Lecture Outlines

Chapter 13

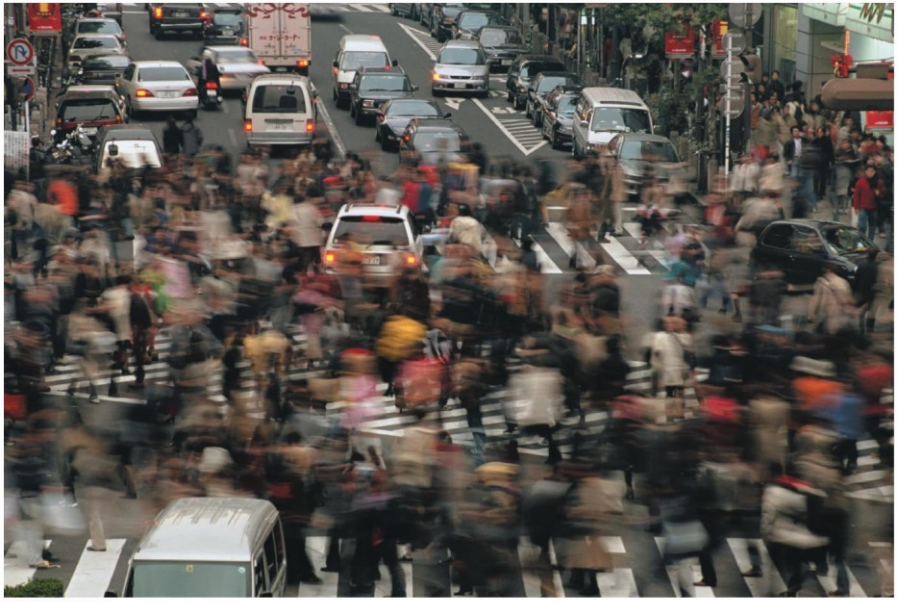
Environment: The Science behind the Stories

4th Edition

Withgott/Brennan

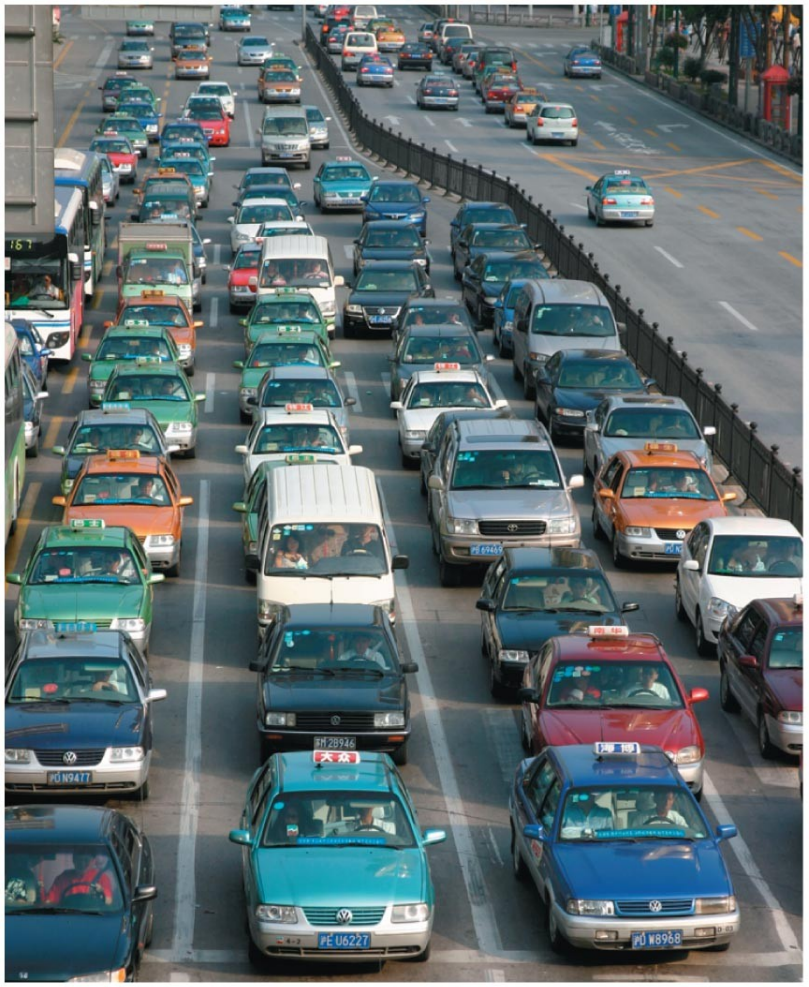
This lecture will help you understand:

- The scale of urbanization
- Urban and suburban sprawl
- Planning and land use strategies
- Transportation options
- The role of urban parks
- Impacts and advantages of urban centers
- Urban ecology, green building, sustainable cities



Central Case: Managing growth in Portland, Oregon

- Sprawling development can ruin communities
- **Urban Growth Boundaries** (**UGBs**) separate urban from rural areas
- UGBs are a key to quality of life, but critics say it's elitist
- Urban reserves will allow development
- Rural reserves will preserve farms and forests



Our urbanizing world

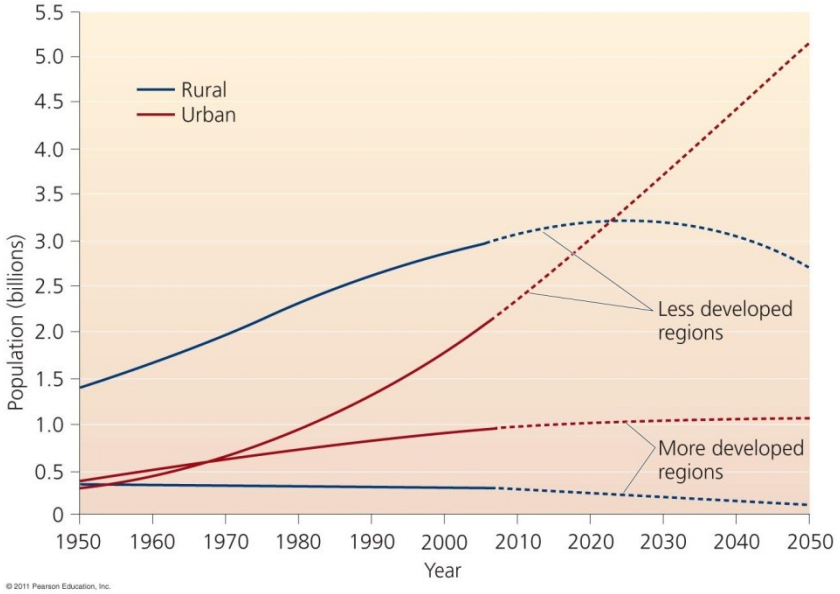
- **Urbanization** = the movement of people from rural to urban (cities and suburbs) areas
  - Society's greatest change since it became sedentary
- People need a safe, clean, urban environment
  - Urban systems must be sustainable
- Urban populations are growing rapidly
  - The growing human population
  - More people are moving to urban areas

Industrialization drove urbanization

- Urbanization began when agricultural surpluses allowed people to leave their farms
  - Creating specialized manufacturing professions, class structure, political hierarchies, and urban centers
- The industrial revolution spawned technology
  - Creating jobs and opportunities in cities
  - Increasing production efficiencies
- In 1950, 30% of the population was urban; today, it's 49%
  - Urban populations will double by 2050
  - Rural populations will decline by 16%

Trends in urbanization

- In developed nations, urbanization has slowed
  - People already live in cities and **suburbs** (smaller communities that ring cities)
- Developing nations are urbanizing rapidly
  - Searching for jobs, wars, ecological damage



Factors influence the location of cities

- Climate, topography, and waterways determine whether a small settlement becomes a large city
- Many well-located cities are linchpins in trading networks
  - Funneling in resources from agricultural regions
  - Shipping products to other areas

(a) St. Louis, Missouri

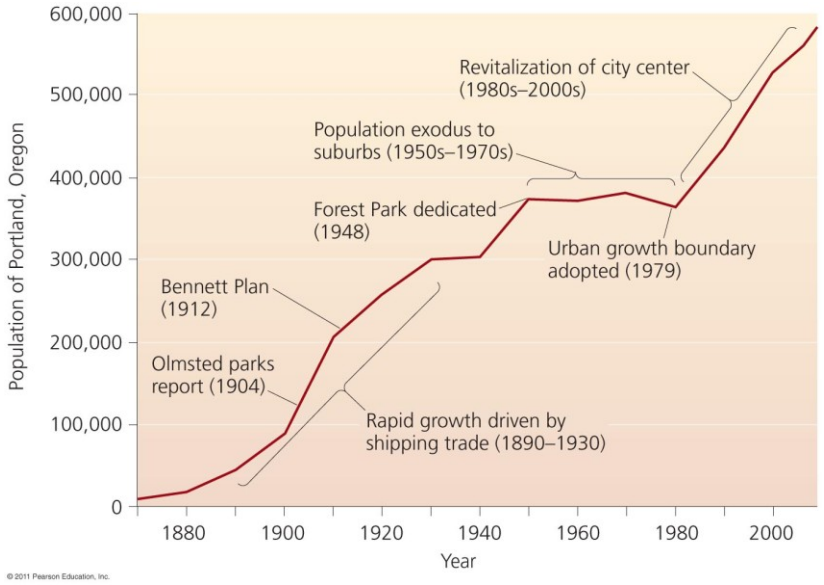
(b) Fort Worth, Texas

Spatial patterns of urbanization change

- Today, cities thrive in resource-poor areas
  - Cheap fossil fuels and powerful technologies (Dallas)
  - Water is brought in from distant areas (e.g., Las Vegas)
- Cities in the southern and western U.S. have grown
  - People (retirees) moved from northern and eastern states
  - Warmer weather, more space
  - Phoenix grew 91% between 1990 and 2008

People moved to suburbs and cities suffered

- By the mid-1900s immigration and trade increased urbanization
  - Increasing crowding, poverty, and crime
  - Affluent people moved to suburbs
- Suburbs had more space
  - Economic opportunities
  - Cheaper real estate
  - Less crime
  - Better schools
- Inner cities declined



Some cities like Portland rebounded

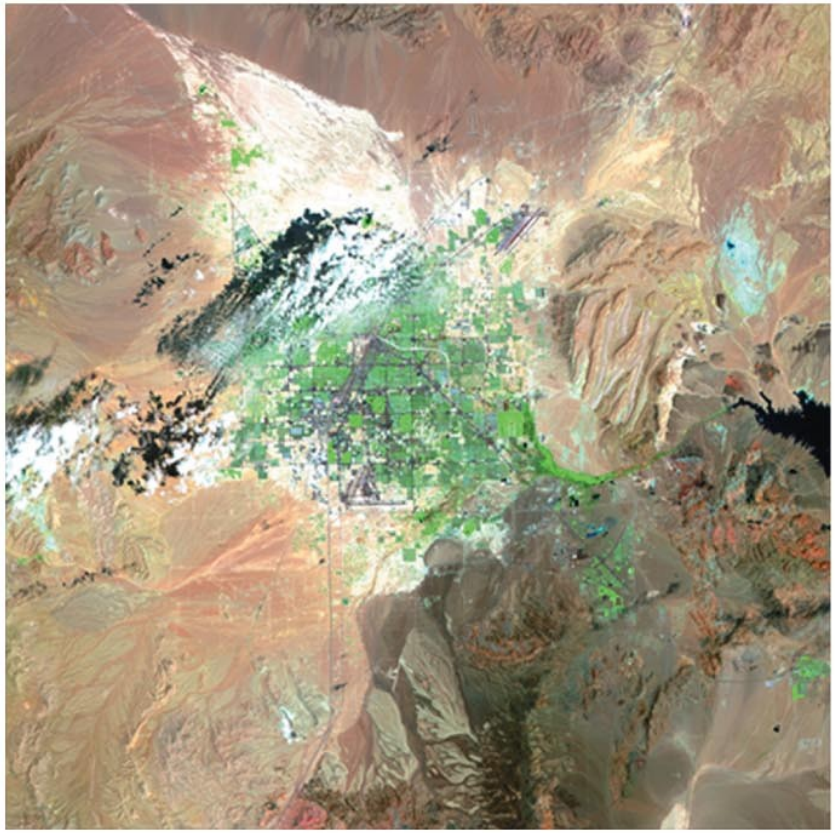
What enabled people to move to suburbs?

- Millions commute to downtown jobs from suburban "bedroom communities"
  - Automobiles and an expanding road network
  - Abundant, cheap oil
- Business could import and export resources, goods, and waste using roads and fossil fuels
  - Helped by the U.S. government's development of the interstate highway system
- Jet travel, television, cell phones, the Internet allow easier communication from any area

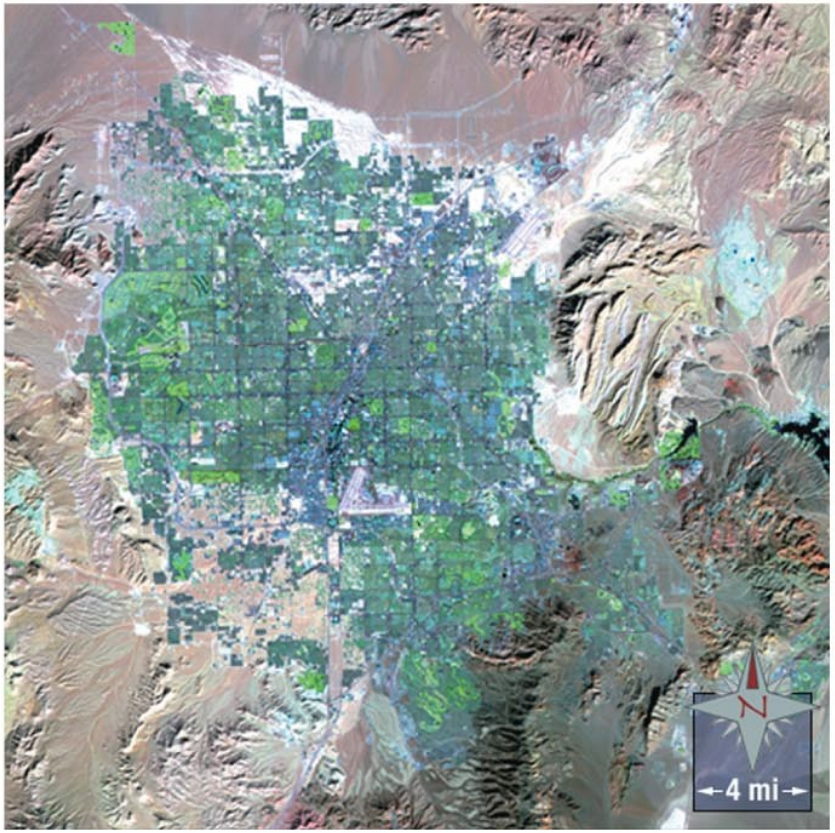
Sprawl

- **Sprawl** = the spread of low-density urban or suburban development outward from an urban center
  - Some see it as ugly, environmentally harmful, and inefficient
  - Others see it as the outgrowth of desires and decisions in a world of increasing humans
- Urban and suburban areas grow in population size and spatially
  - Houses and roads replace 1 million ha (2.5 million acres) of U.S. land each year – 6,700 acres/day!

People in suburbs take up lots of space



(a) Las Vegas, Nevada, 1984



(b) Las Vegas, Nevada, 2009

Even in metro areas where population decreases, the amount of land covered increases

Several types of development lead to sprawl

(a) Uncentered commercial strip development

(b) Low-density single-use development

(c) Scattered, or leapfrog, development

(d) Sparse street network

Sprawl has several causes

- Two major factors contribute to sprawl:
  - Population growth and per capita land consumption
  - The amount of sprawl = population size times the amount of land the average person occupies
- Cities vary in which is more important
  - More people in Los Angeles vs. increased land consumption in Detroit
- Per land consumption increases due to:
  - Better highways, cheap gas, telecommunication, etc.
  - Consumption-oriented lifestyles needing more space

What is wrong with sprawl?

- Economists, politicians, and city boosters think growth is always good
- **Transportation**: people are forced to drive cars
  - Pressure to own cars and drive greater distances
  - Lack of mass transit options
  - More traffic accidents
  - Increases dependence on nonrenewable petroleum
- **Pollution** = carbon dioxide, air pollutants, ozone, smog, acid precipitation
  - Motor oil and road salt from roads and parking lots

What else is wrong with sprawl?

- **Health** = sprawl promotes physical inactivity because driving cars replaces walking
  - Increases obesity and high blood pressure
- **Land use** = less forests, fields, farmland, or ranchland
  - Loss of resources, recreation, beauty, wildlife habitat, air and water purification, services
- **Economics**: sprawl drains tax dollars from communities
  - For roads, water and sewer systems, electricity, police and fire services, schools, etc. in new areas
  - Taxpayers, not developers, subsidize improvements

Planning helps create livable urban areas

- **City (urban) planning** = designing cities to maximize their efficiency, functionality, and beauty
  - Planners advise policymakers on development options, transportation needs, public parks, etc.
- Washington, D.C. is the nation's first and best example of city planning
- Daniel Burnham's 1909 *Plan of Chicago* = parks and playgrounds, improved neighborhoods, etc.
- The 1912 *Greater Portland Plan* recommended rebuilding the harbor, new construction, wide roads

Washington, D.C. was a planned city

Pierre Charles L'Enfant's 1791 plan called for splendid diagonal avenues, monuments, a spacious, stately feeling

(a) The L'Enfant plan, 1791

(b) Washington, D.C., today

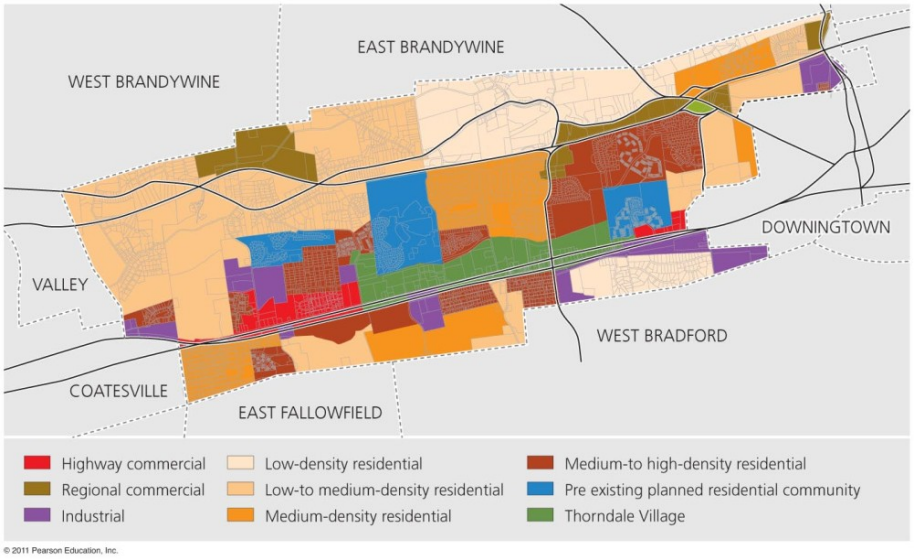
City and regional planning

- **Regional planning** = deals with same issues as city planning, but with broader geographic scales that must coordinate with multiple municipal governments
- Some areas have institutionalized planning in formal government bodies
  - Urban and rural reserves in Portland
  - Homeowners, farmers, developers, and governments will know what future land uses will be

Zoning is a key tool for planning

- **Zoning** = classifies areas for different types of development and land use
  - A powerful means to guide what gets built where
- Opponents say that its restrictions violate individual freedoms
- Proponents say government can set limits for the good of the community

After seeing undesirable development, Oregonians voted for land restrictions



Urban growth boundaries (UGBs)

- Limit sprawl: keeps growth in existing urbanized areas
  - Revitalize downtowns
  - Protect farms, forests, and industries
  - Ensure urban dwellers some access to open space
  - May reduce infrastructure costs
- Disadvantages:
  - Increase housing prices within their boundaries
  - Restrict development outside the UGB
  - Increase the density of new housing inside the UGB
  - Increasing pressure to expand boundaries

Many cities have urban growth boundaries

- Other states, regions, and cities have adopted UGBs
  - Boulder, Colorado; many California areas
  - Trying to concentrate development, prevent sprawl, and preserve farmland and habitat

Oregon's long-term goal was to prevent growth of a megalopolis stretching from Eugene to Seattle

Smart growth tries to counter sprawl

- **Smart growth** = urban growth boundaries and other land use policies to control sprawl
- Proponents of smart growth promote:
  - Healthy neighborhoods and communities
  - Jobs and economic development
  - Transportation options
  - Environmental quality
- Building "up, not out"
  - Focusing development in existing areas
  - Favoring multistory shop-houses and high-rises

New urbanism is now in vogue

- **New urbanism** = neighborhoods are designed on a walkable scale
  - Homes, businesses, and schools are close together
- Functional neighborhoods in which most of a family's needs can be met without using a car

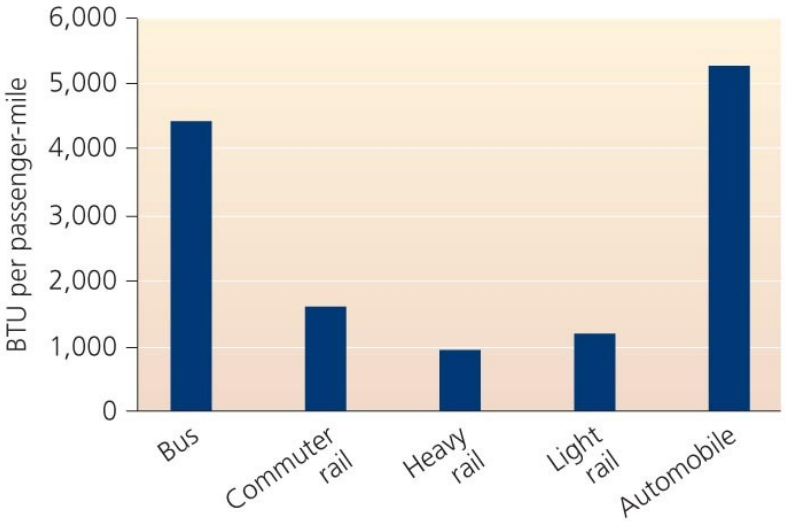
New urbanist developments have green spaces, mixed architecture, creative street layouts

Transit-oriented development

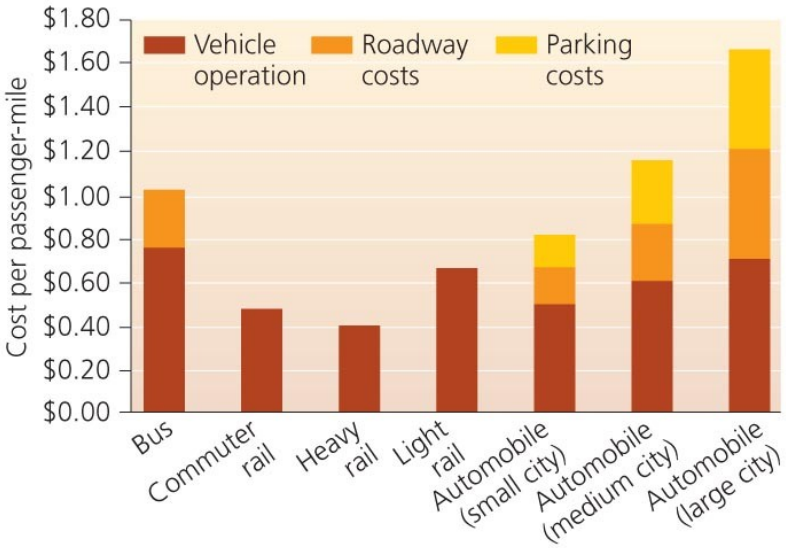
- **Transit-oriented development** = compact communities in the new urbanist style
  - Are arrayed around stops on a major rail transit line
  - People can travel by train and foot
- Zoning rules must cooperate with new urbanism
  - Denser development must be allowed so sprawl is prevented

Mass transportation

- Traffic jams cause air pollution, stress, and lost time
  - Cost the U.S. economy $74 billion/year
- Key in improving quality of urban life: mass transportation
  - Buses, trains, subways
  - *Light rail* = smaller systems powered by electricity
- Cheaper, more energy efficient, and cleaner
- Traffic congestion is eased



(a) Energy consumption for different modes of transit

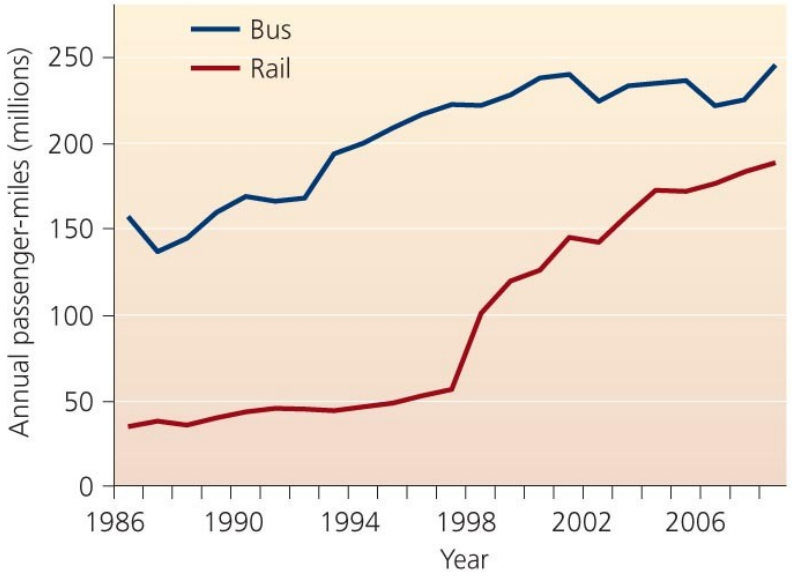


(b) Operating costs for different modes of transit

Train and bus systems

- The most-used U.S. train systems are in large cities
  - Carry 25% of each city's daily commuters
  - New York's subways, the T in Boston
- Portland's buses carry 66 million/year
  - Each bus keeps 250 cars off the road each day

(a) MAX light rail train



(b) Portland transit ridership trends

U.S. mass transit lags behind other nations

- Most nations have extensive, accessible bus systems
  - The U.S. lags behind in mass transit systems
- Other nations have high-speed bullet trains
  - The U.S. starves its only national passenger trains (Amtrak) of funding
- Why is U.S. mass transit behind?
  - Low population density and cheap fuel support roads and cars
  - In 2009, Congress set aside $8 billion for high-speed rail

Establishing mass transport is not easy

- It is expensive to replace existing roads
- Strong, visionary political leadership is needed
  - Growth is directed, instead of being overwhelming
- Governments can encourage mass transit
  - Raise fuel taxes
  - Tax inefficient modes of transport
  - Reward carpoolers
  - Encourage bicycle use and bus ridership
  - Charge trucks for road damage
  - Stimulate investment in renewed urban centers

Parks and open spaces are key elements

- City dwellers want to escape noise, commotion, and stress of urban life
- Natural lands, public parks, and open space provide greenery, scenic beauty, freedom, and recreation
  - Along with regulating natural processes (e.g., filtering pollutants)
- Urbanization makes protecting natural lands important
  - Urban dwellers become disconnected from nature

City parks

- Arose in the U.S. at the end of the 19th century
  - People wanted to make dirty, crowded cities more livable
- Lawns, groves, and curved pathways originated with European ideals
- Portland's Forest Park is the largest U.S. city park

New York's Central Park: one of the first city parks

Parklands come in various types

- Even small spaces can be important
  - Playgrounds or community gardens
- *Greenways* = strips of land connecting parks or neighborhoods
  - Protect water quality, boost property values, provide corridors for wildlife

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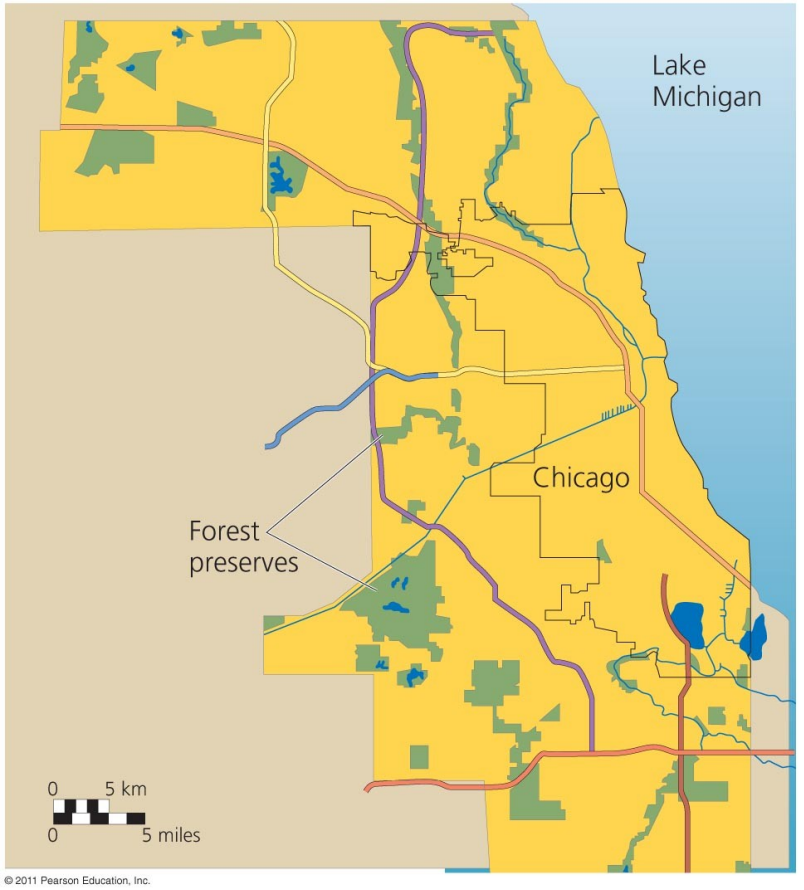
Community gardens allow people to grow vegetables and flowers

Greenbelts

- *Greenbelts* = long, wide corridors of parklands
  - May surround an entire urban area
- Many cities are trying ecological restoration to restore the area's naturalness
  - Volunteers help remove exotic plants, restore prairies



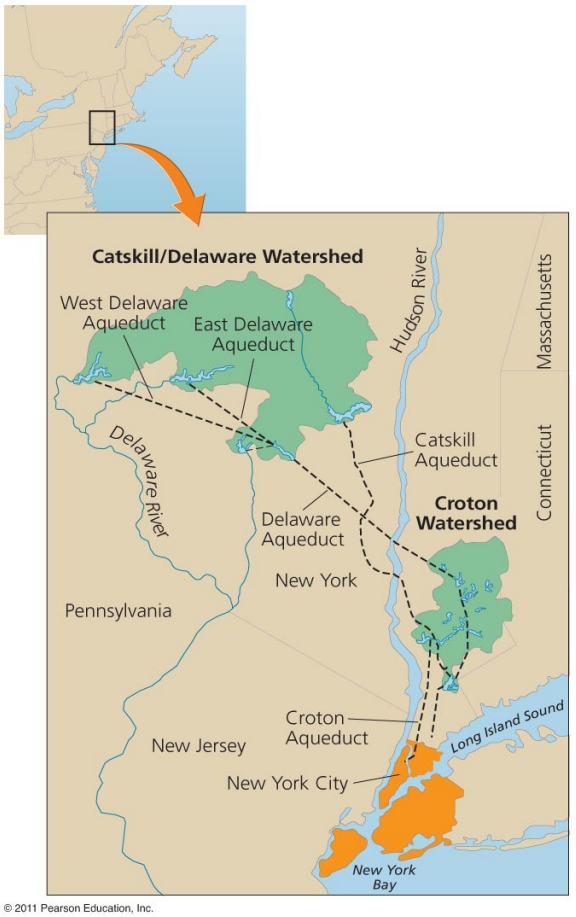
Chicago's 100,000 acres of forest preserves stretch through the suburbs

Urban sustainability

- Things that make cities safe, clean, healthy and pleasant also make them more sustainable
- A sustainable city functions effectively and prosperously over the long term
  - Generations will have a good quality of life
  - Impacts on natural systems and resources are minimized
- A city's impacts depend on how we use resources, produce goods, transport materials, and deal with waste

Urbanization impacts the environment

- **Resource sinks** = cities must import resources
  - Relying on large expanses of land elsewhere for resources
- We need natural land for
  - Food, shelter, ores
  - Ecosystem services (air and water purification, nutrient cycling, waste treatment)



Many cities must import water from far places

Urbanization's effects: efficiency

- **Efficiency** = dense concentrations of people in cities allow efficient delivery of goods and services
  - Delivery of electricity is more efficient
- High city density facilitates social services that improve the quality of life
  - Medical services, education, water and sewer systems, waste disposal, transportation

Urbanization's effects: consumption

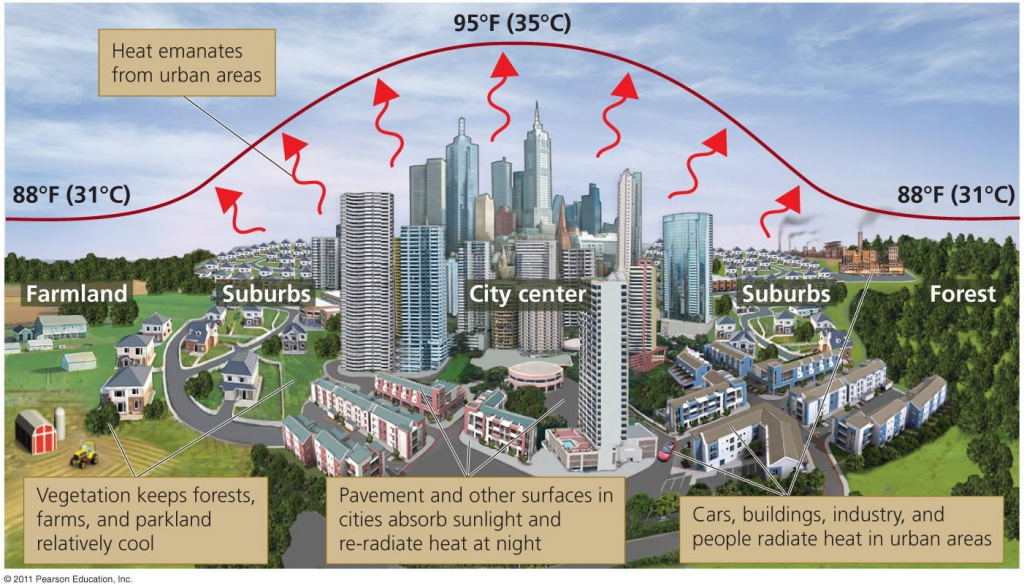
- **Consumption** = heavy use of outside resources increases the ecological footprints of cities
- The footprint is far greater than their land area
  - Cities take up 2% of the land surface, but consume over 75% of the world's resources
- Urban dwellers have far larger ecological footprints than rural dwellers
  - Urban residents tend to be wealthier, and wealth correlates with consumption

Cities preserve land but export pollution

- Because people are packed densely in cities, more land outside cities is left undeveloped
  - Without cities, we would have much less room for agriculture, wilderness, biodiversity, or privacy
- Cities export wastes through pollution and trade
  - They transfer the costs of activities to other regions
  - Citizens are exposed to heavy metals, chemicals, smog, acid precipitation, etc.
  - The poor bear the brunt of pollution because they are too poor to move

Pollution in cities

- **Noise pollution** = undesired ambient sound
  - Degrades surroundings, stressful, hurts hearing
- **Light pollution** = lights obscure the night sky
  - Impairing the visibility of stars
- **Urban heat island effect** = cities are hotter than surrounding areas
  - Buildings, vehicles, factories, and people generate heat
  - Dark buildings and pavement absorb heat



Urban centers foster innovation

- Cities promote a flourishing cultural life
  - They spark innovation and creativity, promoting education and scientific research
  - They are engines of technological and artistic inventiveness that can solve societal problems
  - They serve as markets for organic produce, recycling, and education

Urban ecology helps sustainability

- Cities must replace the one-way linear metabolism of importing resources and exporting wastes
  - This destabilizes environmental systems and is not sustainable
- **Urban ecology** = cities can be viewed explicitly as ecosystems
  - Fundamentals of ecology and systems apply to cities
- Cities should follow an ecosystem-centered model

Cities following an ecosystem model…

- Use resources efficiently
- Recycle
- Develop environmentally friendly technologies
- Account fully for external costs
- Offer tax incentives for sustainable practices
- Use locally produced resources
- Use organic waste and wastewater to restore soil fertility
- Encourage urban agriculture

Sustainability is happening, but slowly

- Future "eco-cities," built from scratch have not yet been built
  - Faulty implementation, corruption, misunderstanding
- Urban sustainability is happening piecemeal
  - But rapidly
- Singapore produces all its own meat
- Other cities have community gardens, recycling programs, mass transit, environmental education, etc.
- PlaNYC = New York City is trying to become the first environmentally sustainable 21st-century city

Green buildings: key toward sustainability

- Constructing or renovating buildings using efficient technologies
  - The best way to reduce energy use and greenhouse gas emissions
  - Buildings consume 40% of energy and 70% of electricity
- **Green buildings** = structures that reduce their ecological footprints
  - Built from sustainable materials
  - Minimize energy and water use
  - Recycle wastes

LEED program

- **Leadership in Energy and Environmental Design (LEED)** = a certification program run by the U.S. Green Building Council
- New or renovated buildings apply for certification
  - They can be granted silver, gold, or platinum status
- Green building techniques are more expensive
  - But not as much as expected
- LEED certification is booming in the U.S.
  - Built with local, nontoxic products; are energy efficient, educational

Steps to livability enhance sustainability

- Making cities more livable (pleasant, safe, clean, healthy) helps make them more sustainable
- Planning and zoning are long-term, powerful sources for sustaining urban communities
- Smart growth and new urbanism reduce energy use
  - Mass transit reduces gasoline use, carbon emissions
- Developed nations should invest in resource-efficient technologies to reduce their impacts
- Developing nations should invest in infrastructure to improve health and living conditions

Conclusion

- As half the human population has moved to urban lifestyles, our environmental impact has changed
- Resources must be delivered over long distances
- Urban sustainability makes urban areas better places to live
  - Expanding transportation options to relieve congestion
  - Park lands and green spaces prevent us from becoming isolated from nature
- American cities are becoming more livable

QUESTION: Review

As cities grew through immigration and trade, people responded by:

a) Moving to suburbs
b) Moving to rural areas
c) Developing inner cities
d) Decentralizing city management

QUESTION: Review

What happens during urban sprawl?

a) Increased resources are extracted from rural areas.
b) Inner cities become more “livable”.
c) People move outwards, away from an urban center.
d) High-density development occurs in rural areas.

QUESTION: Review

Which of the following is NOT something that is wrong with sprawl?

a) People are forced to use mass transit.
b) Pollution increases in the area.
c) People become inactive and less healthy.
d) There are fewer forests, farmlands, and ranchlands.

QUESTION: Review

In new urbanism:

a) Architects try to envision what a city could look like.
b) Families still use their cars for going to jobs, but not shopping.
c) Neighborhoods are designed on a walkable scale.
d) Jobs are created through expanding suburbs.

QUESTION: Review

Increased use of mass transportation:

a) Is not a viable option for U.S. cities
b) Can be implemented only in wealthier cities
c) Reduces traffic jams and pollution
d) Are more expensive and dirtier, but make people feel good

QUESTION: Review

Why does urbanization make protection of natural lands important?

a) People in cities lose their connection with nature
b) Natural processes must be protected
c) People want to escape the stress and noise of city life
d) All of the above

QUESTION: Review

A sustainable city is one that:

a) Must import resources from far away
b) Functions effectively and prosperously over the long term
c) Relies on large expanses of land for ecosystem services
d) Is less safe, but cleaner

QUESTION: Interpreting Graphs and Data

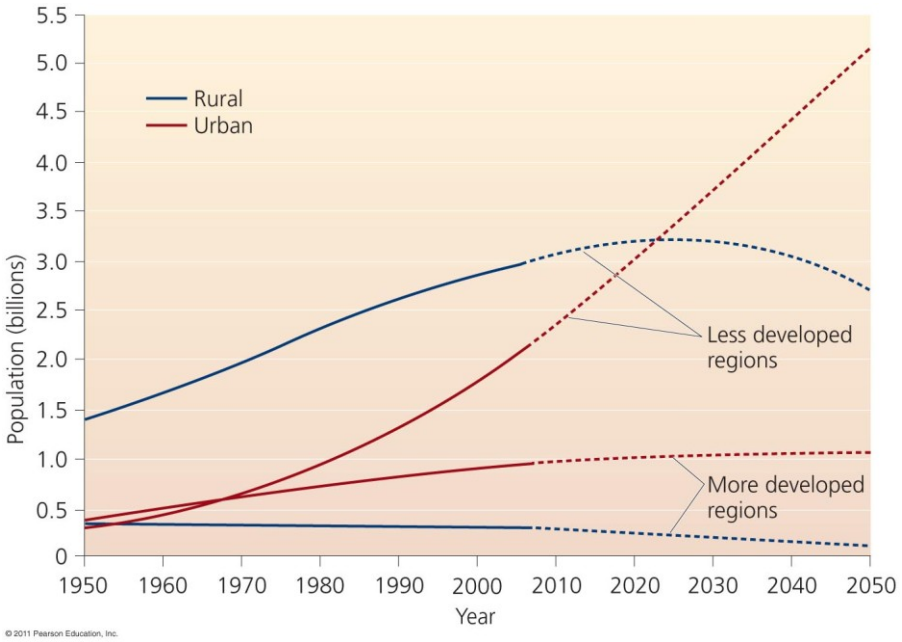
What are the projections for the future of *developing* nations?

a) Urban areas will increase, but not rural.

b) Rural areas will increase, not urban.

c) Urban and rural areas will increase.

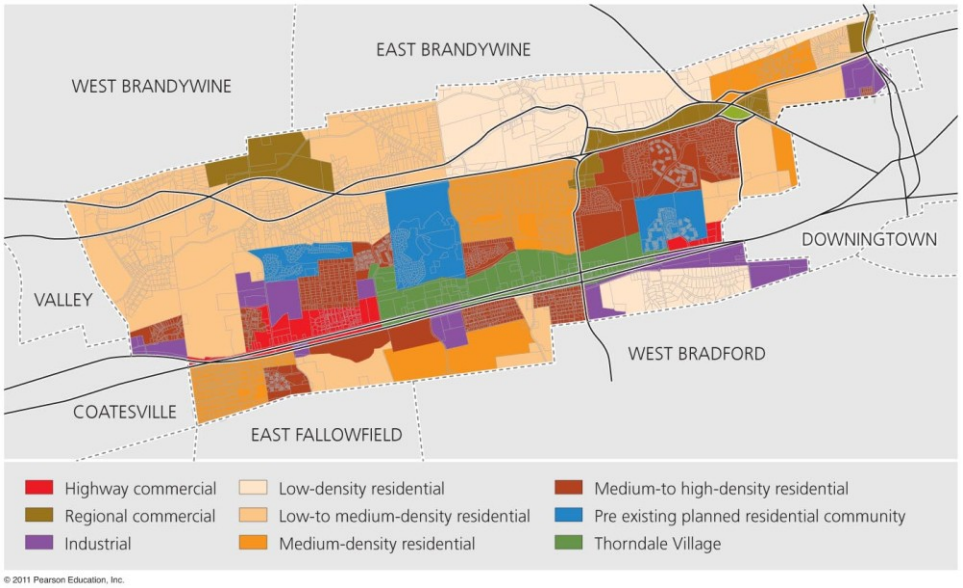
d) Urban and rural areas will decrease.



QUESTION: Interpreting Graphs and Data

According to this zoning pattern, where will public and institutional buildings be concentrated?

a) On the city's outskirts
b) In a rural area
c) In a downtown area
d) Along major roads



QUESTION: Viewpoints

Imagine you live next to a 10-acre parcel of forested land that the owner wants to develop into a shopping mall. How would you feel?

a) Fine; it's the person's right to develop the land as he or she wants.
b) I would not like it, but it's the person's right to develop the land.
c) The city should buy the property to put in a park.
d) I would try to buy the property, and post large "Keep Out" signs.

QUESTION: Viewpoints

Do you want your university to become more sustainable (e.g., increased recycling, LEEDS certification, etc.)?

a) Absolutely, even if it slightly increased my costs.
b) Yes, but only if it didn't affect my costs.
c) No, this is a temporary phase and not worth the cost.
d) I'm not sure; it really does not affect me.