

The Ecological Capital of Brazil

- This chapter examines the urban environment from a system perspective.
- The case study highlights the success story of Curitiba, Brazil, a city that grew from 300,000 in 1950 to 1.5 million.
- By 1970 the city was in trouble, but a visionary mayor turned the city around with improvements in mass transportation, provision of decent low cost housing, and green spaces.
- The success of Curitiba demonstrates the importance of urban planning.

CITY LIFE

- About 75% of the U.S. population now lives in an urban area, and there is growing interest in revitalizing U.S. cities.
- Globally, about 45% of the total population is urbanized and the percentage is expected to grow to 62% by 2025.
- Economic development leads to urbanization.
- About 75% of people in developed nations are urbanized compared to only 38% in developing nations.
- By 2015 there will be 36 megacities with populations exceeding 8 million, most of them will be in Asia.
- Urban areas present ecological challenges, but they also present opportunities.

A CLOSER LOOK: Venice Sinking

- Venice is a UN World Heritage site renowned for its architectural beauty, and it is slowly slipping beneath Venice lagoon.
- Founded more than 1000 years ago, the city is sinking because of sea level rise and pumping of ground water.
- Today many studies are being done about how to save Venice. Its future is uncertain.

THE CITY AS A SYSTEM

- Cities need to be understood as ecological systems.
- Cities are very complex systems of social networks and resource supply networks (food, water, energy, products).

- A city is not a self-sustaining system as it requires inputs for the surrounding countryside.
- Cities also must supply products.
- *One could view a system as a living organism that requires energy and resources and produces outputs, including waste.*
- The average city resident in an industrial country uses annually about 208,000 kg of water, 660 kg of food, and 2,1466 kg of fossil fuel and produces 1,660,000 kg of sewage, 660 kg of solid waste and 200 kg of air pollutants.

Two alternative futures exist

- One in which cities are managed so as to minimize negative environmental impacts and maximize social benefits
- And one in which cities are allowed to become polluted and decay, sending the population on an ever expanding migration away from the core.

The City as a System

- A city influences and is influenced by its environment
- A city must:
 - Maintain a flow of energy
 - Provide necessary material resources
 - Have ways of removing waste
- Accomplished through transportation and communication with outlying areas

Importance of Site and Situation

- The location of a city is influenced by:
 - *Site*: the summation of all environmental features of that location
 - *Situation*: the placement of a city in respect to other areas
 - Ex) fall line

SITUATION: THE LOCATION OF CITIES

- The spatial distribution of cities is non random.
- They develop where they do because of special circumstances such as the availability of local resources, transportation, or for political reasons.

- Site and situation have strong impacts on the development and importance of cities.
- A city's *situation* is its placement with respect to other areas, resources, etc.

SITE: THE LOCATION OF CITIES

- A city's *site* is its local environment, which may not always be favorable (e.g. Venice, Italy).
- Most early cities in the U.S. developed along the fall line of *major rivers* for purposes of energy and access to transportation (situation).
- *Transportation* has been a major driver in the development of many of the world's great cities.
- Ideally, cities should have ideal sites and situations, but that is often not the case.
 - For example, New Orleans has a good situation but a poor site (it is largely below sea level).
- A city's environment or its site characteristics can be altered by technology.
- Using the example of New Orleans again, pumps that work around the clock and dikes protect the city from flooding, most of the time.

A CLOSER LOOK: Cities and the Fall Line

- A fall line occurs on a river where there is an abrupt drop in elevation, creating waterfalls or rapids.
- The mid- and south-Atlantic states have a fall line that separates the Piedmont from a broad coastal plain.
- It is along the fall line that waterpower is available and where most of our important colonial cities developed.

4 CITY PLANNING AND THE ENVIRONMENT

Many cities grew with a conscious plan, and many of those that did had two dominant themes: defense and beauty (fortress and park cities).

- Parks have become important elements in cities.
- Olmsted designed Central Park in NYC as a place for psychological and physiological relief from city life, and vegetation was one of the keys.
- Instead of preservation, Olmsted added ponds and created a landscape pattern.

- Central Park is an example of 'design with nature.' Olmsted also designed much of Boston's landscape, adding holding ponds for tidal flooding, restoring a salt marsh, rerouting sewage, and added tidal gates to the Charles River.
- The control of water became an aesthetic design element. An extension of Olmsted's design with nature concept was Howard's 1902 garden city concept in which the city was surrounded by a greenbelt and where planning of countryside and city were integrated.
- Both concepts influence city planning today.

A CLOSER LOOK: A Brief History of City Planning

- Two dominant themes in urban planning have been defense and beauty.
- Cities such as Rome and Granada are known for their beauty.
- Cities such as Carcasone in France were developed as walled fortresses.

A CLOSER LOOK: Design with Nature

- Knowledge of urban ecology is paying off in the design of new cities.
 - Woodlands, TX is an example.
- The city was designed so that the homes and roads were on ridges, and the lowlands were left as natural open space for the temporary storage of floodwater.
- The lowlands also provide habitat for flora and fauna, and is aesthetically pleasing.

THE CITY AS AN ENVIRONMENT

- A city has a great impact on its immediate environment.
- For example, a city alters the energy budget of its landscape by modifying the absorption and reflection of solar energy, evaporation of water, conduction of air, wind, convection of water, and combustion of fuel.
- Consequently, the local climate is modified.
- Cities are warmer than surrounding areas (heat island effect).

THE CITY AS AN ENVIRONMENT (cont)

- Use of solar energy for heating was once common, but was replaced by cheap fossil fuel.
- It is now coming back in some places.
- Cities have a large impact on the water cycle by increasing the amount of impervious surface, and therefore runoff.

- Storm sewers collect runoff.
- This decreases infiltration and ET, which decreases evaporative cooling and humidity.
- Many cities now are discouraging the spread of new impervious surfaces.
- This is done sometimes by setting a tax rate proportional to the amount of impervious surface area.
- Cities also are using artificial wetlands to hold runoff, which serves three purposes:
 - Water treatment, decreased runoff, and aesthetics.
- Cities also can have higher rainfall amounts; fog and cloud cover because dust particles in the air serve as condensation nuclei.

THE CITY AS AN ENVIRONMENT (cont)

- Many cities are build on flood plains, which often requires the construction of levees to protect against river flooding.
- The levees affect the hydrology of the entire river, and worsen the flooding along other unprotected sections of the river.
- An alternative is to use the floodplain for parks or for multiple uses that can tolerate periodic flooding.
- Urban soils are highly modified by pavements and toxic substances like heavy metals. Many urban soils are 'made land' or sols made from fill. Fill soil is unconsolidated and vulnerable to shaking from earthquakes.
- Everything in a city is concentrated, including pollutants.
- Urbanites are exposed to more kinds of toxic chemicals in higher concentrations and more noise than their rural counterparts and the average lifespan of urbanites is shorter.
- Pollution sources include motor vehicles, stationary power sources, home heating, and industry.
- It is impossible to eliminate exposure to pollutants, but exposure can be minimized through proper urban planning.

The History of a City

- 4 Stages:
 - The rise of towns

- The era of classic urban centers
- The period of industrial metropolises
- The age of mass telecommunication, computers and new forms of travel

A CLOSER LOOK: An Environmental History of Cities

- Cities developed in parallel with agriculture 1000's of years ago.
- Prior to agriculture people were nomadic.
- As improvements in agriculture and transportation were made, the population density of urban areas expanded.
- The population size of an urban area is limited by water and food.
- The future of our cities depends on our ability to plan and to conserve and use resources wisely.

BRINGING NATURE TO THE CITY

- Bringing nature into the city is a practical problem.
- Riparian cities can integrate waterfront, which is a natural magnet for people and has helped with the renewal of a number of cities from Austin to Providence.
- The use of trees provides not only aesthetics but benefits the microclimate.
- However, the vegetation in cities must be carefully selected to tolerate the different kinds of stresses that an urban environment imposes, including pollution and drought stress.

BRINGING NATURE TO THE CITY (cont)

- With the exception of some birds and small mammals (e.g. squirrels), most forms of wildlife in cities are considered pests.
- There are species that cannot persist in urban environments and disappear, species that tolerate urban environments but do better elsewhere, and species that thrive in urban environments.
- Species that do too-well become pests.
- Many animals adapt to urban environments and manage to find suitable habitat and alternative foods (e.g. road kill).
- There are species that are very beneficial such as the peregrine falcon that now nest on skyscrapers and prey on pest species.
- Cities can be better managed to encourage the beneficial wildlife species

BRINGING NATURE TO THE CITY (cont)

- Pests include insects, birds, and mammals. Some can spread disease.
- The Bubonic plague, spread by fleas found on rodents is an example.
- The best way to control them is using knowledge of their urban ecology to identify and exploit their vulnerabilities.
- City Planning for Defense and Beauty

City Planning

- Formal, conscious planning for new cities
- 2 themes of city planning: defense and beauty

Diagrams from Textbook:

- The City as an Environment
- Energy budget
- Urban atmosphere and climate
- Solar energy
- Water
- Soils (made lands)
- Pollution

Bringing Nature to the City

- Cities favor certain animals and plants
- Trees are important to urban environments
- Cities help conserve biological diversity

CRITICAL THINKING ISSUE

- Urban sprawl is a growing problem in the United States that a number of cities are attempting to solve.
 - For example, the City of Boulder created the 'blue line' which is a line that follows the 1,761 m contour on the map above which the city will not extend water or sewer service.

- Boulder has also used a portion of its sales tax to purchase land to create a greenbelt around the city, and it has capped the growth rate of new residences at 2% per year.
- These policies have reduced sprawl immediately around Boulder and have reduced growth, but they have spawned an increase in population growth of nearby cities where housing is more affordable and have increased the number of commuters.
- Is a city a closed or open system?
- Do Boulder's policies have positive or negative feedback on growth?
- Are these policies elitist?
- How would you solve the problem of sprawl?

Web Resources

- <http://www.urbanecology.org.au/links/>
- This site gives links to assorted EcoCities, EcoVillage, EcoTransport, etc. web pages.
- <http://www.pbs.org/wnet/nature/wildside/index.html>
- Home page of the PBS Nature series featuring urban ecology.