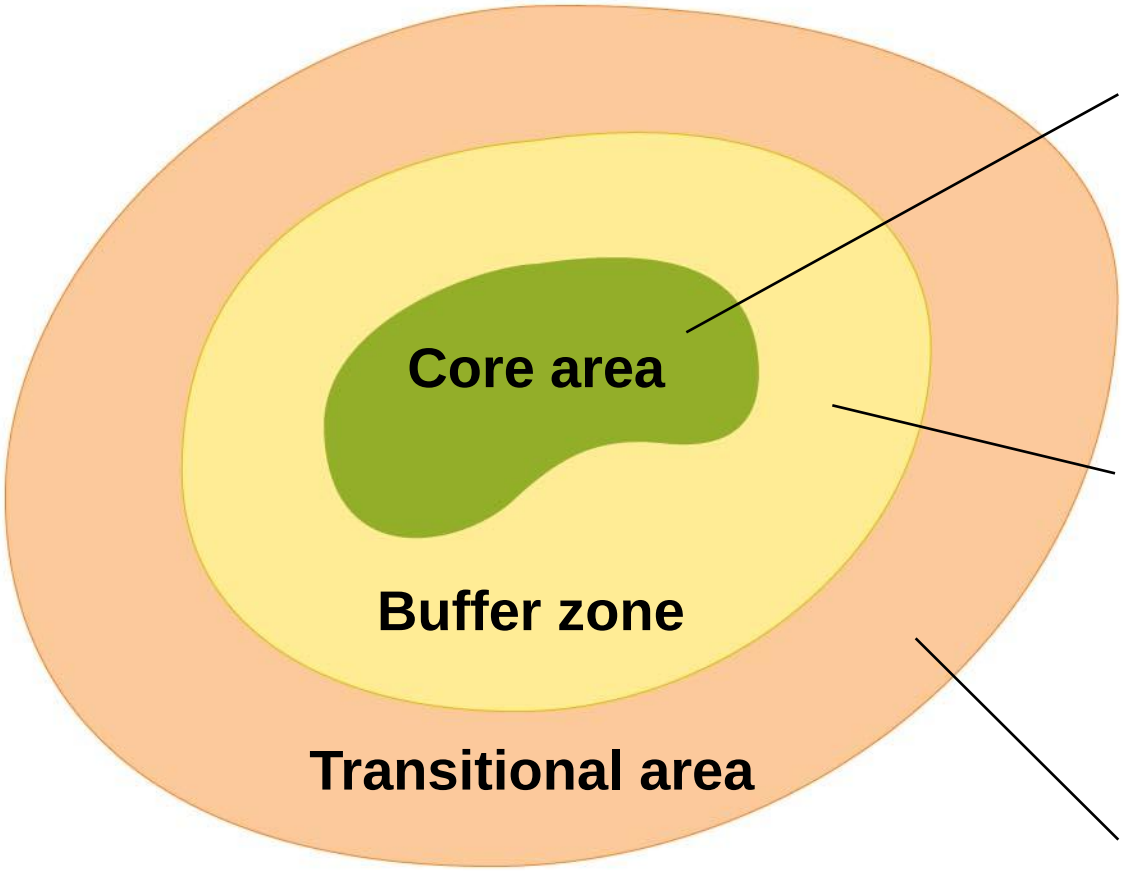
International parks and reserves

- Protected areas have been growing fast in many countries.
- The world now has 38,536 protected areas, covering 9.6% of the planet's land surface.
- But many of these are "*paper parks*"—protected on paper but subject to illegal exploitation because of lack of funding for enforcement.

International parks and reserves

Biosphere reserves that straddle international boundaries consist of three zones, combining preservation with sustainable development.

LE 9-18



Biodiversity preservation

Local activities and limited development such as research, education, and tourism

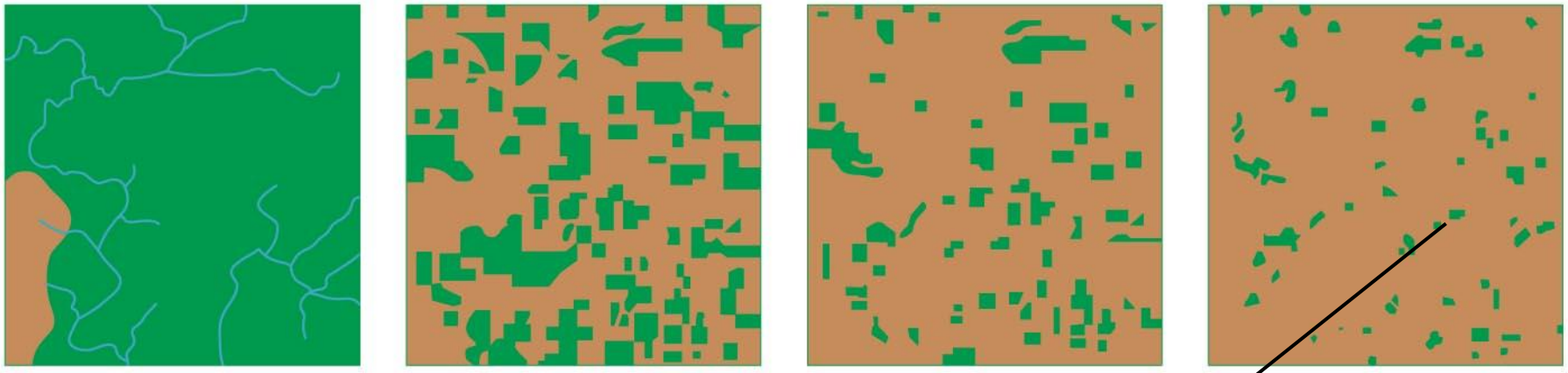
Sustainable agriculture, human settlements, and other land uses

Design of protected areas

How parks and reserves are designed has consequences.

Recall how habitat is fragmented by development:

LE 9-19c



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

Forest fragmentation *at Mt. Hood N.F., Oregon, and in Cadiz Township, Wisconsin, 1831–1950.*

LE 9-19a

(a) Clear-cuts in Mount Hood National Forest, Oregon

Design of protected areas

- Questions for reserve design:
  - What is better for biota: single large or several small ("**SLOSS**")?
  - How important are **corridors** for wildlife to travel from one reserve to another?

These are key issues in conservation biology.

Conclusion

- Environmental impacts of urban dwellers are less direct but more far-reaching than those of rural dwellers.
- Resources must be delivered over long distances, requiring the use of still more resources.
- Cities are developing solutions to promote sustainability.
- While smart growth and new urbanism provide solutions to sprawl, free-market theorists resist government involvement in influencing land-use choices.

Conclusion, *continued*

- On the lands beyond our cities, prudent resource management will be essential.
- Public forests today are managed for timber, recreation, wildlife habitat, and ecosystem integrity.
- Public support has resulted in parks and other reserves in North America and abroad.

QUESTION: Testing Your Comprehension

Which of the following is NOT considered an impact of urban growth boundaries?

a. Increased housing costs

b. Reduced infrastructure costs

c. Farmland preservation

d. Relocation of businesses outside of cities

QUESTION: Testing Your Comprehension

Which of the following is NOT considered an impact of urban growth boundaries?

d. Relocation of businesses outside of cities

QUESTION: Testing Your Comprehension

Which is NOT something modern city planners might do to make a city more livable?

a. Develop a new light rail line

b. Encourage neighborhood shops and restaurants

c. Eliminate bicycle lanes on city streets

d. Revise zoning codes to limit sprawl

e. Create a new city park in place of an abandoned warehouse

QUESTION: Testing Your Comprehension

Which is NOT something modern city planners might do to make a city more livable?

c. Eliminate bicycle lanes on city streets

QUESTION: Testing Your Comprehension

The U.S. Forest Service…?

a. Burns forests to restore ecosystems

b. Helps put out fires that threaten homes

c. Builds roads used to log forests

d. Manages the national forest system

e. Does all of the above

QUESTION: Testing Your Comprehension

The U.S. Forest Service…?

e. Does all of the above

QUESTION: Testing Your Comprehension

Which is NOT a reason national parks were created?

a. For outdoor recreation

b. To protect beautiful and unusual natural features

c. To provide timber products

d. To preserve biodiversity

QUESTION: Testing Your Comprehension

Which is NOT a reason national parks were created?

c. To provide timber products

QUESTION: Testing Your Comprehension

A supporter of the wise use movement would…?

a. Want to see a beautiful mountain range in Utah made into a wilderness area

b. Want to open Yellowstone National Park to unrestricted snowmobile use

c. Oppose a mining project to exploit a newly discovered silver deposit in Nevada

d. Want federal officials to crack down on private landholders in Wyoming violating the Endangered Species Act

QUESTION: Testing Your Comprehension

A supporter of the wise use movement would…?

b. Want to open Yellowstone National Park to unrestricted snowmobile use

QUESTION: Seeking Solutions

Would you personally live in a neighborhood developed in the style of the new urbanism? Would you like to live in a city or region with an urban growth boundary? Why or why not?

QUESTION: Seeking Solutions

Environmentalists in developed countries are fond of warning people in developing countries to stop destroying rainforest. Leaders of developing countries often respond that this is hypocritical, as developed nations deforested their lands in the past and became wealthy along the way. What would you say to the president of a developing country that is clearing its forest for economic development?

QUESTION: Viewpoints

Is sprawl a problem?

a. Yes; it degrades quality of life, and we should take all actions necessary to slow or stop it.

b. It causes problems but is difficult to deal with because it results from the choices individual people make about where and how to live.

c. No; it reflects people's choices and therefore is not a problem.