Chapter 22:

Urban Environments

Overview

- City Life
- The City as a System
- The Location of Cities: Site and Situation
- An Environmental History of Cities
- City Planning and the Environment
- The City as an Environment
- Cities and Their Rivers

Rivers, Seacoasts and Cities

Floods, droughts, and shifting seacoasts and rivers can determine the success or failure of cities. A good harbor on a seacoast or on a river can make a great place for a city.

But because the environment is always changing, coastlines and rivers can be, from a human point of view, fickle.

In the **Middle Ages, Venice, Italy**, was one of the most powerful cities in the world, a center for trade. But after the discovery of America and alternative routes to the Far East, Venice's situation relative to other cities was no longer important for trade.

It then became a famous center for tourism, crafts, industries such as glassmaking, and the arts. But in recent decades those roles have been threatened by the city's site, subject, as sea level rises, to winter high waters.

The Missouri River passes an island near Weston, Missouri

A historic example begins with the Lewis and Clark expedition as they traveled up the Missouri River in 1804.

Not far north of the present location of Kansas City, Missouri, on July 2, 1804, the expedition camped opposite an old Kansas Indian village where there was a large island in the river and an “extensive” prairie (ecosystems considered part of the temperate grasslands) beyond it.

But in 1881 a bad flood occurred on the Missouri River, and the river cut a new main channel two and one-half miles southwest of Weston.

In this one event, the river meandered away from the town, leaving Weston high and dry, with a harbor no longer at the foot of Main Street. The town was quickly abandoned, and many of its buildings were left intact.

Figure 22.1 (a) The Missouri River passes an island near Weston, Missouri. Changes in the path of the river led to a decline in the town, as explained in the text. (b) Abandoned by the river, Weston was soon abandoned by its residents. As a result, its buildings were not replaced by newer structures, leaving the town a historic place, as shown here.

Bruges, Belgium

Burges developed as an important center for commerce in the 13th century, because its harbor on the English Channel permitted trade with England and other European nations.

By the 15th century, however, the harbor had seriously silted in, and the limited technology of the time did not make dredging possible. This problem, combined with political events, led to a decline in the importance of Bruges—a decline from which it never recovered.

Nevertheless, today, Bruges still lives, a beautiful city with many fine examples of medieval architecture. Because these buildings were never replaced with modern ones, Bruges has become a modern tourist destination.

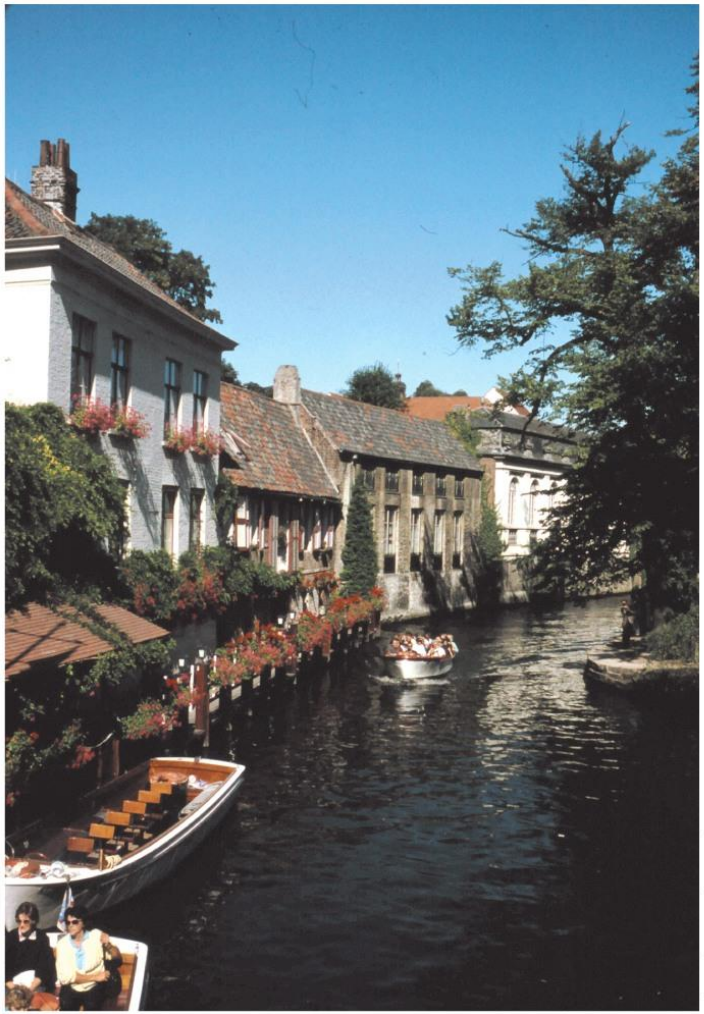


Photo by Daniel B. Botkin

(c) Bruges, Belgium, was also once an active seaport, but the ocean waters gradually filled in the land, leaving Bruges high and dry. Like Weston and Venice, it became a historic city and a tourist attraction.

City Life

- Environmental action has focused on natural landscapes outside cities
- It is time to turn more of our attention to city environments
  - Cities thought of as polluted, dirty, lacking in wildlife and native plants, and artificial
  - Majority of people live in cities and have suffered directly from their decline

City Life

- Almost half of the world's population live in cities
- Economic development leads to urbanization
  - 45% of the world's population live in cities
  - Projected that 62% of the world's population will live in cities by the year 2025
  - 75% of people in developed countries live in cities
  - Only 38% of people in the poorest of the developing countries are city dwellers

City Life

- Many urban people see environmental issues as outside their realm, but the reality is just the opposite: City dwellers are at the center of some of the most important environmental issues. People are realizing that city and wilderness are inextricably connected.

- In summary, today and in the future, most people

will live in cities. For most people, living in an environment of good quality will mean living in a city that is managed carefully to maintain that environmental quality.

The City as a System

- Must maintain a flow of energy, provide necessary material resources, and have ways of removing wastes
- City ecosystem maintained by transportation and communication with outlying areas
  - Not a self-contained ecosystem
  - Takes in raw materials: food, water, wood, energy, mineral ores, civilizations
  - Produces and exports material goods and ideas, innovations, inventions, and art
  - Wilderness, biological diversity, production of renewable resources, forestry, city lakes

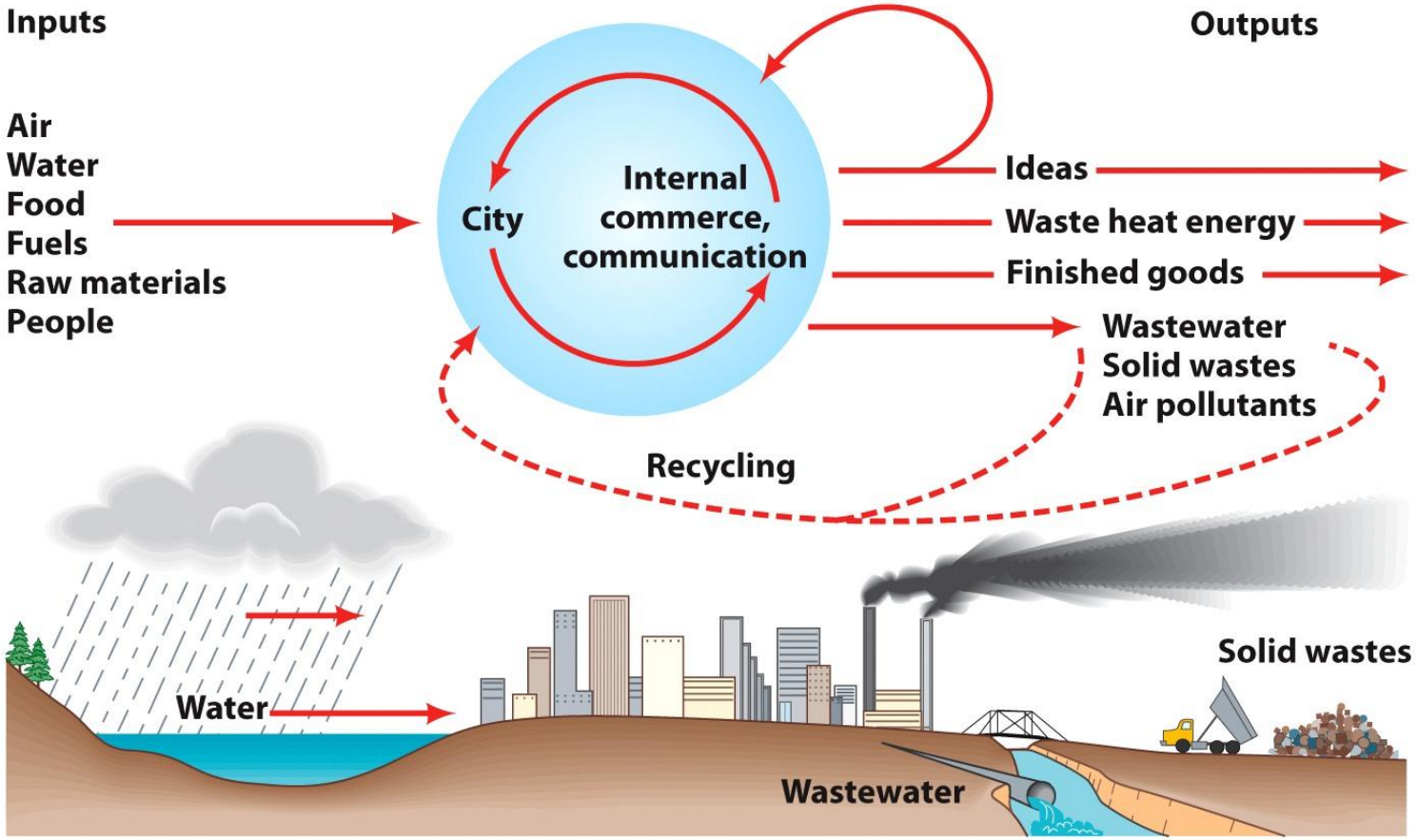


Figure 22.3 The city as a system. with flows of energy and materials. A city must function as part of a city–countryside ecosystem, with an input of energy and materials, internal cycling, and an output of waste heat energy and material wastes. As in any natural ecosystem, recycling materials can reduce the need for input and the net output of wastes.

The City as a System

- Large amount of waste produced by average city resident
  - Exported waste can pollute the countryside
  - Reduces countryside's ability to provide resources for the city
- Relationships between people in cities and countryside have often been strained

The City as a System

- Important tasks
  - Make urban life healthy and pleasant
  - Keep the cities from polluting the countryside
- City planning has a long history
  - Defense and beauty
  - Connecting cities in environmentally and aesthetically pleasing ways with surrounding mountains or water

Outcome

- In light of all these concerns, this chapter describes how a city can fit within, use, and avoid destroying the ecological systems on which it depends, and considers how the city itself can serve human needs and desires as well as environmental functions.

- With this information, you will have the foundation for **making decisions**, based on science and on what you value, about what kind of urban-rural landscape you believe will provide the **most benefits for people and nature.**

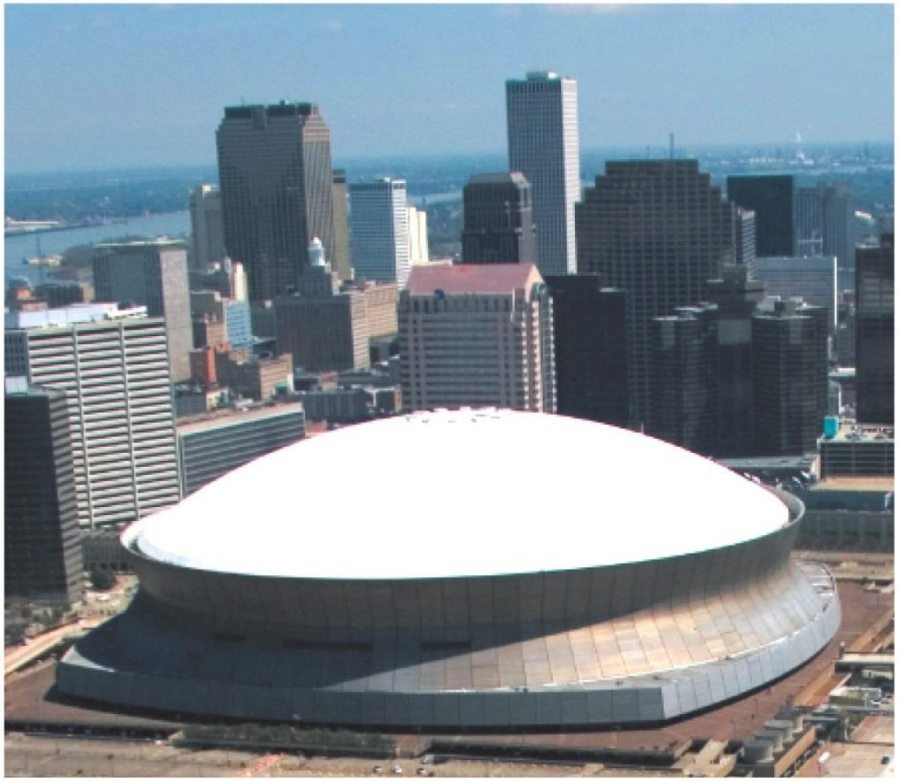
The Location of Cities: Site and Situation

- Cities are not located at random—develop based on local conditions and regional benefits
  - Site—sum of all the environmental features at the location
  - Situation—placement of the city with respect to other areas

The Location of Cities: Site and Situation

- A good site includes
  - Substrate suitable for buildings, transportation, supplies, resources, electronics tools
  - Nearby supplies of drinkable water
  - Nearby lands suitable for agriculture and forest
  - Benign climate
- A quality situation can compensate for a poor site
  - Example—New Orleans

Figure 22.5 New Orleans. (a) air photo before Hurricane Katrina (b) air photo right after Hurricane Katrina.



New Orleans—poor site, important situation

Photo Daniel Botkin

age fotostock/SuperStock

Figure 22.7 (a) (New Orleans) Geologic, topographic, and hydrologic conditions greatly influence how successful the city can be. If these conditions, known collectively as the city's site, are poor, much time and effort are necessary to create a livable environment. New Orleans has a poor site but an important situation.

(b) In contrast, New York City's Manhattan is a bedrock island rising above the surrounding waters, providing a strong base for buildings and a soil that is sufficiently above the water table so that flooding and mosquitoes are much less of a problem. It has a good site and a good situation.

New York City—good site and situation

Site and Situation: The Location of Cities

- Environmental situation affects the development and importance of a city
  - Before railroads, waterways, defense, automobiles, and airplanes, cities depended on water for transportation
  - Most early cities were located on or near waterways
    - Major ocean harbors or at the fall line on major rivers

Fall Line

- A **fall line** on a river occurs where there is an abrupt drop in elevation of the land, creating waterfalls, typically where streams pass from harder, more erosion-resistant rocks to softer rocks.

- Cities have frequently been established at fall lines, especially the major continental fall lines, for a number of reasons. Fall lines provide water power, which was an important source of energy in the 18th and 19th centuries, when the major eastern cities of the United States were established or rose to importance.

- River valleys have rich, water-deposited soils that are good for agriculture

Figure 22.4 The fall line. Most major cities of the eastern and southern United States lie either at the sites of harbors or along a fall line (shown by the dashed line in the figure), which marks locations of waterfalls and rapids on major rivers. This is one way the location of cities is influenced by the characteristics of the environment.

Example of Paris

An ideal location for a city has both a good site and a good situation, but such a place is difficult to find.

Paris is perhaps one of the best examples of a perfect location for a city—one with both a good site and a good situation.

Paris began on an island more than 2,000 years ago, the situation providing a natural moat for defense and waterways for transportation.

Surrounding countryside, a fertile lowland called the Paris basin, affords good local agricultural land and other natural resources.

Site Modification

- Site is provided by the environment
  - Technology and environmental change can alter a site for better or worse
- Changes in a site over time can have adverse effects on a city
  - Example: Bruges, Belgium—harbor silted in in 15th century, cutting city off from trade
  - Example: Weston, MO, on the Missouri River not far north of the present location of Kansas City, Missouri

Photo by Daniel B. Botkin

Photo by Daniel B. Botkin

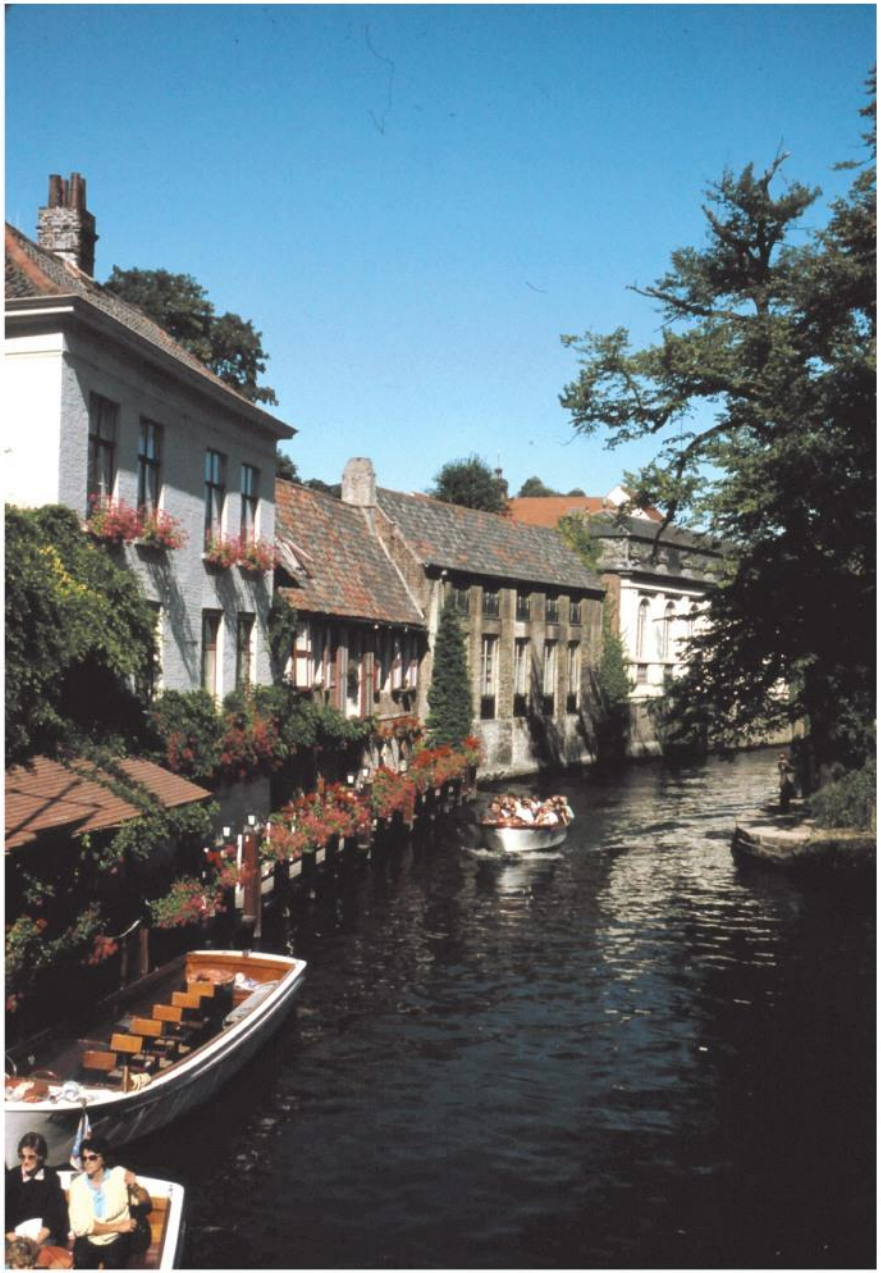


Photo by Daniel B. Botkin

Environmental History of Cities

- First cities emerged with the development of agriculture
  - Provided enough food to sustain a city
  - Cities at this time were still small enough not to damage the environment
- Urban centers emerged with the development of efficient transportation
  - Boats, barges, canals, roads, horses, carriages
  - These cities did not exceed 1 million people

Environmental History of Cities

- Industrial Revolution led to industrial metropolis
  - Three technological advances
    - Improved medicine
    - Improved sanitation
    - Improved transportation
  - Suburban commuting
  - City dwellers feel separated from the environment

City Planning and the Environment

- City planning tends to transform a city center from natural to artificial features
- Replace grass and soil with pavement, gravel, houses, and commercial buildings
- For defense and beauty
  - Formal, conscious planning for new cities
  - Two dominant themes have been defense (fortress cities) and beauty (park cities)

The City Park

- Parks are important in cities
- A significant advance for U.S. cities was the planning and construction of Central Park in New York City
  - The first large public park in the U.S.
  - Designed by Olmsted in 19th century
  - Example of "design with nature"

The City Park

- Olmsted also worked on Boston's city planning
  - Vision—to control water with an aesthetic addition to the city
  - Blending of goals made the development a landmark in city planning

The City Park

- Garden city
  - Extension of the park idea
  - City and countryside should be planned together
- Connect cities with a greenbelt
  - Locate garden cities in a set connected by greenbelts
  - Form a system of countryside and urban landscapes

Olmsted Naturalistic Environment

- Olmsted created a naturalistic environment, keeping the rugged (rough), rocky terrain but creating ponds where he thought they were desirable.

- To add variety, he constructed "rambles," walkways that were densely planted and followed circuitous patterns. He created a "sheep meadow" (expensive landscape in central park from rocky terrain) by using explosives to flatten the terrain. In the southern part of the park, where there were flat meadows, he created recreational areas.

- To meet the needs of the city, he built transverse roads through the park and also created depressed roadways that allowed traffic to cross the park without detracting from the vistas seen by park visitors.

Transverse Roads

- One of the most innovative features of the original design of Central Park are the four suabterranean Tranverse Roads that carry traffic across the park unimpeded between the East and West sides of the park. (source: http://michaelminn.net/newyork/parks/central-park/bridges/transverse-roads/index.html)

Sheep Meadows

Rambles

Olmsted Fens Project-Solution of Flooding and Water Pollution

Olmsted's solution to these problems was a water-control project called the "**fens**." His goal was to "abate/subsidize existing nuisances" by **keeping sewage out of the streams** and **ponds and building artificial banks** for the streams to prevent flooding—and to do this in a **natural-looking way**.

His solution included

- **creating artificial watercourses (irrigation)** by digging shallow depressions in the tidal flats (mud flats from wetlands' coasts) , **following meandering patterns like natural streams**;
- setting aside **other artificial depressions as holding ponds** for tidal flooding; **restoring a natural salt marsh** (flooded coastal wetlands from tides) planted with **vegetation tolerant of brackish water (saltier than fresh water)**
- and **planting the entire area to serve as a recreational park** when not in flood.

He put a tidal gate on the Charles River—Boston's major river—and had two major streams diverted directly through culverts (tunnel/channel) into the Charles so that they flooded the fens only during flood periods

Tidal Flats

Meandering streams

Tidal Gates

City Planning for Defense and Beauty

Ancient Roman cities were typically designed along simple geometric patterns that had both practical and aesthetic benefits. The symmetry of the design was considered beautiful but was also a useful layout for streets

FIGURE 22.8 Planned beauty. The Alhambra gardens of Granada, Spain, illustrate how vegetation can be used to create beauty within a city.

During the **height of Islamic culture**, in the first millennium, Islamic cities typically contained beautiful gardens, often within the grounds of royalty.

Among the most famous urban gardens in the world are the gardens of the **Alhambra**, a palace in **Granada, Spain.** The gardens were created when this city was a Moorish capital, and they were maintained after Islamic control of Granada ended in 1492.

Today, as a tourist attraction that receives 2 million visitors a year, the Alhambra gardens demonstrate the economic benefits of aesthetic considerations in city planning.

They also illustrate that making a beautiful park a specific focus in a city benefits the city environment by providing relief from the city itself.

The City as an Environment

- A city changes the landscape
  - Also changes the relationship between biological and physical aspects of the environment
  - Pollution, water management, or climate

The Energy Budget of a City

- The city exchanges energy with its environment by
  1. Absorption and reflection of solar energy
  2. Evaporation of water
  3. Conduction of air
  4. Winds (air convection)
  5. Transport of fuels into the city and burning of fuels by people within the city
  6. Convection of water (subsurface and surface stream flow)

The Urban Atmosphere and Climate

- Cities affect the local climate
  - Generally less windy than nonurban areas
    - Buildings obstruct the flow of air
    - But buildings can also channel the wind
  - Receives less sunlight than the countryside
    - High particulates in the atmosphere over cities
  - In spite of the reduced sunlight, cities are warmer than surrounding areas
    - Urban Heat island

The Urban Atmosphere and Climate

- Form heat islands for two reasons
  - Increased heat from the burning of fossil fuels and other industrial and residential activities
  - Lower rate of heat loss
    - Buildings and paving materials act as solar collectors

The Urban Atmosphere and Climate

- A city also typically receives less sunlight than the countryside because of the particulates in the atmosphere over cities—often over ten times more particulates than in surrounding areas.

- Despite reduced sunlight, a city is a heat island, warmer than surrounding areas, for two reasons:

(1) the burning of fossil fuels and other industrial and residential activities and

(2) a lower rate of heat loss, partly because buildings and paving materials act as solar collectors

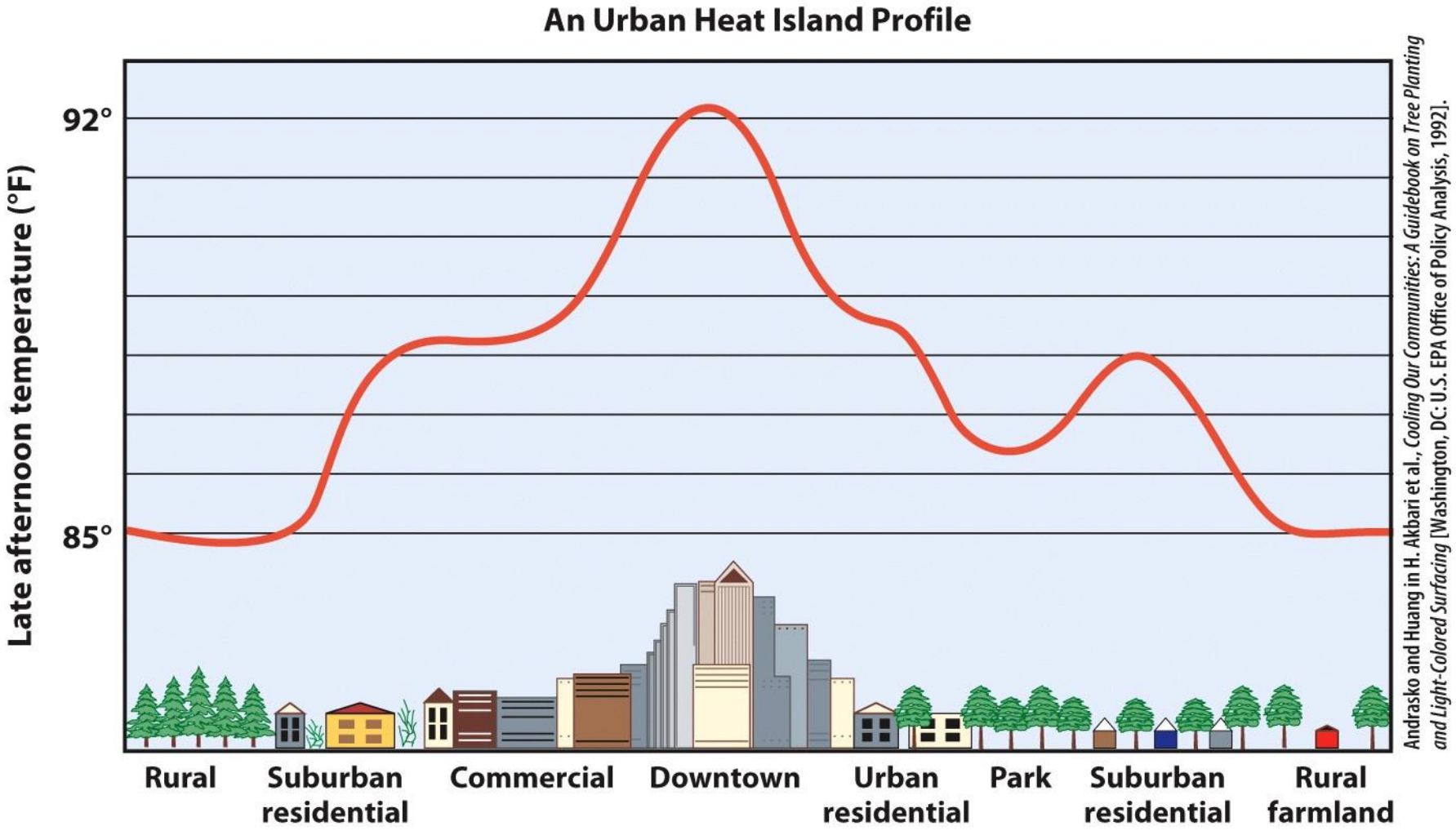


Figure 22.11 A typical urban heat island profile. The graph shows temperature changes correlated with the density of development and trees.

Solar Energy in Cities

- Passive solar energy
  - Used in Greece, Rome and China
  - Overlooked in America and Europe because of cheap fossil fuels
  - Importance beginning to be appreciated again
- Photovoltaic devices now used in many cities

Water in the Urban Environment

- Streets and sidewalks add to heat island effect by preventing water in the soil from evaporating to atmosphere (cools natural ecosystem)
- Paved city streets and city buildings are impermeable
  - Most rain runs off into storm sewers
- Water in the soil prevented from evaporating to the atmosphere
  - Process cools natural ecosystems
  - Adds to heat island effect
- Chances of flooding increase both within the city and downstream

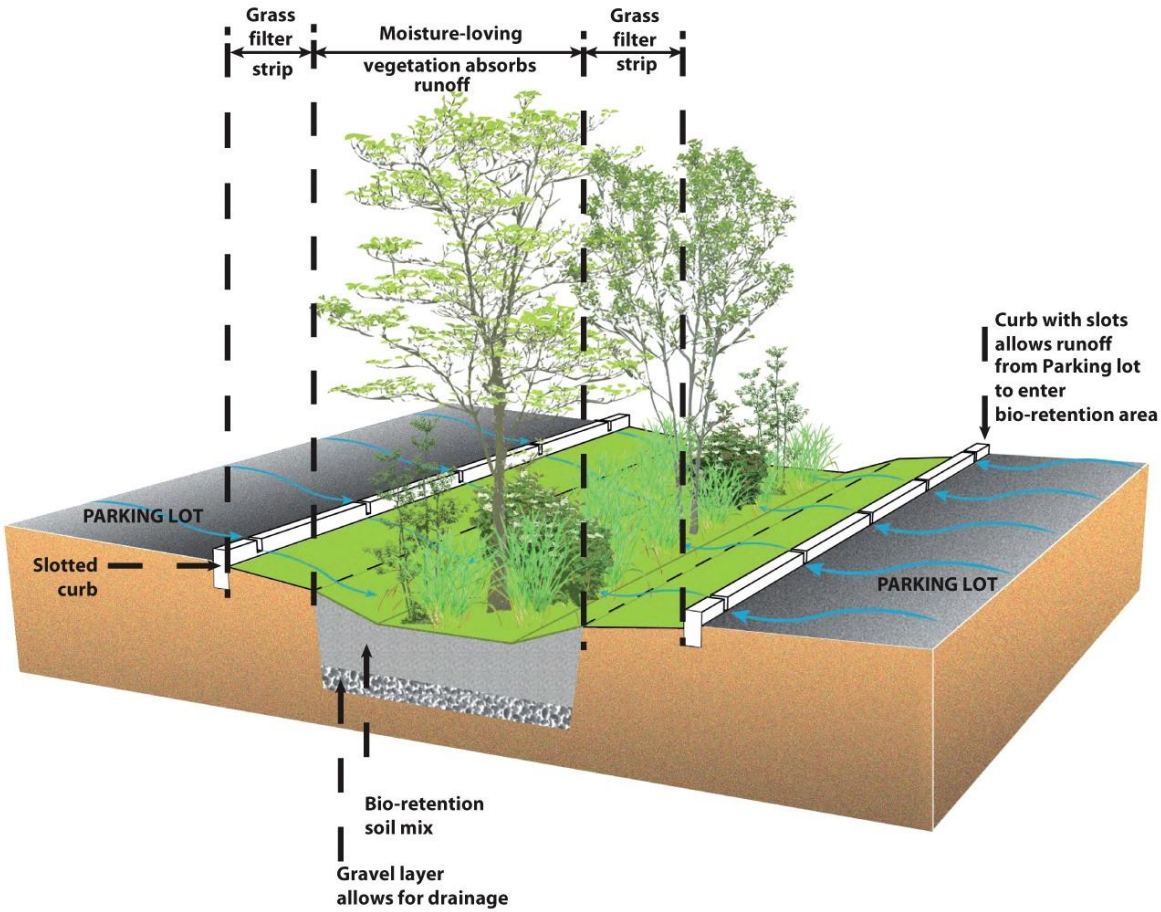


Figure 22.12 Planned for better drainage.

A plan for the Alexandria, Virginia, central library parking lot includes wetland vegetation and soils that temporarily absorb runoff from the parking lot (see arrows).

The landscape architecture firm of Rhodeside & Harwell planned the project.

A curb, is the edge where a raised sidewalk or road median/central reservation meets a street or other roadway.

New, ecological methods of managing storm water (water that originates during precipitation events and snow/ice melt) can alleviate problems

Bioretention Systems

A bioretention system consists of a soil bed planted with suitable non-invasive (preferably native) vegetation.

Stormwater runoff entering the bioretention system is filtered through the soil planting bed before being either conveyed downstream by an underdrain system or infiltrated into the existing subsoil below the soil bed.

Vegetation in the soil planting bed provides uptake of pollutants and runoff and helps maintain the pores and associated infiltration rates of the soil in the bed.

Source: https://njstormwater.org/bmp_manual/NJ_SWBMP_9.1%20print.pdf

Water in the Urban Environment

- Most cities have a single underground sewage system
  - During times of no rain or light rain
    - Moves mostly sewage
  - During periods of heavy rain
    - Runoff is mixed with the sewage
    - Can exceed the capacity of sewage-treatment plants
    - Sewage may be emitted downstream without sufficient treatment

Because of reduced evaporation, midlatitude cities generally have lower relative humidity (2% lower in winter to 8% lower in summer) than the surrounding countryside.

At the same time, cities can have higher rainfall than their surroundings because dust above a city provides particles for condensation of water vapor.

Some urban areas have 5–10% more precipitation and considerably more cloud cover and fog than their surrounding areas.

Fog is particularly troublesome in the winter and may impede ground and air traffic.

Soils in the City

- A modern city has a great impact on soils
- City soils may become
  - Compacted
  - Waterlogged
  - Impervious (impermeable) to water flow
  - Lack organic matter
- Some cities built on fill
  - Unconsolidated and not well suited for building foundations
  - Vulnerable to earthquakes

Pollution in the City

- Pollutants are concentrated in cities
- City dwellers are exposed to
  - Toxic chemicals in higher concentrations
  - Human-produced noise, heat, and particulates
- Lives are shortened by an average of one to two years in the most polluted cities in the U.S.

Pollution in the City

- Sources of urban pollution
  - Motor vehicles
  - Stationary power sources
  - Home heating
  - Industry
- Primary sources of particulate air pollution
  - Older, coal-burning power plants
  - Industrial boilers
  - Gas- and diesel-powered vehicles

Bringing Nature to the City

- A practical problem for planners and managers of cities
- Evolved into several specialized professions
  - Urban forestry
  - Landscape architecture
  - City planning
  - Civil engineering specializing in urban development

Design with Nature

- The new town of Woodlands, a suburb of Houston, Texas, is an example of professional planning. Woodlands was designed so that most of its houses and roads were on ridges; the lowlands were left as natural open space.
- The lowlands provide areas for temporary storage of floodwater and, because the land is unpaved, allow rain to penetrate the soil and recharge the aquifer for Houston.
- Preserving the natural lowlands has other environmental benefits as well. In this region of Texas, low-lying wetlands are habitats for native wildlife, such as deer.
- Large, attractive trees, such as magnolias, grow here, providing food and habitat for birds.
- The innovative city plan has economic as well as aesthetic and conservational benefits

Cities and Their Rivers

- Rivers valued for transportation and waste disposal
- New view of rivers i cities
  - Make city life more pleasant
  - Conserve of nature
  - Example—Hudson River Park in NYC

Photo by Daniel B. Botkin

Figure 22.13 The newly built Hudson River Park on Manhattan's West Side illustrates the changing view of rivers and the improved use of riverfronts for recreation and urban landscape beauty.

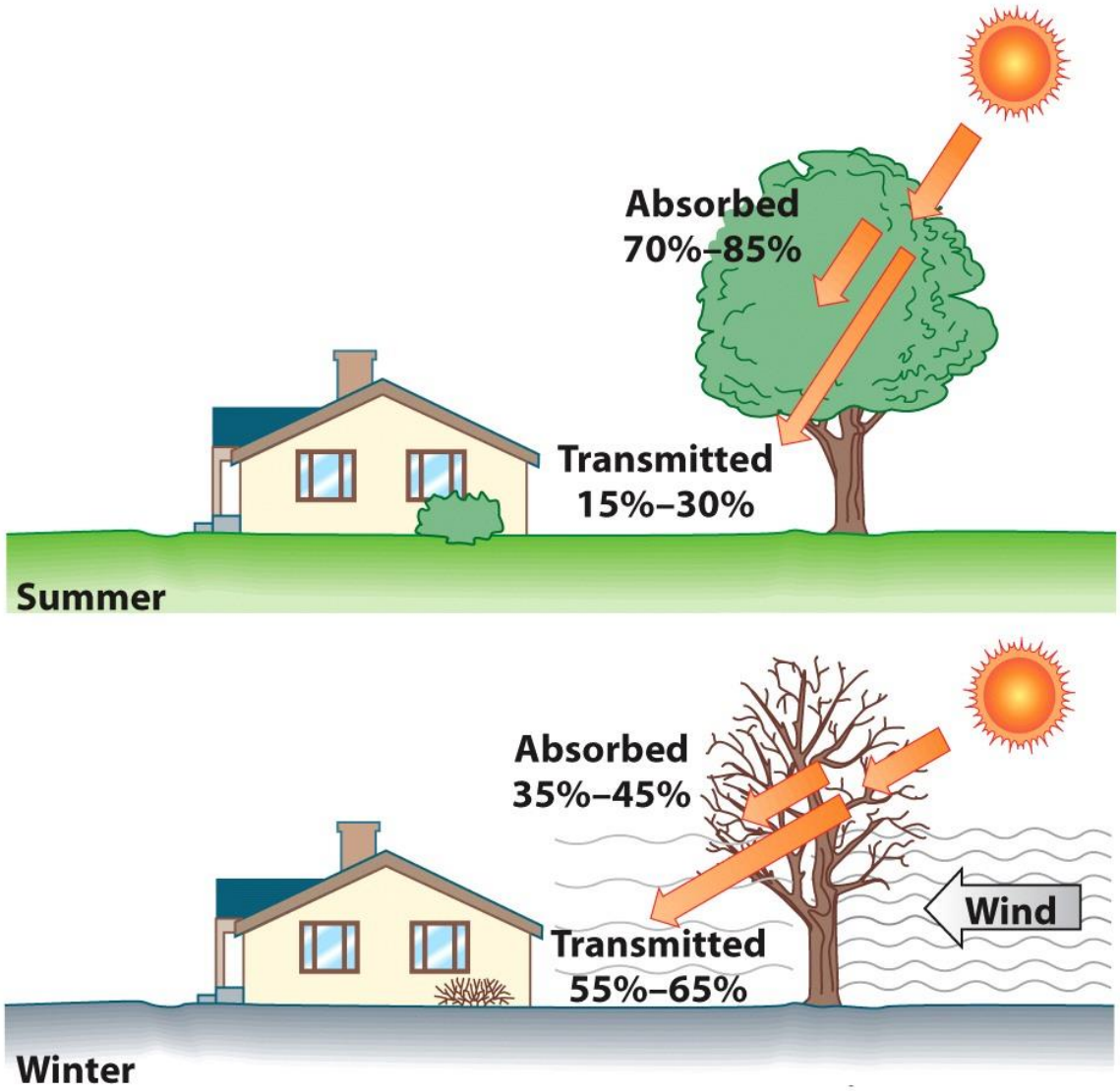
Vegetation in Cities

- Plants fill different needs in different locations
  - Shade
  - Places for quiet contemplation
  - Block noise
  - Complex shapes and structures create solitude
  - Provide habitats for wildlife
- Paris and London among the first cities to plant trees along streets

Figure 22.14 Paris was one of the first modern cities to use trees along streets to provide beauty and shade, as shown in this picture of the famous Champs-Elysées.

Vegetation in Cities

- Used to soften the effects of climate near houses
  - Rows of conifers (north side) planted to the north of a house can protect it from winter winds
  - Deciduous trees (south side) to the south can provide shade in the summer, yet allowing sunlight to warm the house in the winter



J. Huang and S. Winnett, in H. Akbari et al., *Cooling Our Communities: A Guidebook on Tree Planting and Light-Colored Surfacing* [Washington, DC: U.S. EPA Office of Policy Analysis, 1992].)

Figure 22.15 Trees cool homes. Trees can improve the microclimate near a house, protecting the house from winter winds and providing shade in the summer while allowing sunlight through in the winter.

Vegetation in Cities

- Vegetation in cities must be tolerant to stress
  - Root systems lack access to water and air and are more likely to suffer from extremes
  - Some species sensitive to air pollution (ozone)
  - Dust interferes with gas exchange
  - Subject to physical damage
- Lifetime of city trees usually shorter than rural counterparts
- Cities can even provide habitat for endangered plants
- trees along city streets are often surrounded by cement, and because the soils tend to be compacted and drain poorly, the root systems are likely to suffer from extremes of drought on the one hand and soil saturation (immediately following or during a rainstorm) on the other.
- The solution to this particular problem is to specially prepare streets and sidewalks for tree growth

Plants and trees in Cities (Weeds)

- Some species of trees are more useful and successful in cities than are others. An ideal urban tree would be resistant to all forms of urban stress, have a beautiful form and foliage, and produce no messy fruit, flowers, or leaf litter that required removal. In most cities, in part because of these requirements, only a few tree species are used for street planting.

- Cities, of course, have many recently disturbed areas, including abandoned lots and the medians in boulevards and highways. Disturbed areas provide habitat for early successional plants, including many that we call "weeds," which are often introduced (exotic) plants, such as European mustard.

Urban Wilds

The falcons disappeared when DDT and other organic pollutants caused a thinning of their eggshells and a failure in reproduction, but they have been reintroduced into the city

there is growing recognition that urban areas can be modified to provide habitats for wildlife that people can enjoy. This can be an important **method of biological conservation**

- We can divide city wildlife into the following categories:
  1. Those species that cannot persist in an urban environment and disappear
  2. Those that tolerate an urban environment but do better elsewhere
  3. Those that have adapted to urban environments, are abundant there, and are either neutral or beneficial to human beings
  4. Those that are so successful they become pests (irritant, nuisance)

Urban Wilds

- Cities provide homes for many forms of wildlife
  - Example—Cooper's hawks (medium sized hawk) in Tucson—population is increasing
- Cities can provide physical structures and necessary resources for many plants and animals
  - Can identify ecological food chains in cities
  - Artificial structures can be sufficiently similar to original habitat
    - Example—Chimney swifts (sooty gray bird)
- Cities can be home to rare or endangered species
  - Example—Peregrine falcons

Urban Wilds

- Conservation of wildlife in cities
- Rivers and their riparian zones (interface between land and river or stream), ocean shorelines, and wooded parks provide habitat
- Can design wildlife habitat
  - Urban kitchen gardens provide habitat for endangered hummingbirds
  - City Zoo, marine wildlife, city seaport, city parks
  - Urban drainage structures can be designed as wildlife habitat
  - Urban corridors-modified to promote wildlife – to mitigate natural routes

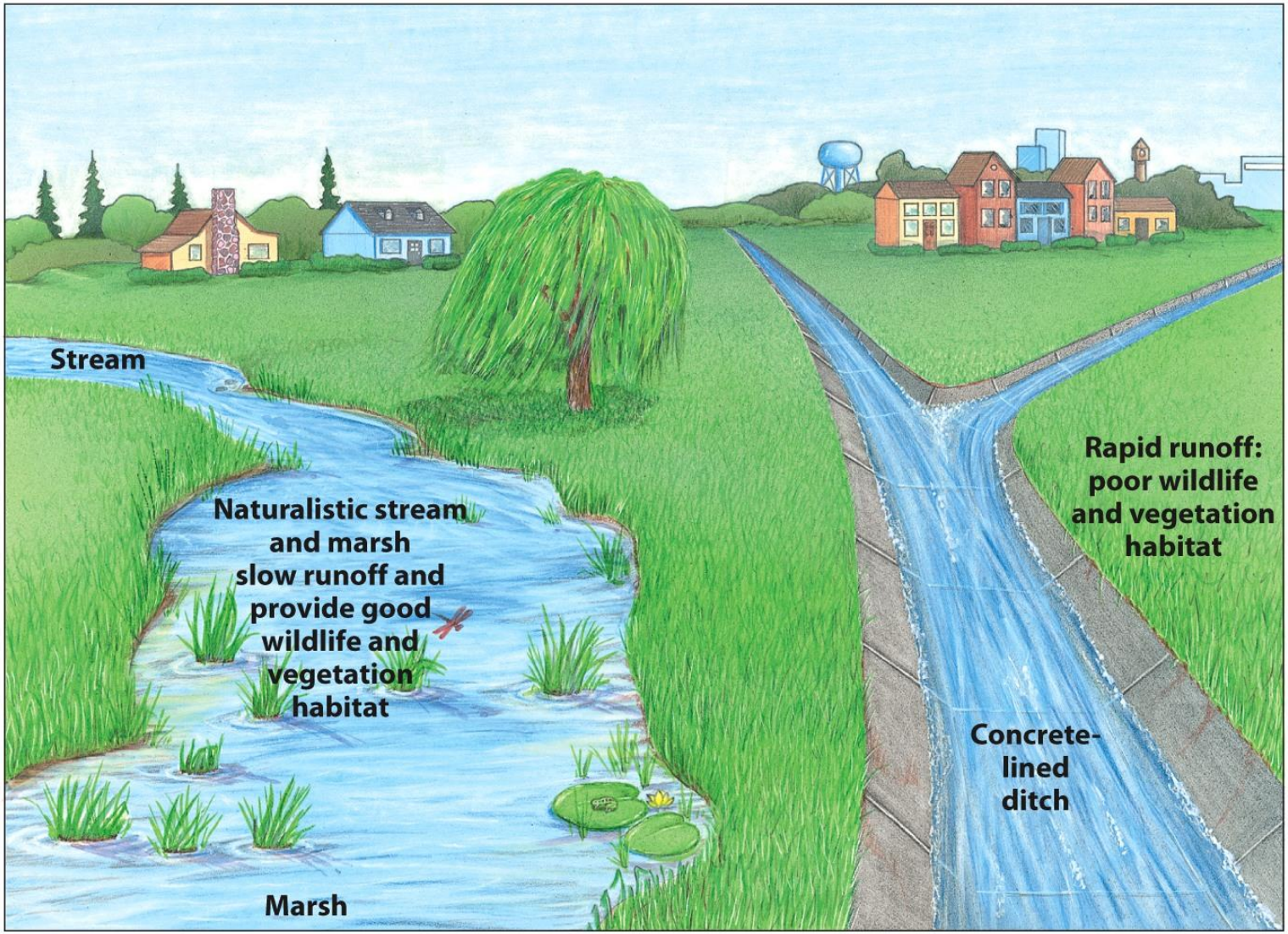


Figure 22.17 Water drainage systems in a city can be modified to provide wildlife habitat in the community

Animal Pests

- In gardens and parks, pests include insects, birds, and mammals that feed on fruits and vegetables and destroy foliage (leaves) of shade trees.
- Pests compete for food and spread diseases (Bubnonic plague from rodents from bacterium *Yersinia pestis*).
- Most common city pests are cockroaches, fleas, termites, rats and pigeons
  - Compete with people for food
  - Spread diseases
- Animals that survive best in cities have certain characteristics
  - Generalists in their food choice
  - High reproductive rate
  - Short average lifetime

Animal Pests

- An animal is a pest to people when it is in an undesired place at an undesirable time doing an unwanted thing.

- A termite in a woodland helps the natural regeneration of wood by hastening decay and speeding the return of chemical elements to the soil, where they are available to living plants.

- But termites in a house are pests because they threaten the house's physical structure.

Controlling Pests

- Control pests by recognizing how they fit their natural ecosystem and identifying their natural controlling factors
- Often assumed that the only way to control animal pests is with poisons
  - Species can develop resistance, which can lead to rebound
- Key to controlling pests is to eliminate their habitats

Chapter Summary

- As an urban society
  - We must recognize the city's relation to the environment
  - A city influences and is influenced by its environment
  - A city is an environment itself
- Like any other life-supporting system
  - A city must maintain a flow of energy
  - Provide necessary material resources
  - Have ways of removing wastes
- Such functions accomplished through transportation and communication with outlying areas

Chapter Summary

- Because cities depend on outside resources, they developed only when human ingenuity resulted in modern agriculture and thus excess food production
- The history of cities divides into four stages
  - Stage 1—the rise of towns
  - Stage 2—the era of classic urban centers
  - Stage 3—the period of industrial metropolises
  - Stage 4—the age of mass telecommunication, computers, and new forms of travel

Chapter Summary

- City locations strongly influenced by environment
  - Cities are not located at random
  - Cities in places of particular importance and environmental advantage
  - A city's site and situation are both important
- A city creates an environment that is different from surrounding areas
  - Cities change local climate
  - Cities commonly cloudier, warmer, and rainier than surrounding areas
- In general, life in a city is riskier because of higher concentrations of pollutants and pollutant-related diseases

Chapter Summary

- Cities favor certain animals and plants
  - Natural habitats in city parks and preserves will become more important as wilderness shrinks
- Trees are an important part of urban environments
  - Cities place stresses on trees
  - Especially important are the condition of urban soils and the supply of water for trees
- Cities can help to conserve biological diversity, providing habitat for some rare and endangered species in some instances

Chapter Summary

- As the human population continues to increase, we can envision two futures
  - One in which people are dispersed widely throughout the countryside and cities are abandoned except by the poor
  - One in which cities attract most of the human population, freeing much landscape for conservation of nature, production of natural resources, and public-service functions of ecosystems

Presentations
26th April, 2018 (5 pm to 8 pm)
MS Civil Engineers Students (Environmental Science for Civil Engineers)

Roll Nos.	Names	Title of Presentation	
14L-5603	Ahsan Naeem	Mineral Resources and Reserves Environmental Impacts	
14L-5603	Arslan Khan	Integrated Waste Management Reduce, Reuse, Recycle	
15L-5154	Fakhar Abbas	Municipal Solid-Waste Management Composition of Solid Waste, Onsite Disposal	
16L-5151	Ali Shan	Life of A Plastic Water Bottle	
16L-5153	Bilal	Municipal Solid-Waste Management Composting, Incineration	
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