



## Chapter 10:

# Indicators of the Condition and Use of Urban and Suburban Areas

Thinking of America's cities and suburbs as an ecosystem does not come automatically to many people. "Ecosystems" are usually defined by plants, animals, naturally occurring attributes like landscape type, and the interaction among these elements. People, by contrast, create cities and suburbs, and it is the built environment—houses, office buildings, factories, roads, sidewalks, piers, parking lots—that defines them. Although they occupy less than 2% of the land area of the lower 48 states, cities and suburbs are home to more than 75% of all Americans. Characterized by a great many people living in a very small area, much of it covered by a variety of hard surfaces, cities and suburbs nevertheless provide a range of goods and services not unlike those provided by the other, more "natural," ecosystems. In fact, 20% of urban and suburban land is forest, farmland, wetlands, or grassland and shrubland; streams run through cities and suburbs, and many cities lie on the coast. It is in this unconventional ecosystem that people interact most often with nature.

### What can we say about the condition and use of urban and suburban areas?

Fifteen indicators describe the condition and use of urban and suburban areas. Partial or complete data are available for six of these indicators. Only one (air quality) has a long enough data record to judge trends, while four can be compared to a regulatory standard or guideline. For five indicators, data are not available for reporting on a national basis, and four indicators require additional development before it will be possible to assess the availability of data.

After the following brief summaries of the findings and data availability for each indicator, the remainder of this chapter consists of the indicators themselves. Each indicator page offers a graphic representation of the available data, defines the indicator and explains why it is important, and describes either the available data or the gaps in those data.

### System Dimensions

Five key indicators describe the dimensions of the urban/suburban system. The first and most basic is how much land these areas occupy, and how much is developed or remains as forest, grassland or shrubland, or other undeveloped land. A second indicator, still requiring development, would track conversion of land from rural to suburban. Three other indicators provide further detail on the character of urban and suburban lands. One tracks the size of the patches of forest, grasslands and shrublands, and other natural areas that provide green space and wildlife habitat; a second tallies the fraction of urban and suburban lands covered by asphalt, buildings, and other impervious surfaces that prevent the penetration of rainfall and on which plants cannot grow. A final measure will track the percentage of urban streams that are lined with vegetation, which can have a significant effect on water quality and which also serves as wildlife habitat.

- **How much land do "urban and suburban areas" occupy? How much of this land is developed, and how much is forest, grasslands and shrublands, wetlands, and croplands?** In 1992, urban and suburban areas, as defined by this report, accounted for about 32 million acres in the lower 48 states, or about 1.7% of total land area. About 22% of urban and suburban land in the South, Northeast, and West was undeveloped; in the Midwest, this figure was 17%.
- **How are patterns of development changing at the boundary between suburban and rural areas?** When suburban development expands into rural areas, the pattern of development—how dense or spread out it is; how transportation, water, sewer, and other infrastructure are integrated, and so



on—can affect both wildlife and people living in and around newly developed areas. This indicator requires further development.

- **How large are patches of “natural” lands (forests, grasslands and shrublands, and wetlands), which provide green space and wildlife habitat?** Natural lands are important for urban and suburban recreation and quality of life, and they are also important as wildlife habitat. The value of these patches for both people and wildlife can be affected by their size. About half of all natural lands in urban and suburban areas are in patches smaller than 10 acres. A progressively smaller percentage are found in larger patches—nationally, less than 5% of urban/suburban natural lands are found in patches of 1,000 acres or more.
- **How much of urban and suburban areas is covered with buildings, concrete, asphalt, and other “hard,” or impervious, surfaces?** Places that have a higher percentage of impervious surfaces often have more, and dirtier, runoff, than places with less “hard” surface. Data are not adequate for national reporting on this indicator.
- **What fraction of urban and suburban stream banks are vegetated?** Vegetation along streams can reduce the effects of runoff and serve as wildlife habitat. This indicator requires further development.

### Chemical and Physical Conditions

As is the case for several of the other systems, many of the indicators of chemical and physical condition of urban and suburban areas focus on streams. Because streams receive runoff from the land surface, they are powerful indicators of conditions on that land surface. Two indicators track concentrations of nitrate and phosphorus, nutrients that can, in excess, cause problems. A third indicator tracks contaminants such as pesticides, PCBs, and heavy metals in stream water and soils, while a fourth tracks urban air quality, particularly concentrations of ozone, a key component of smog. Finally, one indicator, requiring further development, tracks the differences in temperature between cities and their surrounding regions.

- **How much nitrate is there in urban and suburban streams?** Nitrate is an important plant nutrient, but it also contributes to water quality problems. Nitrate in drinking water is a health threat for young children, and it must be removed at significant cost by municipalities that rely on river water. Sources of nitrate include sewage treatment plants, animal wastes, and fertilizers. About 60% of urban and suburban stream sites tested have concentrations of nitrate below 1 part per million (ppm); all samples were below the federal drinking water standard of 10 ppm. No trend data are available, but nitrate levels are lower in urban/suburban streams than in streams in agricultural areas, but higher than in forest streams.
- **How much phosphorus is there in urban and suburban streams?** About two-thirds of urban and suburban stream sites had phosphorus levels of at least 0.1 part per million, the upper limit recommended by the Environmental Protection Agency to prevent nuisance algae growth in fresh waters. Phosphorus concentrations in urban and suburban streams are similar to those in farmland streams, and much higher than those in forest streams. Sources of phosphorus in urban streams include sewage treatment plants, animal wastes, some detergents, and fertilizers.
- **How common are air pollution (ozone) levels that exceed federal guidelines in urban and suburban areas?** In 1999 about 55% of monitoring stations in urban and suburban areas recorded high ozone levels on at least 4 days, a number that generally triggers violations of federal air quality regulations. Throughout the 1990s, about 50% of monitoring stations recorded high ozone levels on at least 4 days each year. During the same period, the number of monitors recording high levels on 25 or more days per year declined, to about 5% in 1999.
- **What levels of contaminants (primarily artificial compounds and heavy metals) are found in stream water and soil?** All urban and suburban stream sites had at least one chemical that exceeded guidelines for protection of aquatic life, and 5% of sites had contaminants that exceeded human health standards or guidelines. About 85% of stream sites in urban and suburban areas had an



average of at least five detectable contaminants throughout the year. Data are not adequate to report on contamination in soils in urban and suburban areas.

- **How much hotter are urban and suburban areas than less developed areas nearby?** Asphalt, concrete, and other constructed materials in developed areas absorb solar energy, often leading to higher temperatures than in undeveloped areas. This can raise summertime cooling costs and cause human health problems where air conditioning is not available. This indicator requires further development.

### Biological Components

The biological condition of urban and suburban regions is captured by three indicators. The first reports the percentage of presettlement species that are now rare or missing from urban areas. The second tracks the number of disruptive species, like white-tailed deer and Tartarian honeysuckle. The third indicator, also used in the freshwater system, compares the fish and bottom-dwelling communities in urban and suburban streams to those in relatively undisturbed streams.

- **How many of the plants and animals that once inhabited areas that are now urban and suburban are locally at risk or absent?** Conversion of land from rural to urban or suburban is often accompanied by declines in the populations of native plants and animals or loss of species. These declines and losses may be influenced by the kind and amount of development, and by how sensitive different species are to disruption. Data are not adequate for national reporting on this indicator.
- **Are there more or fewer “disruptive species,” like white-tailed deer and Scotch broom, in urban and suburban areas?** Disruptive species are those that—whether they are native or non-native—cause problems for people, property, or wildlife. For example, deer are so numerous in some suburban areas that damage to gardens, car accidents, and increased incidence of Lyme disease have become serious political, health, and safety issues. Data are not adequate for national reporting on this indicator.
- **What is the condition of fish and bottom-dwelling animals in urban/suburban streams?** Modifying a stream, through pollution, changes to the streambed or bank, flow modification, or other means can change the number and diversity of fish and bottom dwelling animals. Data are not adequate for national reporting on this indicator.

### Human Use

Natural areas in cities and suburbs provide many benefits to people. The most basic measure of the potential for such benefits is the amount of public open space per resident. A second indicator would tally natural ecosystem services, such as purifying air and water, lowering energy consumption, and reducing stormwater runoff.

- **How much public open space is there per urban/suburban resident?** Open space is valued by many urban dwellers for recreation and general “quality of life” reasons. Data are not adequate for national reporting on this indicator.
- **What other important natural ecosystem services are provided by urban and suburban areas?** Undeveloped lands provide a variety of services of value to people, including purification of stormwater by forested areas and wetlands and cooling and noise reduction by shade trees. This indicator requires further development.

### What do we mean by the “urban and suburban ecosystem”?

Urban and suburban areas are those places where most of the land is devoted to buildings, houses, roads, concrete, grassy lawns, and other elements of human use and construction.

This system spans a range of density, from high-rise-dominated downtowns to the suburban fringe, where residential tract development gradually thins to a rural landscape. This transition is neither



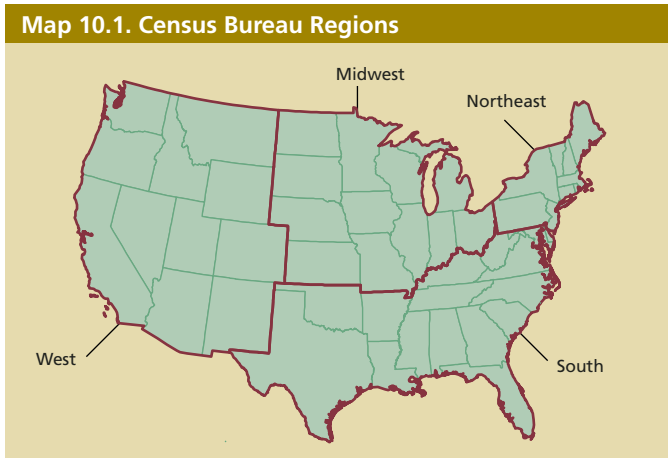
smooth nor uniform. At this outer edge, new developments—some quite dense—may appear in otherwise rural areas and leave intervening areas undeveloped, at least for a time.

This report uses a newly developed approach to define urban and suburban lands. It relies upon the physical characteristics of the land, rather than population density, as is commonly done, and employs two basic criteria. First, a substantial portion of the land must be covered with buildings, roads, concrete, and the like, and second, these areas must be sufficiently large (about 270 acres or more) to be considered “urban / suburban.” This method excludes scattered or isolated areas such as small settlements, large parking lots, or single residences, but includes large “natural” areas, such as city parks, which are surrounded by otherwise-urban lands. Details of the methods used for identifying these areas are provided in the Area of Urban and Suburban Lands technical note (p. 264).

### A Note about Undeveloped Lands in Urban and Suburban Areas

Three indicators describe undeveloped urban and suburban lands (Area of Urban and Suburban Lands; Patches of Forest, Grassland and Shrubland, and Wetlands; and Publicly Accessible Open Space per Resident). Since these indicators focus on different aspects of undeveloped land, they count different types of such lands. In the Area of Urban and Suburban Lands indicator (p. 181), we classify forests, croplands (including pastures), grasslands and shrublands, and wetlands as “undeveloped lands.” In the Patches of Forest, Grassland and Shrubland, and Wetlands indicator (p. 183), we focus on “natural” lands, a subset of undeveloped lands that includes forests, grasslands and shrublands, and wetlands, but not croplands or pastures. Finally, in the per capita open space indicator (p. 194), we report on all lands that are publicly accessible, as long as they are not paved. This includes publicly accessible forests, grasslands and shrublands, and wetlands (natural lands), but also areas such as parks with manicured

lawns, ballfields, beaches, and the like. Farms, which provide significant amounts of open space in many areas, are generally privately owned and not typically accessible to the general public.



### A Note about Regions

Two indicators—Area Of Urban and Suburban Lands (p. 181) and Patches of Forest, Grassland and Shrubland, and Wetlands (p. 183)—are reported on the basis of multistate regions adopted by the Census Bureau (Map10.1). While the data presented for these indicators do not include Alaska and Hawaii, the Census Bureau includes these states in the

Western region; when data on Alaska and Hawaii become available, future reports will include them in this region. The air quality indicator is presented in map form. Several other indicators would, if data were available, also be presented in regional or map form.

Finally, many of the indicators included in this report would probably require local financial resources and expertise, which may not be available for all areas meeting the “urban and suburban” definition we used. Therefore, several indicators—Urban Heat Island (p. 190) and Species Status (p. 191), among others—are presented on the basis of the “percent of all metropolitan areas,” which is intended to imply that the reporting will be focused on major cities and their surrounding areas. Implementing these indicators might best be achieved by identifying a suite of metropolitan areas (perhaps defined by size or population) to serve as the basis for national and regional reporting.