"A high-rise block of flats would give many people a chance to enjoy a rural life..."

Chapter 22
Cities and Sustainability

The city is not an ecological monstrosity. It is rather the place where both the problems and the opportunities of modern technological civilization are most potent and visible.
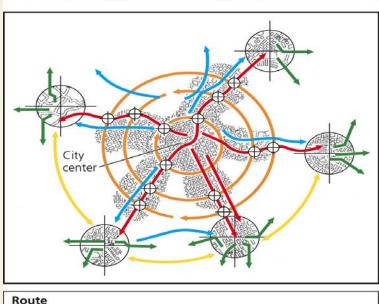
- *Peter Self*

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**

Route

— Express — Interdistrict — Direct — Feeder — Workers

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 less-developed countries.*

Trends in Urbanization, by Region

Urban Population
Percent

Region	1950	2000	2030 (Projected)
World	29	47	61
Africa	15	37	54
Asia	17	37	55
Latin America/Caribbean	42	76	85
More Developed Regions	53	74	82

Source: United Nations, *World Urbanization Prospects: The 2003 Revision* (medium scenario), 2004.

Half of the World's People Live in Urban Areas

Urbanization

- Creation and growth of urban and suburban areas
- Percentage of people who live in such areas

Urban growth

- Rate of increase of urban populations
- Immigration from rural areas
  - Pushed from rural areas to urban areas
  - Pulled to urban areas from rural areas

From Rural Area to Urban Areas

Push factors

- Poverty

- Lack of land to grow food

- Declining labor market in agriculture

- War, famine, conflicts

Pull factors

- Jobs, food, housing

- Education

- Health care

Urban Areas: Major Trends

Four major trends

1. Proportion of global population living in urban areas is increasing

2. Number and size of urban areas is mushrooming
   - Megacities, hypercities

3. Urban growth slower in developed countries

4. Poverty is becoming increasingly urbanized; mostly in less-developed countries

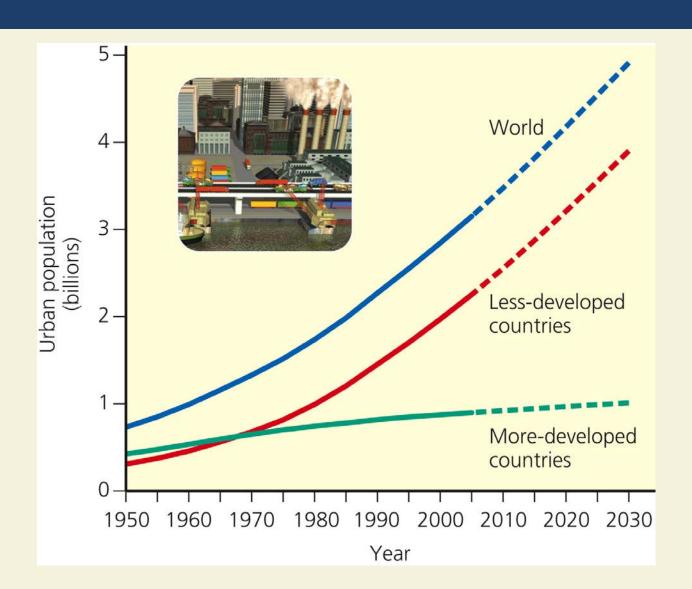# Urban Shanghai, Suburban Southern California, and Rural Malawi

Fig. 22-2, p. 588

Urban Population Growth
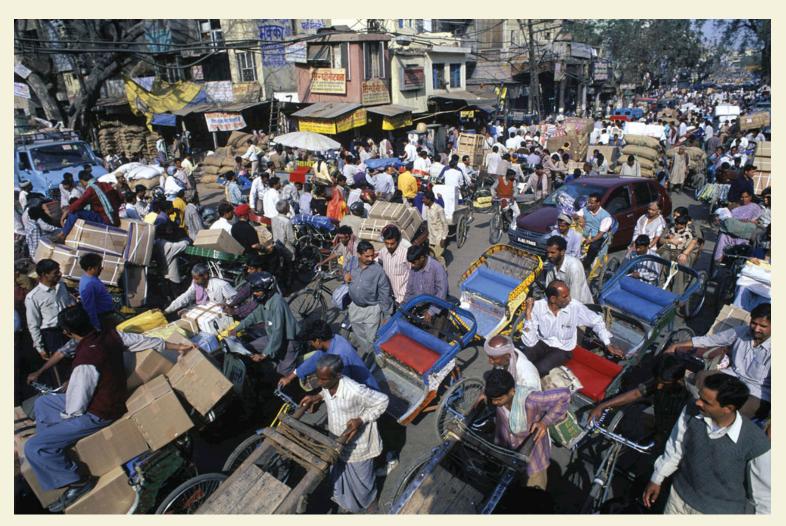

Fig. 22-3, p. 588

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

Fig. 22-4, p. 589

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

Fig. 22-5, p. 589

Case Study: Urbanization in the United States

Four phases between 1800 and 2008

1. Migration from rural areas to large central cities
2. Migration from large central cities to suburbs and smaller cities
3. Migration from North and East to South and West
4. Migration from cities and suburbs to developed areas outside the suburbs = exurbs

Urbanization went from 5% to 79%

Case Study: Urbanization in the United States

Environmental problems decreasing
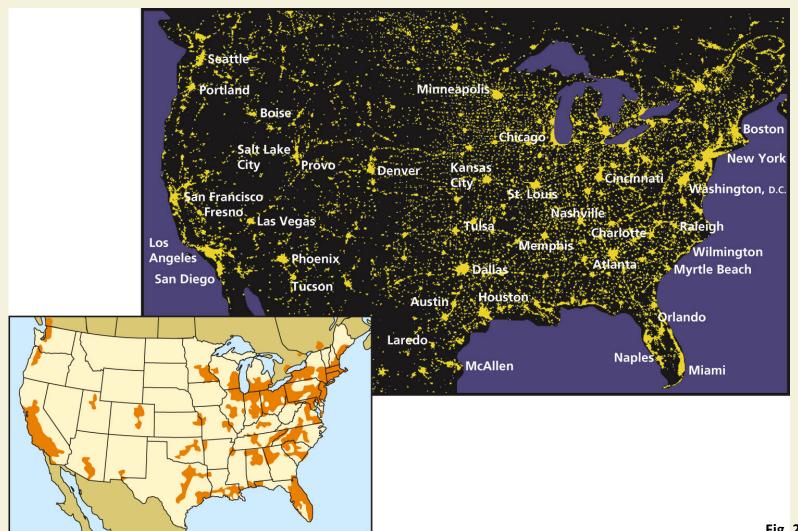
- Better working and housing

- Better water and sanitation

- Better health care

Older cities

- Deteriorating services

- Aging infrastructures

- U.S. $2.2 trillion behind in infrastructure maintenance

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

Fig. 22-6, p. 590

Urban Sprawl Gobbles Up the Countryside

Urban sprawl

- Low-density development at edges of cities/towns
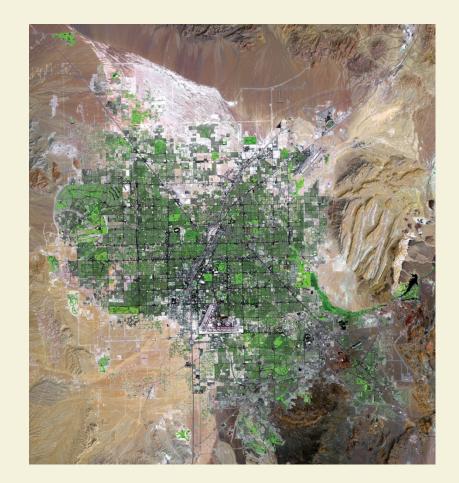
Contributing factors to urban sprawl in the U.S.

1. Ample land
2. Low-cost gasoline; highways
3. Tax laws encouraged home ownership
4. State and local zoning laws
5. Multiple political jurisdictions: poor urban planning

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

Fig. 22-7, p. 591

Natural Capital Degradation: Urban Sprawl

Natural Capital Degradation

Urban Sprawl

Land and Biodiversity

Loss of cropland

Loss and fragmentation of forests, grasslands, wetlands, and wildlife habitat

Water

Increased use and pollution of surface water and groundwater

Increased runoff and flooding

Energy, Air, and Climate

Increased energy use and waste

Increased emissions of carbon dioxide and other air pollutants

Economic Effects

Decline of downtown business districts

More unemployment in central cities

Fig. 22-8, p. 592

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: Advantages

Centers of:

- Economic development
- Innovation
- Education
- Technological advances
- Jobs
- Industry, commerce, transportation

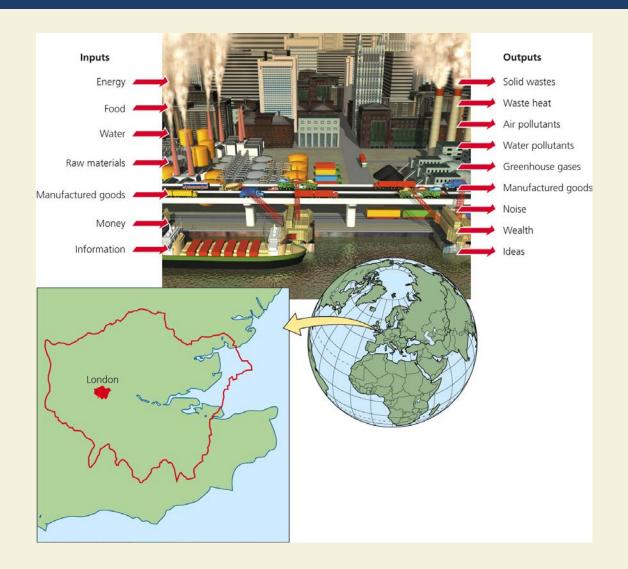# Urbanization: Advantages

Urban residents tend to have

- Longer lives
- Lower infant mortality
- Better medical care
- Better social services
- More recycling programs

- Concentrating people in cities can help preserve biodiversity in rural areas

Urbanization: Disadvantages

- Huge ecological footprints
- Lack vegetation
- Water problems
- Concentrate pollution and health problems
- Excessive noise
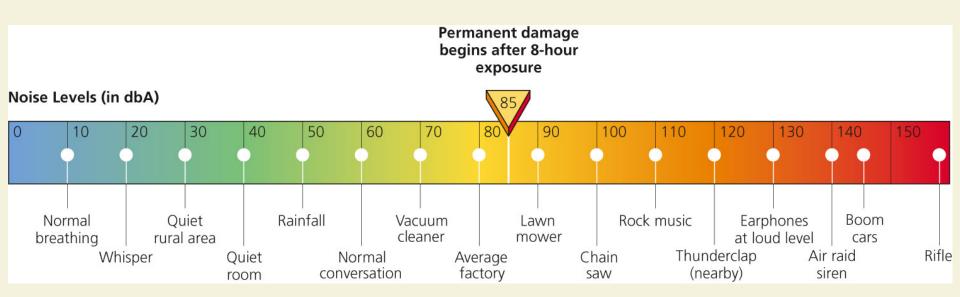- Altered climate and experience light pollution

Natural Capital Degradation: Urban Areas Rarely Are Sustainable Systems

Fig. 22-9, p. 594

Noise Levels of Some Common Sounds

Permanent damage begins after 8-hour exposure

Noise Levels (in dbA)

0 · 10 · 20 · 30 · 40 · 50 · 60 · 70 · 80 · 85 · 90 · 100 · 110 · 120 · 130 · 140 · 150

Normal breathing · Whisper · Quiet rural area · Quiet room · Rainfall · Normal conversation · Vacuum cleaner · Average factory · Lawn mower · Chain saw · Rock music · Thunderclap (nearby) · Earphones at loud level · Air raid siren · Boom cars · Rifle

Fig. 22-10, p. 595

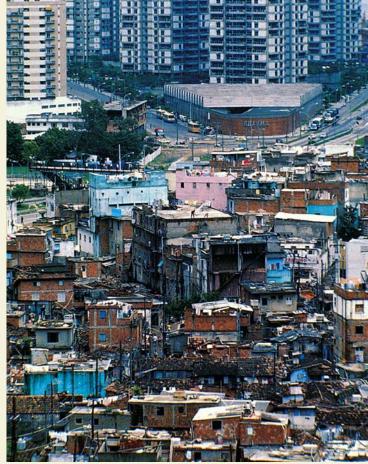# Life Is a Desperate Struggle for the Urban Poor in Less-Developed Countries

- Slums

- Squatter settlements/shantytowns

- Terrible living conditions
  - Lack basic water and sanitation
  - High levels of pollution

- What can governments do to help?

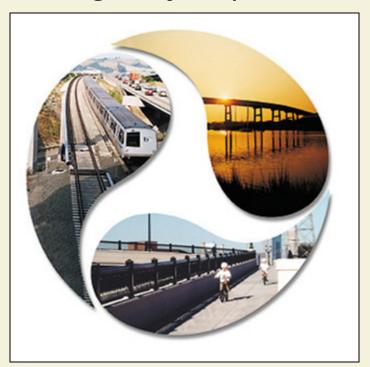**Extreme Poverty in Rio de Janeiro Slum**

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*** *In some countries, many people live in widely dispersed urban areas and depend mostly on motor vehicles for their transportation, which greatly expands their ecological footprints.*

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: Advantages

Advantages

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

Motor Vehicles: Disadvantages

Disadvantages

- Accidents: 1.2 million per year, 15 million injured
- Kill 50 million animals per year
- Largest source of outdoor air pollution
- Helped create urban sprawl
- Traffic congestion

Los Angeles Freeways

Fig. 22-13, p. 599

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

Full-cost pricing: high gasoline taxes

- Educate consumers first
- Use funds for mass transit
- Opposition from car owners and industry
- Lack of good public transit is a problem

Rapid mass transit

- Difficult to pass in the United States
- Strong public opposition
- Dispersed nature of the U.S.

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

- Raise parking fees

- Tolls on roads, tunnels, and bridges into major cities

- Charge a fee to drive into a major city

- Car-sharing

Case Study: Zipcars
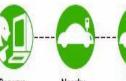
- Car-sharing network

- Rent by the hour

- Saves money for many people

Cars by the hour, for nearly zip.

zipcar®
wheels when you want them™

Drive a car, hassle-free anytime, from only $8/hour plus $.40/mile including gas, insurance, maintenance and parking. With a Zipcard, you have instant access to a variety of great new cars -- near campus, transit and home, parked in designated Zipcar spots.

Visit zipcar.com/umich for University Discounts or call 866-4 Zipcar

Reserve   Nearby   Access   Drive!

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

Trade-Offs

Bicycles

Advantages

Are quiet and non-polluting

Take few resources to make

Burn no fossil fuels

Require little parking space

Disadvantages

Provide little protection in an accident

Provide no protection from bad weather

Are impractical for long trips

Secure bike parking not yet widespread

Fig. 22-14, p. 601

Trade-Offs: Mass Transit Rail

Trade-Offs

Mass Transit Rail

Advantages

Uses less energy and produces less air pollution than cars do

Use less land than roads and parking lots use

Causes fewer injuries and deaths than cars

Disadvantages

Expensive to build and maintain

Cost-effective only along a densely populated corridor

Commits riders to transportation schedules

Fig. 22-15, p. 601

Trade-Offs: Buses

Trade-Offs

Buses

Advantages

Reduce car use and air pollution

Can be rerouted as needed

Cheaper than heavy-rail system

Disadvantages

Can lose money because they require affordable fares

Can get caught in traffic and add to noise and pollution

Commit riders to transportation schedules

Fig. 22-16, p. 601

Trade-Offs: Rapid Rail

Trade-Offs

Rapid Rail

Advantages

Much more energy efficient per rider than cars and planes are

Less air pollution than cars and planes

Can reduce need for air travel, cars, roads, and parking areas

Disadvantages

Costly to run and maintain

Causes noise and vibration for nearby residents

Adds some risk of collision at car crossings

Fig. 22-17, p. 602

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

Fig. 22-18, p. 602

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
- Encourages economic development
- Revenues: property taxes
  - 90% of local government revenue in the U.S.
- Environmental and social consequences

Zoning

- Problems and potential benefits
- Mixed-use zoning

Smart Growth Works

Smart growth

- Reduces dependence on cars
- Controls and directs sprawl
- Cuts wasteful resource
- Uses zoning laws to channel growth

Case Studies: Smart Growth

- Curitiba, Brazil: zoning laws to reduce pollution

- China: stand on urban sprawl

- Europe: compact cities

The Habitable Planet:
Human Population Dynamics

Solutions

Smart Growth Tools

Limits and Regulations

Limit building permits

Draw urban growth boundaries

Create greenbelts around cities

Zoning

Promote mixed use of housing and small businesses

Concentrate development along mass transportation routes

Planning

Ecological land-use planning

Environmental impact analysis

Integrated regional planning

Protection

Preserve open space

Buy new open space

Prohibit certain types of development

Taxes

Tax land, not buildings

Tax land on value of actual use instead of on highest value as developed land

Tax Breaks

For owners agreeing not to allow certain types of development

For cleaning up and developing abandoned urban sites

Revitalization and New Growth

Revitalize existing towns and cities

Build well-planned new towns and villages within cities

Fig. 22-19, p. 604

Case Study: Smart Growth in Portland, Oregon

- Since 1975
  - Population grew 50%
  - Urban area expanded 2%
  - Efficient light-rail and bus system
  - Abundant green space and parks
  - Clustered, mixed-use neighborhoods
  - Air pollution reduced 86%

- Greenest city in the United States

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

Fig. 22-20, p. 605

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; to recycle or reuse most of their wastes; to grow much of their food; and to protect biodiversity by preserving surrounding land.*
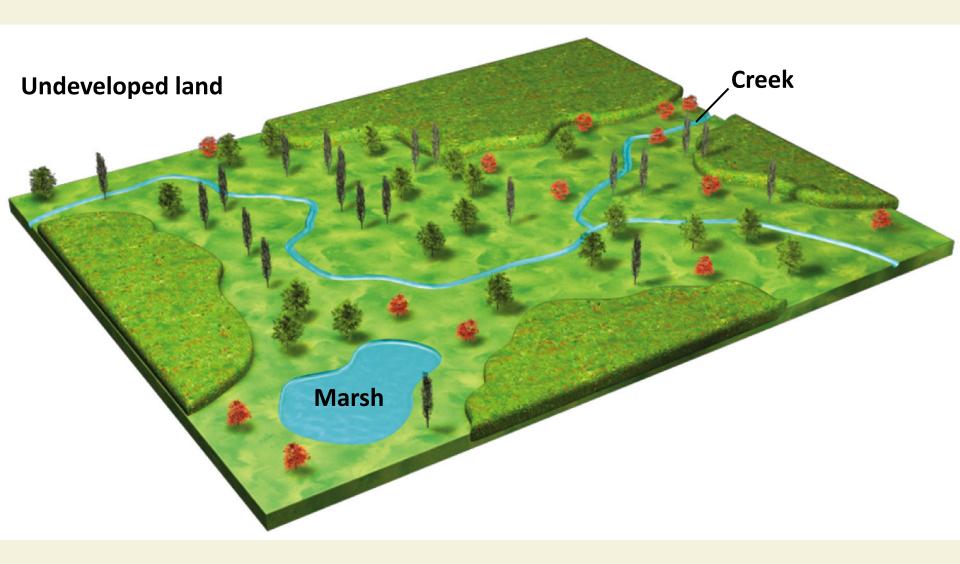
New Urbanism Is Growing

- Conventional housing development

- Cluster development

- New urbanism, old villageism
  - Walkability
  - Mixed-use and diversity
  - Quality urban design
  - Environmental sustainability
  - Smart transportation

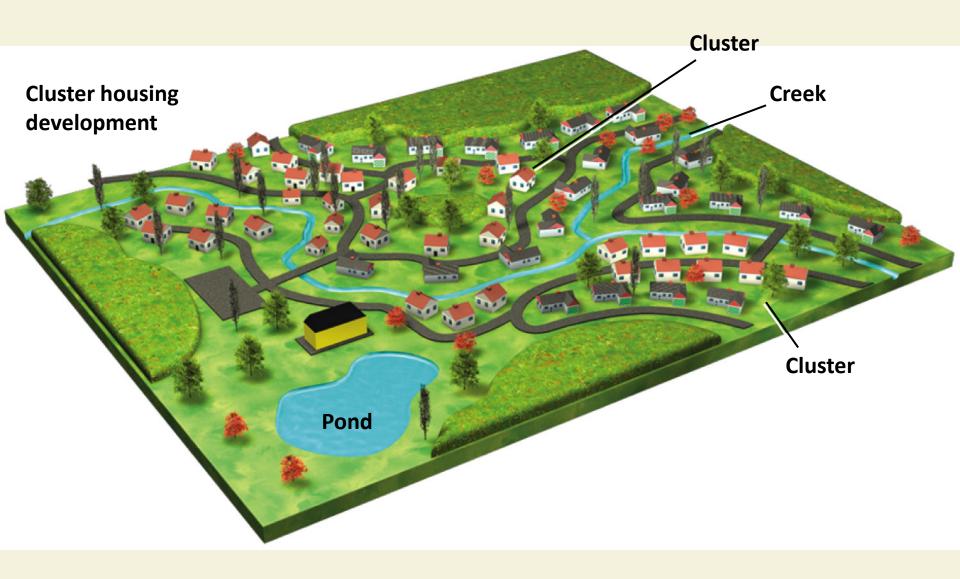# Conventional and Cluster Housing Developments

Fig. 22-21, p. 606

Undeveloped land

Creek

Marsh

Fig. 22-21a, p. 606

Typical housing development

Fig. 22-21b, p. 606

Cluster housing development

Cluster

Creek

Cluster

Pond

Fig. 22-21c, p. 606

Case Study: New Urban Village of Vauban

- Suburb of Freiburg, Germany

- Car use heavily discouraged with high parking fees = $40,000 for a parking space

- All homes within walking distance of
  - Trains and other public transit
  - Stores, banks, restaurants, schools

- Much use of renewable energy

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

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

Case Study: A Living Building

- Living Building
  - Designed to fit in with local climate, vegetation, other characteristics
  - Energy met solely by renewable resources
  - Capture, treat, reuse all water
  - Highly energy efficient
  - Esthetically pleasing

Omega Center for Sustainable Living in Rhinebeck, New York

Fig. 22-22, p. 609

Three Big Ideas

1. Urbanization is increasing steadily and the numbers and sizes of urban areas are growing rapidly, especially in less-developed countries.

2. Most urban areas are unsustainable with their large and growing ecological footprints and high levels of poverty.

3. Urban areas can be made more sustainable and livable just as some cities and villages already are.