Ch. 26 - Sustainable Cities
Urban Land Use and Management

How Fast are Urban Areas Growing?

For more than 6,000 years, cities (often called the cradles of civilization) have been centers of commerce, communication, technological developments, education, religion, social change, political power, and progress. They have also been centers of crowding, pollution, and disease.

For almost 300 years, since the beginning of the industrial revolution, cities have been growing rapidly in size. They are now called urban areas - towns or cities plus their adjacent suburban fringes with populations of more than 2,500 people.

A rural area is usually defined as an area with a population of less than 2,500 people.

A country's degree of urbanization is the percentage of its population living in an urban area. Urban growth is the rate of increase of urban populations. Between 1950 and 1998, the number of people living in the world's urban areas increased 12-fold, from 200 million to 2.6 billion. By 2025 it is projected to reach 5.5 billion, almost equal to the world's current population.

About 90% of this urban growth will occur in developing countries. At current rates the world's population will double in 47 years, the urban population in 22 years, and the urban population of developing countries in 20 years.

Several trends are important in understanding the problems and challenges of urban growth on this rapidly urbanizing planet.

The proportion of the global population living in urban areas increased between 1850 and 1998 from 2% to 44%. This degree of urbanization varies in major areas of the world.

During the 1990s, more than 70% of the world's population increase is expected to occur in urban areas. By 2025 about 63% of the world's people will be living in urban areas. The number of large cities is mushrooming. By 2025, there will be at least 400 cities with populations of more than 1 million.

• Developing countries, with 36% urbanization, contain 1.7 billion urban dwellers- more than the total populations of Europe, North America, Latin America, and Japan combined. The urban population in developing countries is growing at 3.5% per year and they are projected to reach at least 57% urbanization by 2025.

• In developed countries, urban growth is less than 1% per year, much slower than in developing countries. Still, developed countries should reach 84% urbanization by 2025.

• Poverty is becoming increasingly urbanized as more poor people migrate from rural to urban areas.

At least 1 billion people, 17% of the world's current population, live in the crowded slums of inner cities or in vast, mostly illegal squatter settlements and shantytowns, where people move onto undeveloped land and build shacks made of packing crates, plastic sheets, corrugated metal pipes, or whatever they can find. In Manila, Philippines, for example, some 20,000 people live in city dumps in shacks built on huge mounds of garbage and burning industrial waste.
In 1984 the world's worst industrial accident occurred at the Union Carbide factory in Bhopal, India. The release of toxic gas killed at least 5,100 people and caused at least 200,000 serious injuries.

About 100 million people are homeless and sleep on the streets. Half of all urban children under age 15 in developing countries live in conditions of extreme poverty, and about 1/5 of them are street children with little or no family support.

In Villa El Salvador outside Lima, Peru, for example, a network of women's groups and neighborhood associations planted half a million trees, trained hundreds of door-to-door health workers, and built 300 community kitchens, 150 day-care centers, and 26 schools. Illiteracy has fallen to 3% - one of the lowest rates in Latin America, and infant mortality is 40% below the national average.

What causes urban growth?

• Urban populations grow in 2 ways: by natural increase (more births than deaths) and by immigration (mostly from rural areas).
• Improved food supplies and better sanitation and health care in urban areas lower the death rate and cause urban populations to grow.

• Modern mechanized agriculture, for example, uses fewer farm laborers and allows large landowners to buy out subsistence farmers who cannot afford to modernize.

• Urban growth in developing countries is also fueled by government policies that distribute most income and social services to urban dwellers at the expense of rural dwellers.

Case Study: Mexico City

• Mexico City is the world's 4th most populous city. • Immigration is the main reason for Mexico City's high rate of population growth. • Mexico City suffers from severe air pollution, high unemployment (close to 50%), deafening noise, congestion, and a soaring crime rate.

• At least 8 million people have no sewer facilities.

• Air pollution is intensified because the city lies in a basin surrounded by mountains, and frequent thermal inversions trap pollutants at ground level.

What are the major urban problems in the US?

Since 1920, many of the worst urban environmental problems in the US have been significantly reduced.

The biggest problems facing numerous cities in the US are:

- Deteriorating services
- Aging infrastructures (streets, schools, bridges, housing, sewers)
- Budget crunches from lost tax revenues and rising costs as businesses and more affluent people move out
- Rising poverty in many central city areas

What are the major spatial patterns of urban development?

• A **concentric-circle city** develops outward from its central business district (CBD) in a series of rings as the area grows in population and size. Ex. NYC

• A **sector city** grows in pie-shaped wedges or strips. Growth sectors develop when commercial, industrial, and housing districts push outward from the CBD along major transportation routes. Ex. the large urban area extending from San Francisco to San Jose, California

• A **multiple-nuclei city** develops around a number of independent centers, or satellite cities, rather than a single center, e.g., L.A.

Urban Resource and Environmental Problems

The 44% of the world's people currently living in urban areas occupy only about 5% of the planet's land area but consume 75% of the world's resources. Some analysts call for seeking more sustainable relationship between cities and the living world. To do this will require converting high-waste, unsustainable cities with a linear metabolism (based on an ever increasing throughput of resources and output of wastes) to low-waste, sustainable cities with a circular metabolism (based on efficient use of resources, reuse, recycling, pollution prevention, and waste reduction).

One city tree provides over $57,000 worth of air conditioning, erosion and storm water control, wildlife shelter, and air pollution control over a 50-year lifetime.

Urban gardens currently provide about 15% of the world's food and this proportion could be increased.

What are the water supply problems of cities?

Many cities have water supply and flooding problems. As cities grow and their water demands increase, expensive reservoirs and canals must be built and deeper wells drilled.

Many cities are built on floodplain areas subject to natural flooding. Floodplains are considered prime land for urbanization because they are flat, accessible, and near rivers.

What are the pollution problems of cities?

Urban residents are generally subjected to much higher concentrations of pollutants than are rural residents.

In the developing world, it is estimated that 90% of all sewage is discharged into rivers, lakes, and coastal waters without treatment of any kind. In Latin America, 98% of the urban sewage receives no treatment.

According to the World Bank, at least 220 million people in the urban areas of developing countries don't have safe drinking water.

How do urban and rural climates differ?

Urbanization alters the local (and sometime the regional) climate.

The enormous amounts of heat generated by cars, factories, furnaces, lights, air conditioners, and people in cities create an **urban heat island** surrounded by cooler suburban and rural areas. The dome of heat also traps pollutants, especially tiny solid particles, creating a dust dome above urban areas. If wind speeds increase, the dust dome elongates downwind to form a dust plume, which can spread the city's pollutants for hundreds of kilometers.

How serious is noise pollution?

Most urban dwellers are subjected to excessive noise. According to the U.S. Environmental Protection Agency, nearly half of all Americans, mostly urban residents, are regularly exposed to noise pollution.

Noise pollution is any unwanted, disturbing, or harmful sound that impairs or interferes with hearing, causes stress, hampers concentration and work efficiency, or causes accidents.

Harmful effects from prolonged exposure to excessive noise include permanent hearing loss, high blood pressure, muscle tension, migraine headaches, higher cholesterol levels, gastric ulcers, irritability, insomnia, and psychological disorders, including increased aggression.

5 Major Ways to Control Noise:

1. Modify noisy activities and devices to produce less noise
2. Shield noisy devices or processes
3. Shield workers or other receivers from the noise
4. Move noisy operations or things away from people
5. Use anti-noise, a new technology that cancels out one noise with another

How does urban life affect human health?

Urban areas have beneficial and harmful effects on human health

Many aspects of urban life benefit human health, including better access to education, social services, and medical care. In many parts of the world urban populations live longer and have lower infant mortality rates than do rural populations

On the other hand, high-density city life increases the spread of infectious diseases (especially if adequate drinking water and sewage systems are not available), physical injuries (mostly from industrial and traffic accidents), and health problems caused by increased exposure to pollution and noise.

How does urban growth affect nearby rural land and small towns?

Another problem is the loss of rural land, fertile soil, and wildlife habitats as cities expand.

Each year in the U.S. about 526,000 hectares of rural land (mostly prime cropland and forestland) is converted to urban development, right-of-way, highways, and airports.

According to a 1997 study by the American Farmland Trust, the United States may lose 13% of its prime farmland by 2050.

Transportation and Urban Development

Who has most of the world's motor vehicles? There are 2 main types of ground transportation:

- **Individual** - such as cars, motor scooters, bicycles, and walking
- **Mass** - mostly buses and rail systems

About 89% of the world's 501 million cars and trucks are in developed countries. Despite such production, only about 8% of the world's population own cars, and only 10% can afford to. Despite having only 4.6% of the world's people, the U.S. has 35% of the world's cars and trucks. Motor scooters produce more air pollution than cars. Most burn a mixture of oil and kerosene in small, inefficient, and noisy engines that emit clouds of air pollution. Because they are cheap, their numbers are increasing three times faster than cars and trucks in developing countries.

Is riding bicycles the answer?

Globally, bicycles outsell cars by almost 3 to 1 because most people can afford a bicycle whereas fewer than 10% can afford a car.

In China, at least 50% of urban trips are made by bicycle and the government gives subsidies to those who bicycle to work.

Only about 2% of commuters in the U.S. bicycle to work, even though half of all U.S. commutes are less than 8 kilometers. However, according to recent polls, 20% of Americans say they would bicycle to work if safe bike lanes were available and if their employers provided secure bike storage and showers at work.

Case Study: Mass Transit in the U.S.

In the U.S. mass transit accounts for only 3% of all passenger travel, compared with 15% in Germany and 47% in Japan.

In 1917, all major U.S. cities had efficient electric trolley or streetcar systems.

Rail systems, usually operated by electric engines, fall into 3 categories:

- **Rapid rail** (also called the underground, tube, metro, or subway), which operates on exclusive rights-of-way in tunnels or on elevated tracks.
- **Suburban or regional trains**, which connect the central city with surrounding areas or provide transportation between major cities in a region
- **Light rail** (such as trolleys) or trams, more modern versions of streetcars, which can run either with other traffic or on exclusive rights-of-way.

Pros and Cons:

Rail systems are much more energy-efficient, produce less air pollution, cause fewer injuries and deaths, and take up less land than highway and air transport.

However, such train systems are efficient only where many people live along a narrow corridor and can easily reach properly spaced stations.

Pros and Cons of High-Speed Regional Trains

For every kilometer of travel, such trains consume only one-third as much energy per rider as a commercial airplane and one-sixth as much as a car carrying only one driver.

High-speed train systems are expensive to run and maintain, however, and they must operate along heavily used transportation routes to be profitable.

Pros and Cons of Buses:

Bus systems require less capital and have lower operating costs than heavy-rail systems.

However, because they must offer low fares to attract riders, bus systems often cost more to operate than they bring in.

Currently, U.S. drivers pay low gasoline taxes that are used to build roads and other transportation infrastructures, but these taxes cover only 60-69% of the total costs.

It's estimated that heavy trucks cause 95% of all damage to U.S. highways, with one heavy truck causing as much highway wear and tear as 9,600 cars. According to a study by the World Resources Institute, federal, state, and local government automobile subsidies in the United States amount to $300-600 billion a year.

Urban Land-Use Planning and Control

What is conventional land-use planning?

Most urban areas and some rural areas use some form of land-use planning to determine the best present and future use of each parcel of land in the area. Zoning regulations or other means are then used to control how the land is used.

A major reason for this often destructive process is that in the U.S. 90% of the revenue that local governments use to provide schools, police and fire protection, public water and sewer systems, and other public services comes from property taxes levied on all buildings and property based on their economic value.

What is Ecological Land-use planning?

Environmentalists urge communities to use comprehensive, regional ecological land-use planning, in which additional variables are integrated into a model designed to anticipate a region's present and future needs and problems. It is a complex process that takes into account geological, ecological, economic, health and social factors.

6 steps are involved:

1. Make an environmental and social inventory.
2. Identify and prioritize goals.
3. Develop individual and composite maps.
4. Develop a master composite.
5. Develop a master plan.
6. Implement the master plan.

How can land use be controlled?

The most widely used approach to control the uses of various parcels of land by legal and economic methods is zoning, in which various parcels of land are designated for certain uses.

To reduce auto use and the costs of providing services for cars, cities have:

Developed an efficient mass transportation system

Used zoning to encourage high-density development along major transit lines

Allowed mixed development of offices, shops, and residences in the same area

Placed a ceiling on downtown parking spaces

Solutions: Making Urban Areas More Livable and Sustainable

What Urban Maintenance and Repair Problems does the United States face?

America's older cities have enormous maintenance and repair problems, most of them aggravated by decades of neglect Some 39% of America's bridges are unsafe. About 56% of the paved highways in the U.S. are in poor or fair condition and need expensive repairs.

Maintenance, repair and replacement of existing U.S. bridges, roads, mass transit systems, water supply systems, sewers, and sewage treatment plants during the next decade could cost a staggering $2 trillion or more, an average expenditure of $2.1 million per minute during the next 10 years.

How can urban open space be preserved?

One way to provide open space and control urban growth is to surround a large city with a **greenbelt**: an open area used for recreation, sustainable forestry, or other nondestructive uses.

Some cities have converted abandoned railroad rights-of-way and dry creek beds into bicycle, hiking, and jogging paths, often called greenways.

Pros and Cons of Building New Cities and Towns:

Although urban problems must be solved in existing cities, building new cities and towns could take some of the pressure off overpopulated and economically depressed urban areas.

There are 3 types of towns:

Satellite towns: located fairly close to an existing large city

Freestanding new towns: located far from any major city

In-town new towns: located within existing urban areas

New towns rarely succeed without government financial support. Some don't succeed even then, primarily because of poor planning and management.

How can we make cities more sustainable?

In a sustainable and ecologically healthy city, called an ecocity or green city, people walk or cycle for most short trips; they walk or bike to bus, metro, or trolley stops for longer urban trips.

Ways to make existing and new suburbs more sustainable and livable include:

Giving up big lawns

Building houses and apartments in small, dense clusters so that more community open space is available

Developing a town center that is a focus of civic life and community cohesiveness

Planting lots of new trees and not cutting down existing ones

Discouraging excessive dependence on the automobile and encouraging walking and bicycling

Case Study: Chattanooga, Tennessee

In the 1950s Chattanooga was known as one of the dirtiest cities in the U.S.

Since the mid-1980s the combined efforts of thousands of Chattanooga citizens have helped clean up the city's air, revitalize its river front, and diversify its economy.

How can we improve urban living?

The primary problem is not urbanization, but our failure to make most cities more sustainable and livable and to provide economic support for rural areas.