

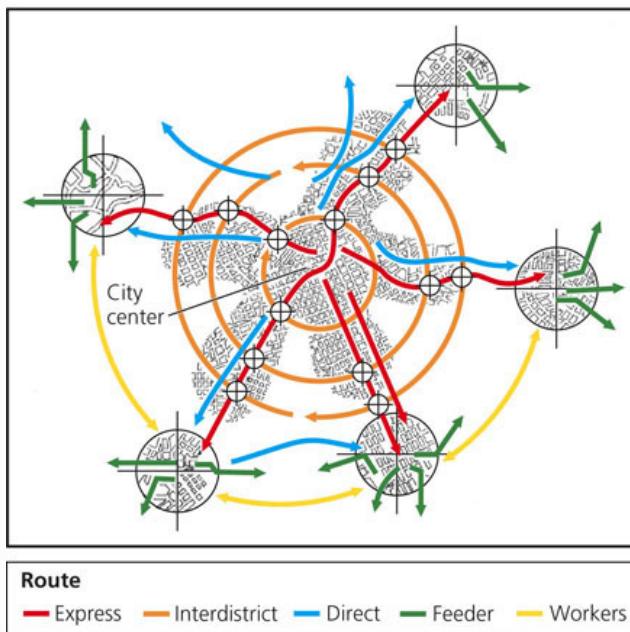
Sustainable Cities

Chapter 22

Core Case Study: The Ecocity Concept in Curitiba, Brazil

- **Ecocity, green city:** Curitiba, Brazil
 - Bus system: cars banned in certain areas
 - Housing and industrial parks
 - Recycling of materials
 - Helping the poor
 - New challenges
-

Solutions: Bus Rapid Transit System in Curitiba, Brazil



22-1 What Are the Major Population Trends in Urban Areas?

- **Concept 22-1** *Urbanization continues to increase steadily and the numbers and sizes of urban areas are growing rapidly, especially in developing countries.*



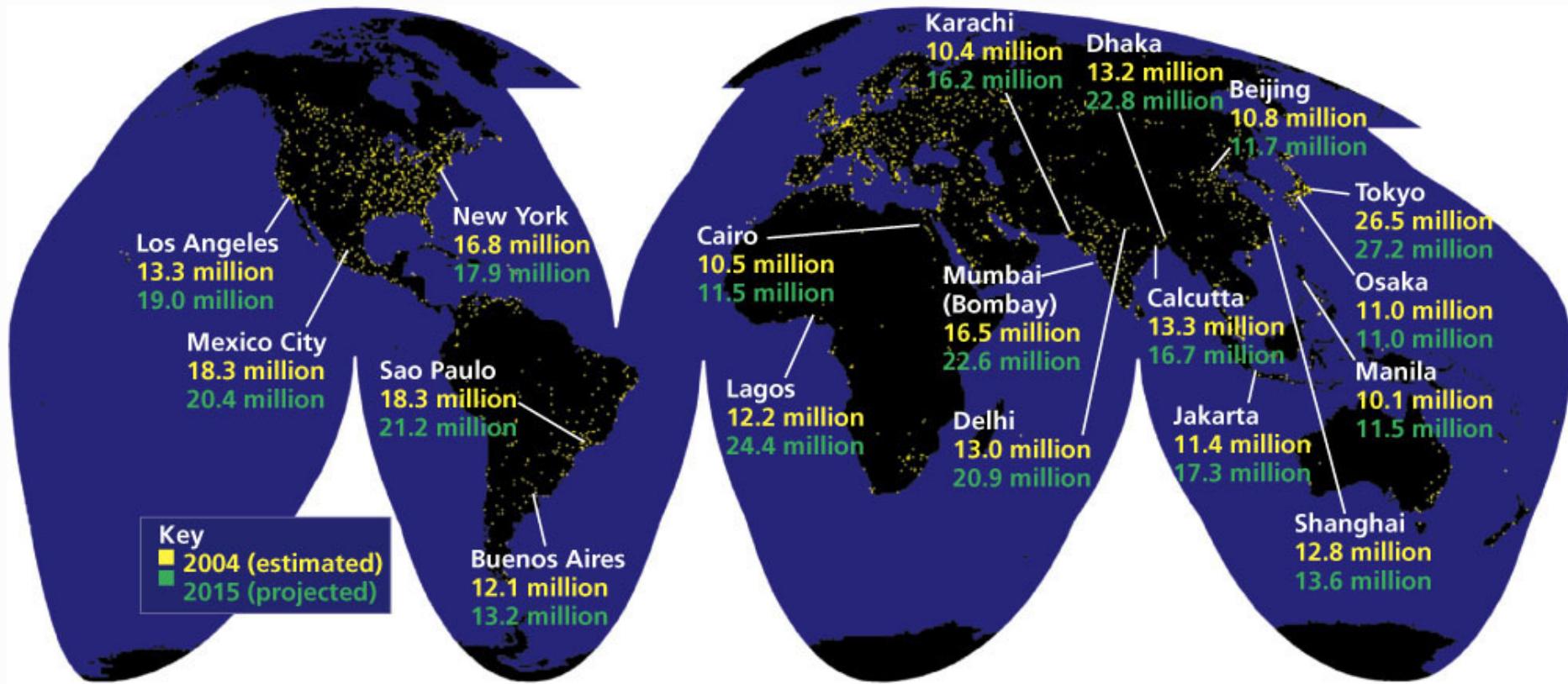
Half of the World's People Live in Urban Areas (1)

- **Urbanization**
 - **Urban growth**
 - Natural increase
 - Immigration from rural areas
 - Pushed from rural areas to urban areas
 - Pulled to urban areas from rural areas
-

Half of the World's People Live in Urban Areas (2)

- Four major trends
 - Proportion of global population living in urban areas is increasing
 - Number and size of urban areas is mushrooming
 - **Megacities, hypercities**
 - Urban growth slower in developed countries
 - Poverty is becoming increasingly urbanized; mostly in developing countries
-

Global Outlook: Satellite Image of Major Urban Areas Throughout the World



Typical Daily Traffic Jam of People, Carts, and Other Vehicles in Delhi, India



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Case Study: Urbanization in the United States (1)

- Four phases between 1800 and 2008
 - Migration from rural areas to large central cities
 - Migration from large central cities to suburbs and smaller cities
 - Migration from North and East to South and West
 - Migration from cities and suburbs to developed rural areas
-

Case Study: Urbanization in the United States (2)

- Environmental problems decreasing
- Older cities
 - Deteriorating services
 - Aging **infrastructures**



Major Urban Areas in the United States Revealed by Satellite Images at Night



Urban Sprawl Gobbles Up the Countryside (1)

- **Urban sprawl**
 - Contributing factors to urban sprawl in the U.S.
 - Ample land
 - Federal government loans
 - Low-cost gasoline; highways
 - Tax laws encouraged home ownership
 - State and local zoning laws
 - Multiple political jurisdictions: poor urban planning
-

Urban Sprawl Gobbles Up the Countryside (2)

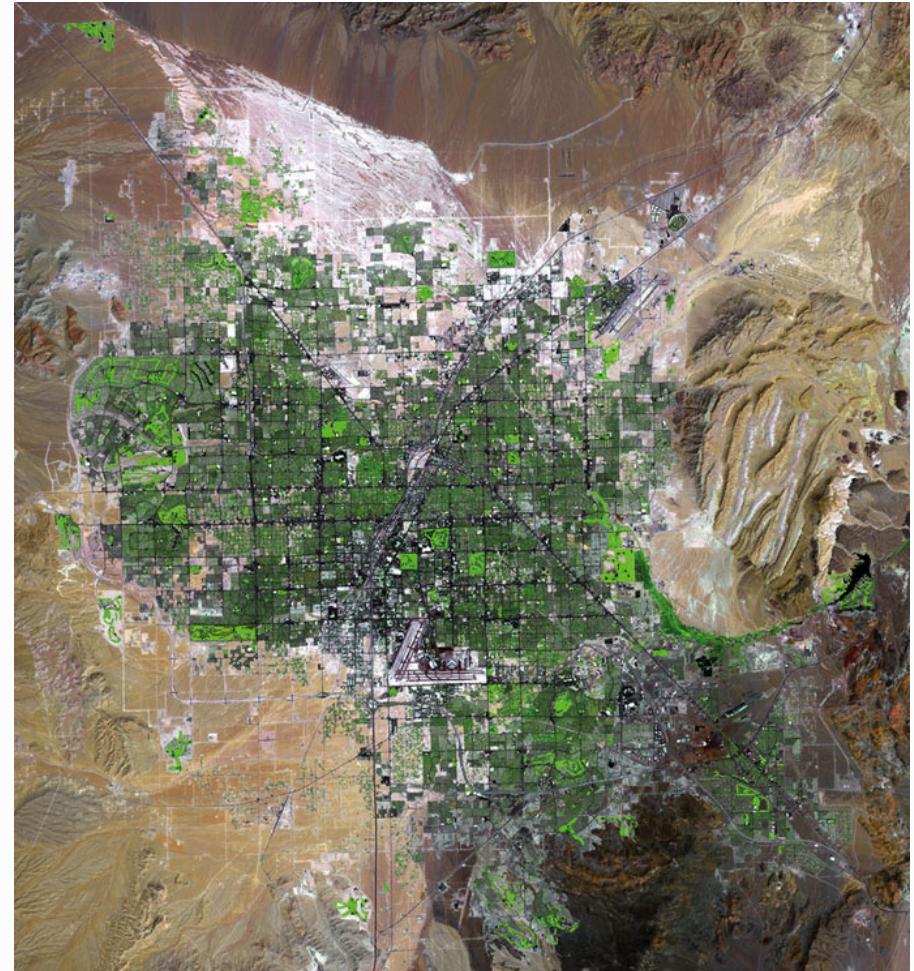
- Effects of urban sprawl
- **Megalopolis**
 - Bowash



Urban Sprawl in and around the U.S. City of Las Vegas, Nevada, from 1973 to 2000



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Natural Capital Degradation: Urban Sprawl

NATURAL CAPITAL DEGRADATION

Urban Sprawl

			
Land and Biodiversity	Water	Energy, Air, and Climate	Economic Effects
Loss of cropland	Increased use of surface water and groundwater	Increased energy use and waste	Decline of downtown business districts
Loss of forests and grasslands	Increased runoff and flooding	Increased air pollution	Increased unemployment in central city
Loss of wetlands	Increased surface water and groundwater pollution	Increased greenhouse gas emissions	Loss of tax base in central city
Loss and fragmentation of wildlife habitats	Decreased natural sewage treatment	Enhanced global warming	

NATURAL CAPITAL DEGRADATION

Urban Sprawl



Land and Biodiversity

- Loss of cropland
- Loss of forests and grasslands
- Loss of wetlands
- Loss and fragmentation of wildlife habitats



Water

- Increased use of surface water and groundwater
- Increased runoff and flooding
- Increased surface water and groundwater pollution
- Decreased natural sewage treatment



Energy, Air, and Climate

- Increased energy use and waste
- Increased air pollution
- Increased greenhouse gas emissions
- Enhanced global warming



Economic Effects

- Decline of downtown business districts
- Increased unemployment in central city
- Loss of tax base in central city

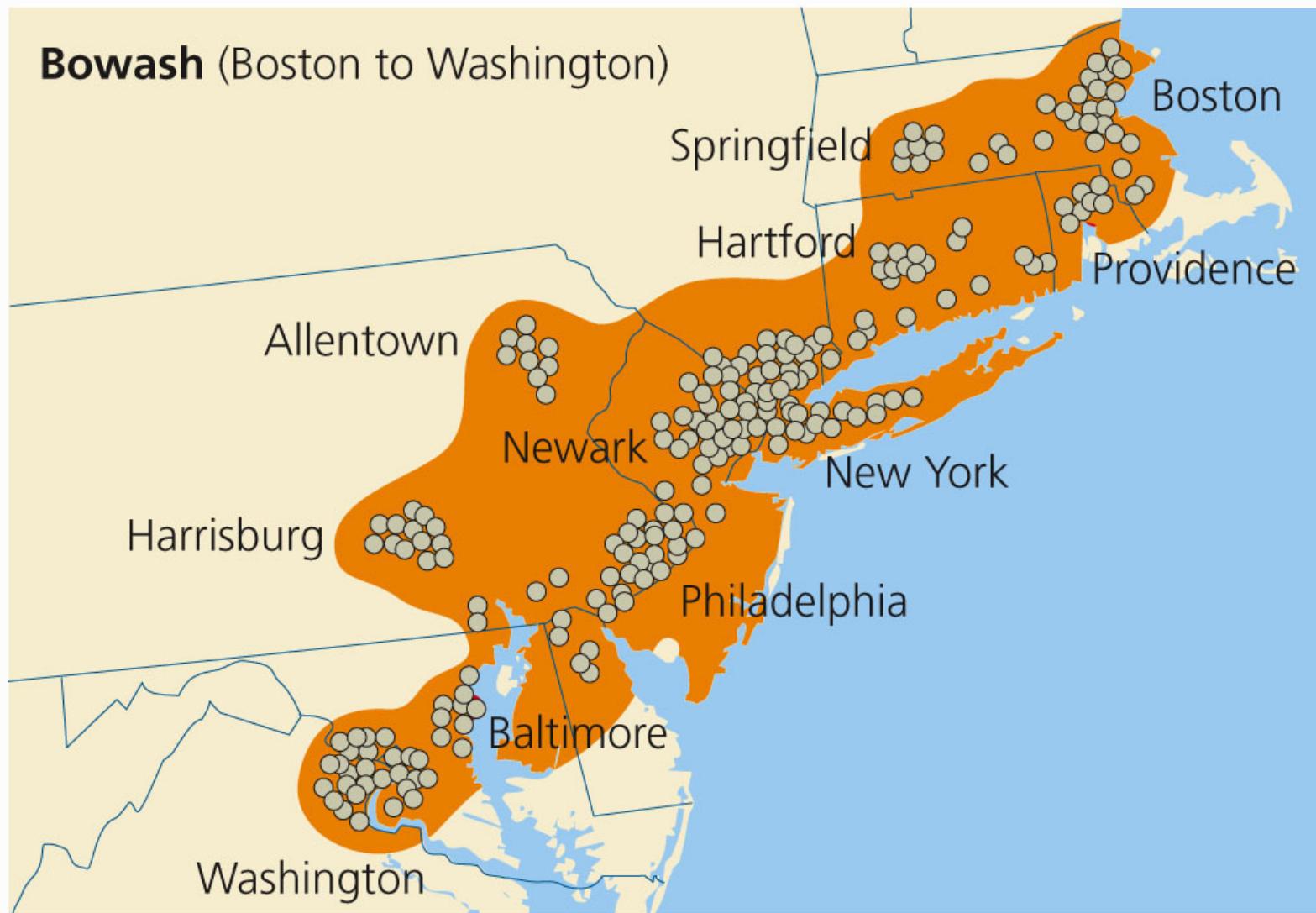
NATURAL CAPITAL DEGRADATION

Urban Sprawl

Stepped Art

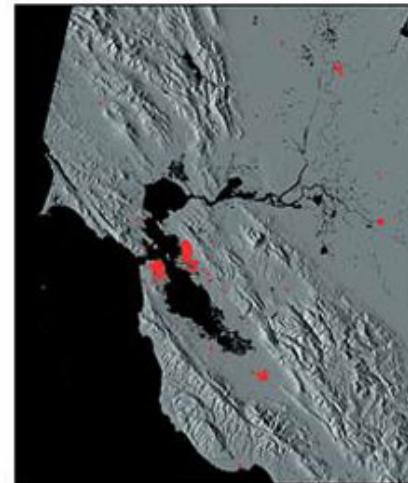
Fig. 22-6, p. 593

U.S. Megalopolis of Bowash



Animation: SF Bay region growth

1900
1940
1954
1962
1974
1990



▶ PLAY

22-2 What Are the Major Urban Resource and Environmental Problems?

- **Concept 22-2** Most cities are unsustainable because of high levels of resource use, waste, pollution, and poverty.



Urbanization Has Advantages

- Centers of:
 - Economic development
 - Innovation
 - Education
 - Technological advances
 - Jobs
 - Environmental advantages
-

Urbanization Has Disadvantages (1)

- Huge ecological footprints
 - Lack vegetation
 - Water problems
-

Urbanization Has Disadvantages (2)

- Concentrate pollution and health problems
 - Excessive noise
 - Different climate and experience light pollution
-

Natural Capital Degradation: Urban Areas Rarely Are Sustainable Systems



Inputs

Energy

Food

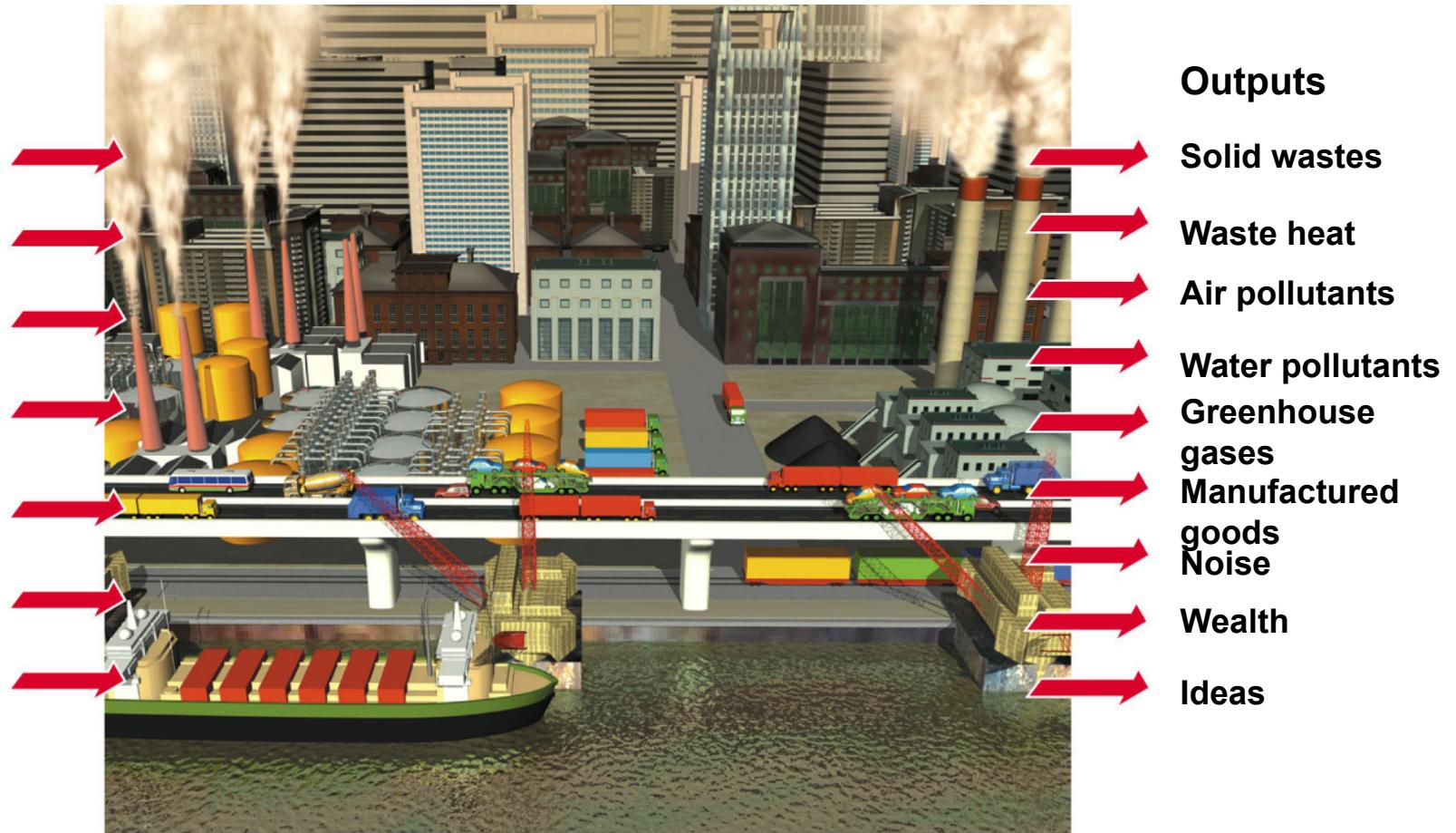
Water

Raw
materials

Manufactured
goods

Money

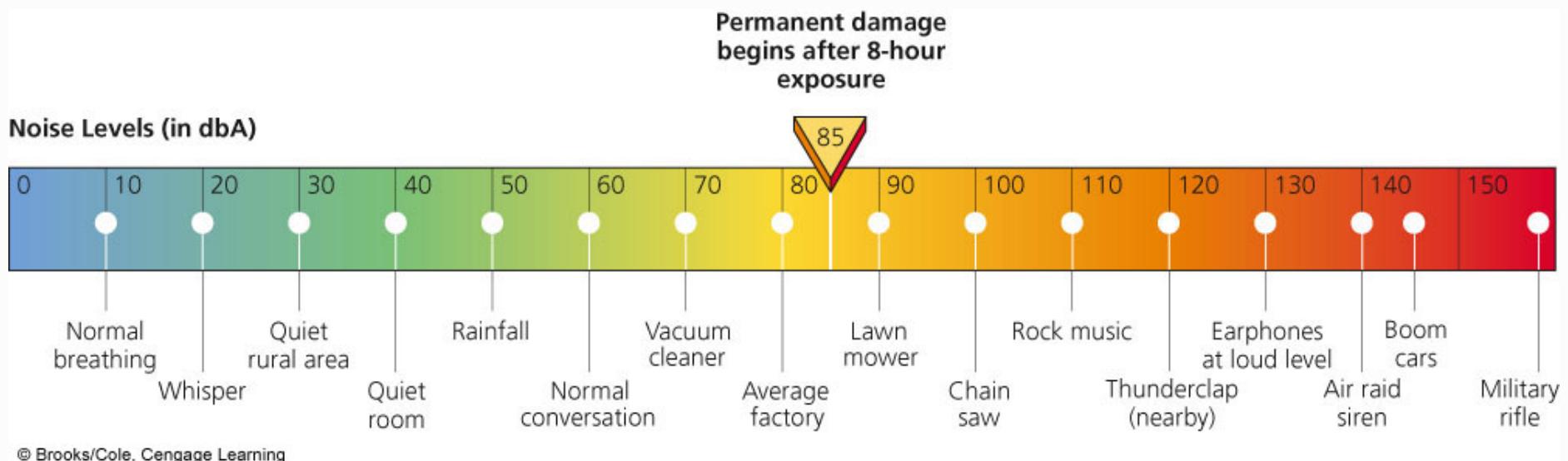
Information



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Fig. 22-8, p. 595

Noise Levels of Some Common Sounds



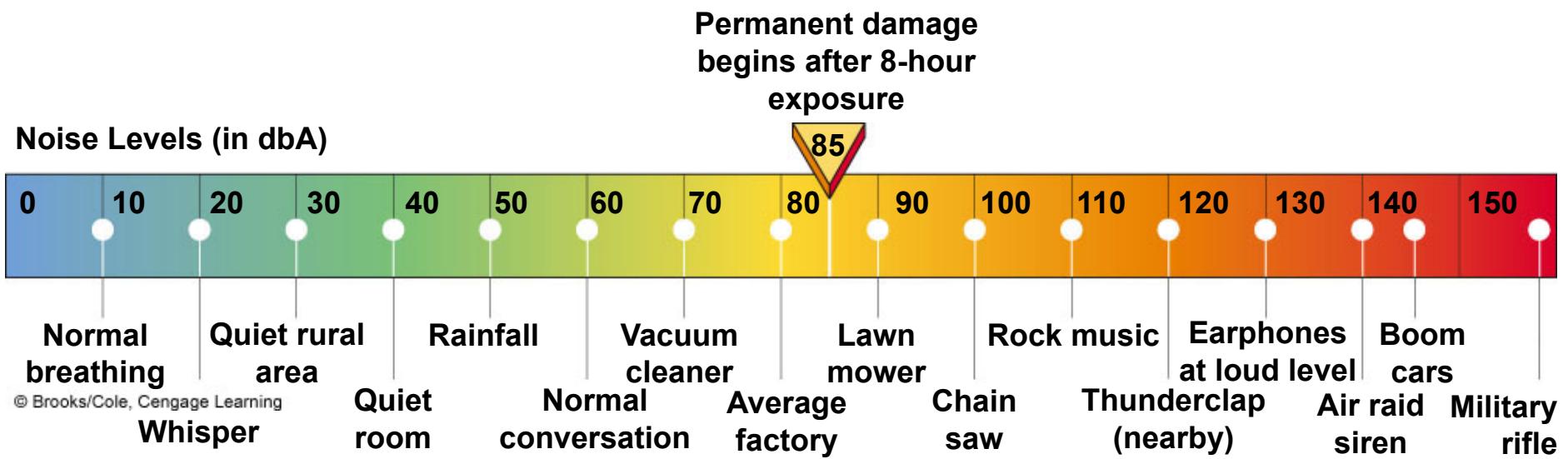
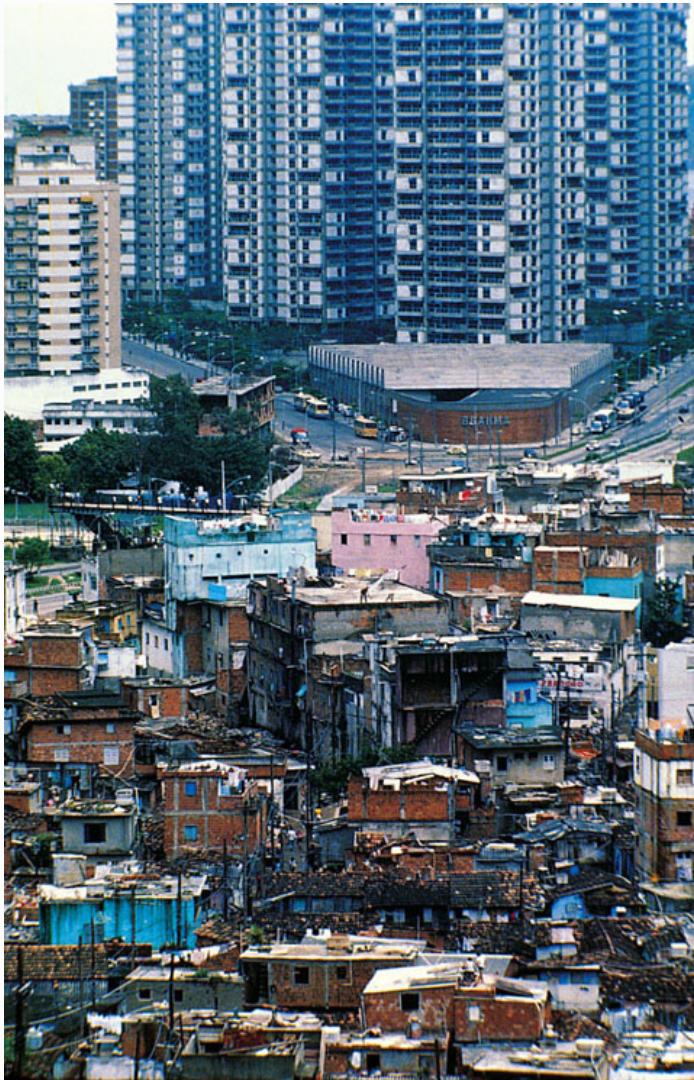


Fig. 22-9, p. 596

Life Is a Desperate Struggle for the Urban Poor in Developing Countries

- **Slums**
 - **Squatter settlements**
 - **Shantytowns**
 - Terrible living conditions
 - What can governments do to help?
-

Global Outlook: Extreme Poverty Forces Hundreds of Millions to Live in Slums



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Case Study: Mexico City

- Urban area in crisis
 - Severe air pollution
 - Water pollution
 - 50% Unemployment
 - Deafening noise
 - Overcrowding
 - Traffic congestion
 - Inadequate public transportation
 - 1/3 live in slums (**barrios**) or squatter settlements
 - What progress is being made?
-

22-3 How Does Transportation Affect Urban Environmental Impacts?

- **Concept 22-3** *A combination of plentiful land, inexpensive fuel, and expanding networks of highways in some countries has resulted in dispersed cities whose residents depend on motor vehicles for most transportation.*



Cities Can Grow Outward or Upward

- Compact cities
 - Hong Kong, China
 - Tokyo, Japan
 - Mass transit
- Dispersed cities
 - U.S. and Canada
 - Car-centered cities



Motor Vehicles Have Advantages and Disadvantages (1)

- Advantages
 - Mobility and convenience
 - Jobs in
 - Production and repair of vehicles
 - Supplying fuel
 - Building roads
 - Status symbol
-

Motor Vehicles Have Advantages and Disadvantages (2)

- **Disadvantages**

- Largest source of outdoor air pollution
- Accidents: death and injury
- Helped create urban sprawl
- Traffic congestion



Reducing Automobile Use Is Not Easy, but It Can Be Done (1)

- Full-cost pricing: high gasoline taxes
 - Difficult to pass in the United States
 - Strong public opposition
 - Mass transit: not an option in most cities
 - Dispersed nature of the U.S.
 - What about a tax shift?
-

Reducing Automobile Use Is Not Easy, but It Can Be Done (2)

- Raise parking fees
 - Tolls on roads, tunnels, and bridges into major cities
 - Car-sharing
 - Charge a fee to drive into a major city
 - It is working in some cities
-

Some Cities Are Promoting Alternatives to Car Ownership

- Bicycles
 - Heavy-rail systems
 - Light-rail systems
 - Buses
 - Rapid-rail system between urban areas
-

Trade-Offs: Bicycles, Advantages and Disadvantages

TRADE-OFFS

Bicycles

Advantages	Disadvantages
Affordable	Little protection in an accident
Produce no pollution	Do not protect riders from bad weather
Quiet	Impractical for long trips
Require little parking space	Can be tiring (except for electric bicycles)
Easy to maneuver in traffic	Lack of secure bike parking
Take few resources to make	



TRADE-OFFS

Bicycles

Advantages

Affordable

Produce no pollution

Quiet

Require little parking space

Easy to maneuver in traffic

Take few resources to make



Disadvantages

Little protection in an accident

Do not protect riders from bad weather

Impractical for long trips

Can be tiring (except for electric bicycles)

Lack of secure bike parking

Trade-Offs: Mass Transit Rail, Advantages and Disadvantages

TRADE-OFFS

Mass Transit Rail

Advantages	Disadvantages
Uses less energy and produces less air pollution than cars	Expensive to build and maintain
Requires less land than roads and parking areas for cars	Cost-effective only along a densely populated corridor
Causes fewer injuries and deaths than cars	Commits riders to transportation schedules
Reduces car congestion in cities	Can cause noise and vibration for nearby residents

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TRADE-OFFS

Mass Transit Rail

Advantages

Uses less energy and produces less air pollution than cars

Requires less land than roads and parking areas for cars

Causes fewer injuries and deaths than cars

Reduces car congestion in cities



Disadvantages

Expensive to build and maintain

Cost-effective only along a densely populated corridor

Commits riders to transportation schedules

Can cause noise and vibration for nearby residents



Trade-Offs: Buses, Advantages and Disadvantages

TRADE-OFFS

Buses

Advantages	Disadvantages
Can be rerouted as needed	Can lose money because they need low fares to attract riders
Cost less to develop and maintain than heavy-rail system	Can get caught in traffic and add to pollution
Can greatly reduce car use and air pollution	Commits riders to transportation schedules
	Noisy



TRADE-OFFS

Buses

Advantages

Can be rerouted
as needed

Cost less to develop
and maintain than
heavy-rail system

Can greatly reduce
car use and air
pollution



Disadvantages

Can lose money
because they need
low fares to attract
riders

Can get caught in
traffic and add to
pollution

Commits riders to
transportation
schedules

Noisy

Trade-Offs: Rapid Rail, Advantages and Disadvantages

TRADE-OFFS

Rapid Rail

Advantages	Disadvantages
Can reduce travel by car or plane	Expensive to run and maintain
Ideal for trips of 200–1,000 kilometers (120–620 miles)	Must operate along heavily used routes to be profitable
Much more energy efficient per rider than a car or plane	Causes noise and vibration for nearby residents



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TRADE-OFFS

Rapid Rail

Advantages

Can reduce travel by car or plane

Ideal for trips of 200–1,000 kilometers (120–620 miles)

Much more energy efficient per rider than a car or plane



Disadvantages

Expensive to run and maintain

Must operate along heavily used routes to be profitable

Causes noise and vibration for nearby residents

Potential Routes for High-Speed Bullet Trains in the U.S. and Parts of Canada



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Case Study: Destroying a Great Mass Transit System in the United States

- National City Lines
 - Purchased and dismantled streetcar systems
 - Sales of cars and buses increased
 - Guilty of conspiracy
-

22-4 How Important Is Urban Land Use Planning?

- ***Concept 22-4*** *Urban land-use planning can help to reduce uncontrolled sprawl and slow the resulting degradation of air, water, land, biodiversity, and other natural resources.*



Conventional Land-Use Planning

- **Land-use planning**
 - Encourages future population growth
 - Economic development
 - Revenues: property taxes
 - Environmental and social consequences

- **Zoning**
 - **Mixed-use zoning**



Smart Growth Works (1)

- **Smart growth**
 - Reduces dependence on cars
 - Controls and directs sprawl
 - Cuts wasteful resource



Smart Growth Works (2)

- U.S. cities
 - Portland, OR
 - San Francisco, CA
 - Curitiba, Brazil
 - China: stand on urban sprawl
 - Europe: compact cities
-

Solutions: Smart Growth Tools

SOLUTIONS

Smart Growth Tools

Limits and Regulations <ul style="list-style-type: none">Limit building permitsUrban growth boundariesGreenbelts around citiesPublic review of new development		Protection <ul style="list-style-type: none">Preserve existing open spaceBuy new open spaceBuy development rights that prohibit certain types of development on land parcels
Zoning <ul style="list-style-type: none">Encourage mixed use of housing and small businessesConcentrate development along mass transportation routesPromote high-density cluster housing developments		Taxes <ul style="list-style-type: none">Tax land, not buildingsTax land on value of actual use (such as forest and agriculture) instead of on highest value as developed land
Planning <ul style="list-style-type: none">Ecological land-use planningEnvironmental impact analysisIntegrated regional planningState and national planning		Tax Breaks <ul style="list-style-type: none">For owners agreeing not to allow certain types of development (conservation easements)For cleaning up and developing abandoned urban sites (brownfields)
		Revitalization and New Growth <ul style="list-style-type: none">Revitalize existing towns and citiesBuild well-planned new towns and villages within cities

SOLUTIONS

Smart Growth Tools

Limits and Regulations

Limit building permits

Urban growth boundaries

Greenbelts around cities

Public review of new development

Zoning

Encourage mixed use of housing and small businesses

Concentrate development along mass transportation routes

Promote high-density cluster housing developments

Planning

Ecological land-use planning

Environmental impact analysis

Integrated regional planning

State and national planning



Protection

Preserve existing open space

Buy new open space

Buy development rights that prohibit certain types of development on land parcels

Taxes

Tax land, not buildings

Tax land on value of actual use (such as forest and agriculture) instead of on highest value as developed land

Tax Breaks

For owners agreeing not to allow certain types of development (conservation easements)

For cleaning up and developing abandoned urban sites (brownfields)

Revitalization and New Growth

Revitalize existing towns and cities

Build well-planned new towns and villages within cities

SOLUTIONS

Smart Growth Tools

Limits and Regulations

Limit building permits

Urban growth boundaries

Greenbelts around cities

Public review of new development

Zoning

Encourage mixed use of housing and small businesses

Concentrate development along mass transportation routes

Promote high-density cluster housing developments

Planning

Ecological land-use planning

Environmental impact analysis

Integrated regional planning

State and national planning



Protection

Preserve existing open space

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Tax Breaks

For owners agreeing not to allow certain types of development (conservation easements)

For cleaning up and developing abandoned urban sites (brownfields)

Revitalization and New Growth

Revitalize existing towns and cities

Build well-planned new towns and villages within cities

Stepped Art

Preserving and Using Open Space

- **Urban growth boundary**
 - U.S. states: Washington, Oregon, and Tennessee
 - Municipal parks
 - U.S. cities: New York City and San Francisco
 - **Greenbelts**
 - Canadian cities: Vancouver and Toronto
 - Western European cities
-

Central Park, New York City, USA



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22-5 How Can Cities Become More Sustainable and Livable?

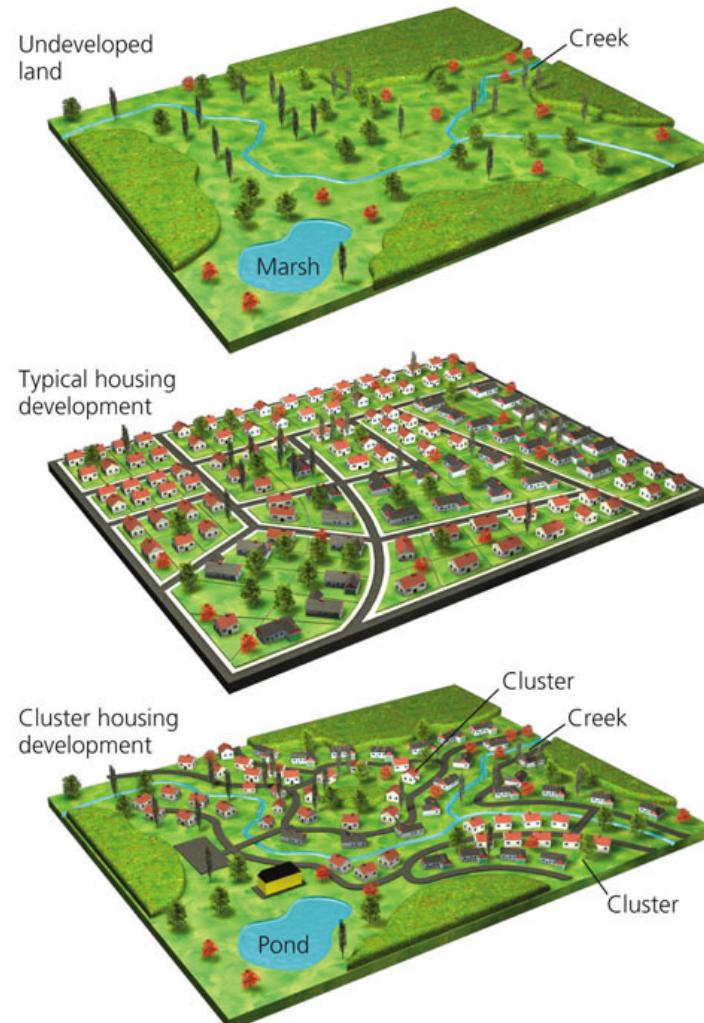
- **Concept 22-5** An ecocity allows people to: choose walking, biking, or mass transit for most transportation needs; recycle or reuse most of their wastes; grow much of their food; and protect biodiversity by preserving surrounding land.

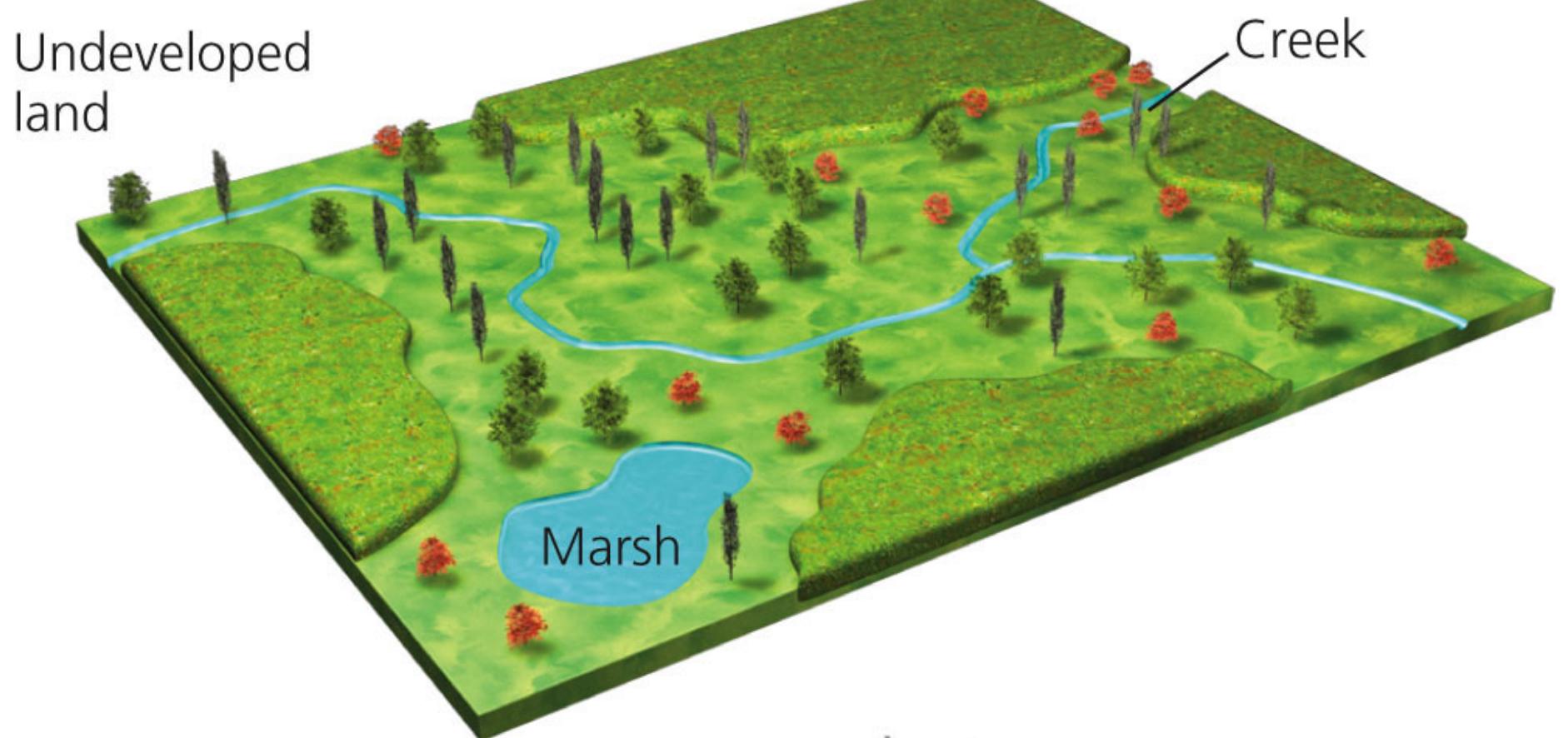


New Urbanism Is Growing

- Conventional housing development
 - **Cluster development**
 - **New urbanism, old villageism**
 - Walkability
 - Mixed-use and diversity
 - Quality urban design
 - Environmental sustainability
 - Smart transportation
-

Conventional and Cluster Housing Developments

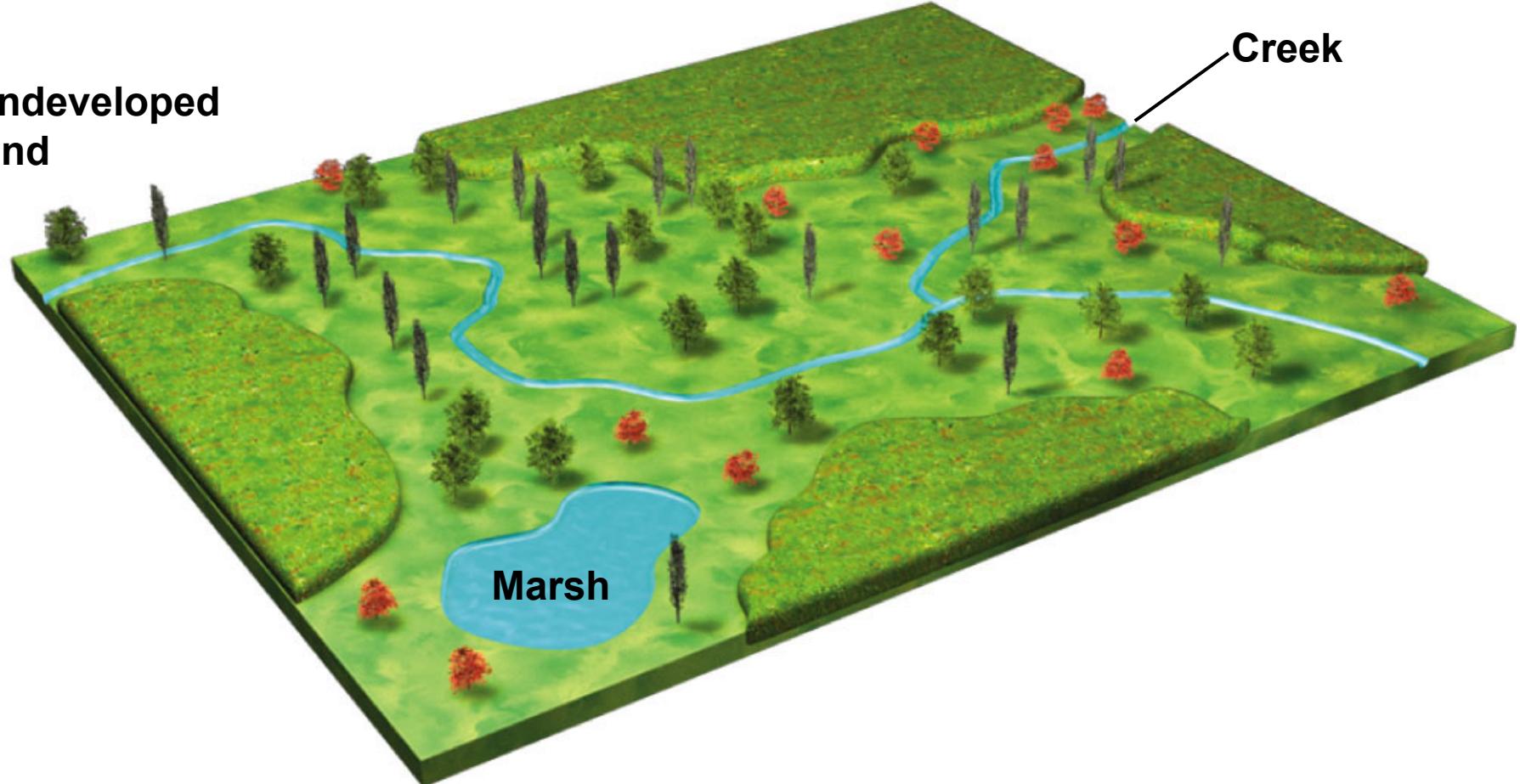




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Fig. 22-18a, p. 605

**Undeveloped
land**



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Fig. 22-18a, p. 605

Typical housing development



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Fig. 22-18b, p. 605

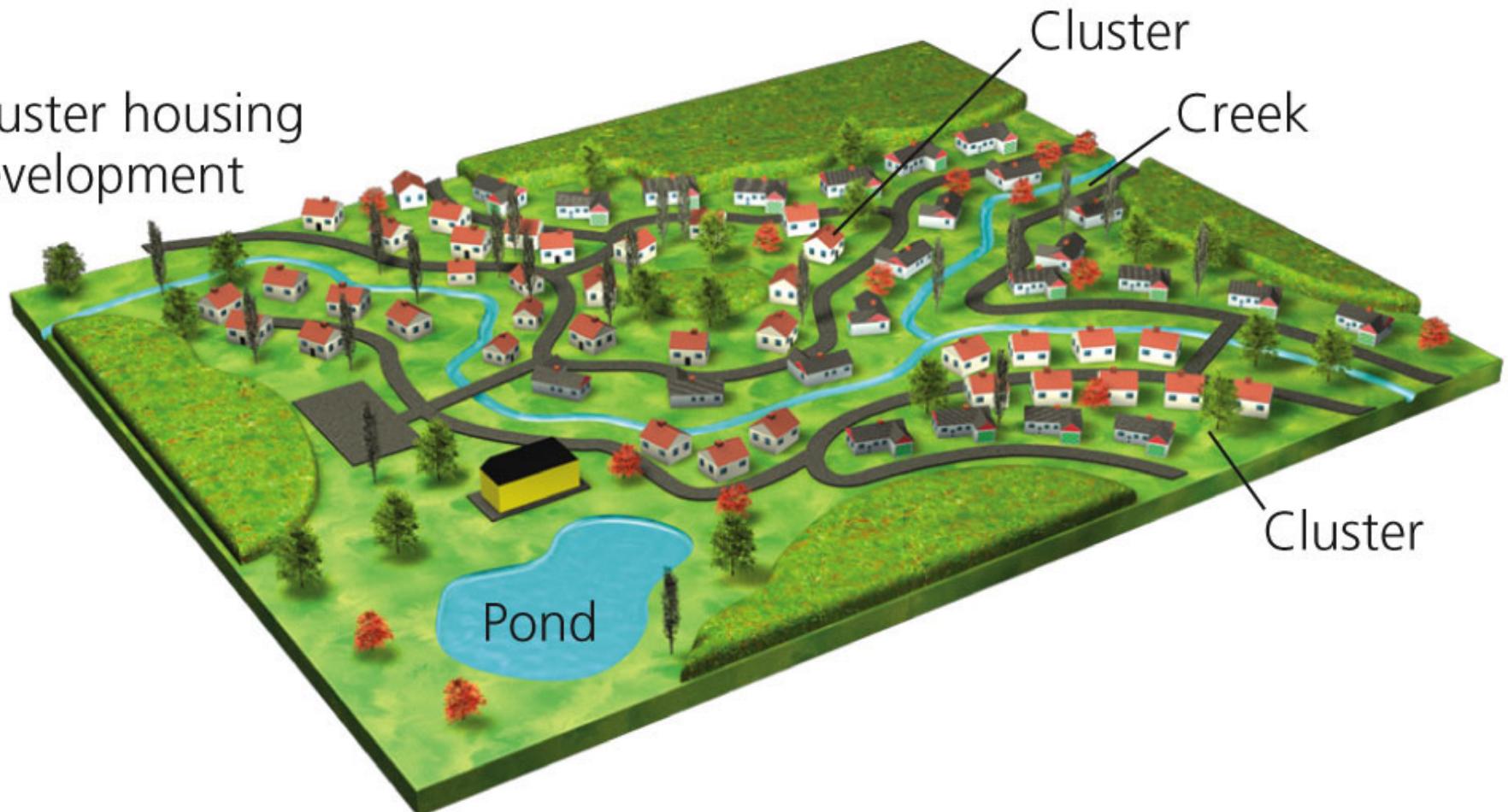
Typical housing development

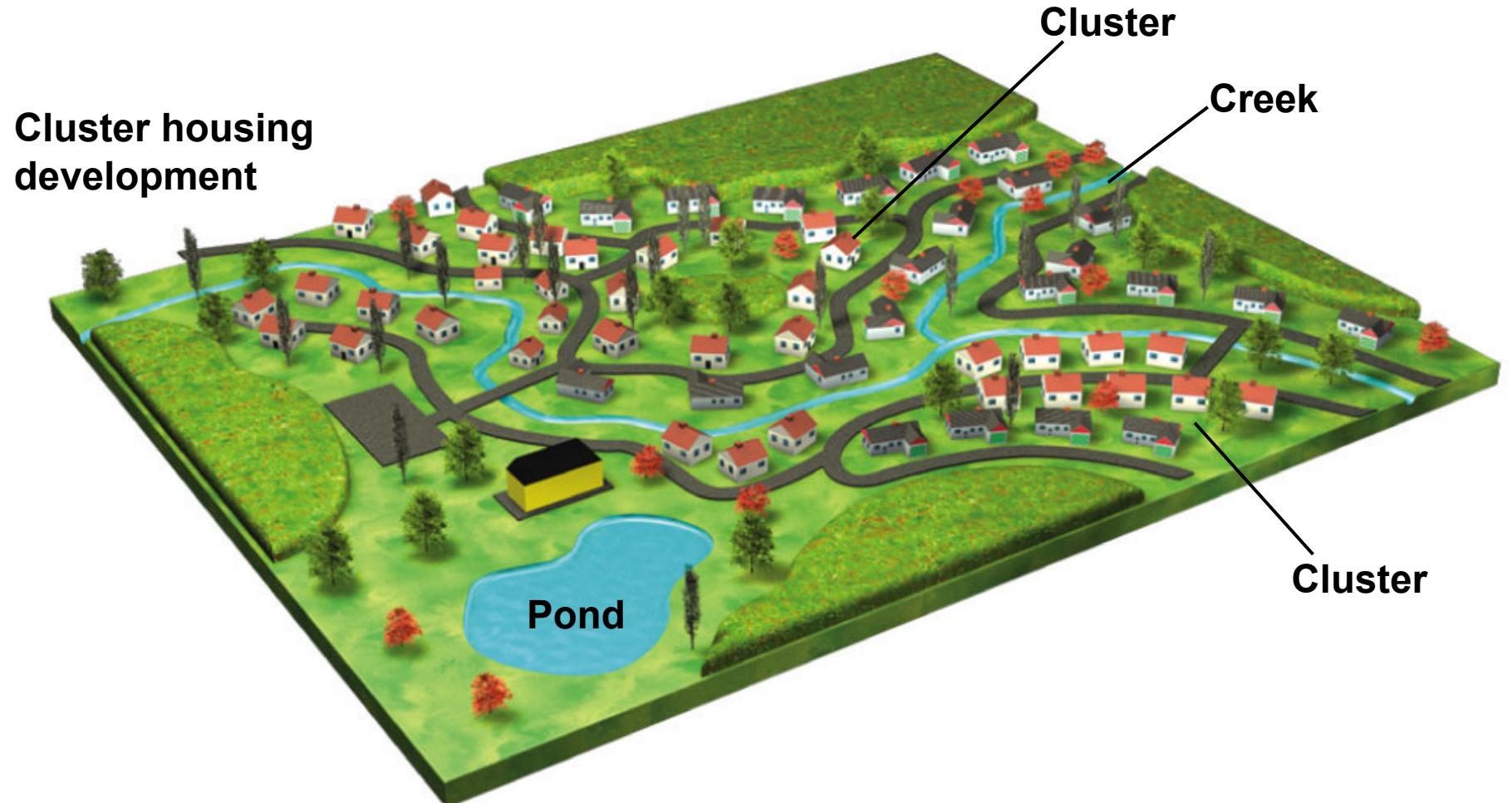


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Fig. 22-18b, p. 605

Cluster housing development





The Ecocity Concept: Cities for People Not Cars

- **Ecocities or green cities**
 - Build and redesign for people
 - Use renewable energy resources
 - Recycle and purify water
 - Use energy and matter resources efficiently
 - Prevent pollution and reduce waste
 - Recycle, reuse and compost municipal waste
 - Protect and support biodiversity
 - Urban gardens; farmers markets
 - Zoning and other tools for sustainability
-

Science Focus: Urban Indoor Farming

- Rooftop greenhouses
 - Sun Works: designs energy-efficient greenhouses
 - Hydroponic gardens
 - Skyscraper farms
 - Ecological advantages and disadvantages
-

Case Study: China's Vision for an Ecocity

- 2008: Dongtan, China, ecocity
 - Carbon neutral city: use renewable resources for energy
 - Reduce the need for cars, or use electric- or hydrogen-powered cars
 - Public transportation
-

The Ecovillage Movement Is Growing

- **Ecovillage movement**
 - Eco-hoods
 - 1993: ecovillage in Los Angeles, CA, U.S.
 - What is making it work?
 - Other ecovillages
 - Success stories
-