

# The Increasing Influence of Urban Environments on US Forest Management

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ABSTRACT

The expansion of urban land promises to have an increasingly significant influence on US forest management in the coming decades. Percent of the coterminous United States classified as urban increased from 2.5% in 1990 to 3.1% in 2000, an area about the size of Vermont and New Hampshire combined. Patterns of urban expansion reveal that increased growth rates are likely in the future. The most urbanized regions of the United States are the Northeast (9.7%) and the Southeast (7.5%), with these regions also exhibiting the greatest increase in percent urban land between 1990 and 2000. Forests near urban communities face a special set of challenges that will only intensify as these communities grow in area, population, and complexity.

**Keywords:** urban forests, urban forestry, urban growth, forest sustainability

Urban areas are having an ever increasing impact on local, regional, and global environments. In the United States, these areas continue to extend outward, altering or displacing forests, agricultural fields, and other valued open spaces. This process of urbanization is likely to be one of the greatest influences on forests in the 21st century. Forest Service Chief Dale Bosworth has noted that one major threat to forest sustainability “is loss of open space. Urban sprawl, transportation corridors, and changes in forest ownership are fragmenting the forest estate. That makes it difficult to meet the multiple demands on forests, even though the total forestland base is stable” (Bosworth 2003).

As urbanization of our landscapes increases across the country, so does the importance of urban forests, which include all the trees and associated resources within urban communities. These forests are in close proximity to the vast majority of the US

population and significantly influence human health and environmental quality in and around US cities and towns. Because of their significant interactions with the US population, urban and community forests are likely to influence people’s attitudes toward forests and their management across the landscape, potentially making them some of the most influential forests of the 21st century.

As stated more than 20 years ago, “all forestry is becoming urban forestry in the sense that it must respond to urban perceptions and needs” (Vaux 1980). This article investigates changes in the extent and growth patterns of urban areas across the United States during the past 10 years and discusses the implications of this expansion for management of both urban and exurban forests. Through a better understanding of urbanization and its influence on forests, forest management can be improved to meet the growing needs of a changing society.

## Urban Area Definition

To analyze changes in the amount of urban land, the boundaries of urban areas need to be identified. Urban area was defined using the new US Census Bureau’s urban definition of all territory, population, and housing units located within either urbanized areas or urban clusters (US Census Bureau 2003). Urbanized area and urban cluster boundaries encompass densely settled territories, which generally consist of

- A cluster of one or more block groups or census blocks with a population density of at least 1,000 people per square mile.
- Surrounding block groups and census blocks with a population density of 500 people per square mile.
- Less densely settled blocks that form enclaves or indentations or are used to connect discontinuous areas (US Census Bureau 2003).

Urbanized areas consist of densely settled territory that contains 50,000 or more people; urban clusters consist of densely settled territory that has at least 2,500 people but fewer than 50,000 people. This new definition tends to be more restrictive than the 1990 census urban definition (Dwyer et al. 2000, Nowak et al. 2001). To help assess change in urban land, the new definition of urban was applied to both the 1990 and the 2000 census data based on census Tiger Line Data from the US Census Bureau (2004). The urban definition includes some land that is typically considered suburban.

To identify the types of land cover that

**Table 1. Urban land (2000) in the United States and changes (1990–2000), by state.**

| State             | Urban (1990)       |      | Urban (2000)       |      | Growth (1990–2000) |     | Percent urban rank (2000) <sup>a</sup> |
|-------------------|--------------------|------|--------------------|------|--------------------|-----|--|
|                   | (km <sup>2</sup> ) | (%)  | (km <sup>2</sup> ) | (%)  | (km <sup>2</sup> ) | (%) |  |
| RI                | 862                | 30.2 | 1,026              | 35.9 | 164                | 5.7 | 2                                      |
| NJ                | 6,280              | 31.2 | 7,304              | 36.2 | 1,024              | 5.1 | 1                                      |
| CT                | 3,947              | 30.6 | 4,591              | 35.5 | 643                | 5.0 | 3                                      |
| MA                | 6,218              | 29.2 | 7,273              | 34.2 | 1,055              | 5.0 | 4                                      |
| DE                | 572                | 10.9 | 787                | 15.0 | 215                | 4.1 | 6                                      |
| MD                | 3,873              | 14.3 | 4,680              | 17.3 | 807                | 3.0 | 5                                      |
| FL                | 12,518             | 8.3  | 16,260             | 10.8 | 3,742              | 2.5 | 7                                      |
| NC                | 6,573              | 5.0  | 9,219              | 7.1  | 2,645              | 2.0 | 11                                     |
| PA                | 8,803              | 7.5  | 11,048             | 9.4  | 2,245              | 1.9 | 9                                      |
| GA                | 6,888              | 4.5  | 9,700              | 6.4  | 2,812              | 1.8 | 13                                     |
| NH                | 1,048              | 4.4  | 1,465              | 6.1  | 417                | 1.7 | 15                                     |
| SC                | 3,672              | 4.6  | 4,832              | 6.0  | 1,160              | 1.4 | 16                                     |
| OH                | 8,923              | 8.3  | 10,394             | 9.7  | 1,471              | 1.4 | 8                                      |
| TN                | 4,848              | 4.4  | 6,304              | 5.8  | 1,456              | 1.3 | 19                                     |
| IN                | 4,599              | 4.9  | 5,761              | 6.1  | 1,162              | 1.2 | 14                                     |
| VA                | 5,069              | 4.8  | 6,160              | 5.9  | 1,091              | 1.0 | 17                                     |
| MI                | 7,272              | 4.8  | 8,817              | 5.8  | 1,546              | 1.0 | 18                                     |
| IL                | 7,846              | 5.4  | 9,325              | 6.4  | 1,479              | 1.0 | 12                                     |
| HI                | 757                | 4.5  | 909                | 5.4  | 152                | 0.9 | 20                                     |
| NY                | 9,169              | 7.2  | 10,277             | 8.1  | 1,108              | 0.9 | 10                                     |
| CA                | 17,600             | 4.3  | 20,584             | 5.0  | 2,984              | 0.7 | 21                                     |
| AL                | 3,683              | 2.8  | 4,617              | 3.4  | 934                | 0.7 | 23                                     |
| WA                | 4,418              | 2.5  | 5,534              | 3.1  | 1,116              | 0.6 | 24                                     |
| LA                | 3,650              | 3.0  | 4,315              | 3.5  | 665                | 0.5 | 22                                     |
| KY                | 2,604              | 2.5  | 3,151              | 3.0  | 547                | 0.5 | 25                                     |
| WI                | 3,539              | 2.4  | 4,293              | 3.0  | 754                | 0.5 | 26                                     |
| TX                | 14,991             | 2.2  | 18,515             | 2.7  | 3,524              | 0.5 | 27                                     |
| WV                | 1,180              | 1.9  | 1,462              | 2.3  | 283                | 0.5 | 29                                     |
| AZ                | 3,099              | 1.0  | 4,347              | 1.5  | 1,247              | 0.4 | 35                                     |
| MO                | 4,069              | 2.3  | 4,728              | 2.6  | 659                | 0.4 | 28                                     |
| MS                | 1,986              | 1.6  | 2,426              | 2.0  | 440                | 0.4 | 30                                     |
| AR                | 1,897              | 1.4  | 2,357              | 1.7  | 460                | 0.3 | 32                                     |
| MN                | 3,477              | 1.6  | 4,087              | 1.9  | 610                | 0.3 | 31                                     |
| CO                | 2,630              | 1.0  | 3,298              | 1.2  | 668                | 0.2 | 37                                     |
| VT                | 327                | 1.3  | 384                | 1.5  | 56                 | 0.2 | 34                                     |
| OK                | 2,621              | 1.4  | 3,008              | 1.7  | 387                | 0.2 | 33                                     |
| OR                | 2,182              | 0.9  | 2,664              | 1.1  | 482                | 0.2 | 39                                     |
| NV                | 873                | 0.3  | 1,409              | 0.5  | 535                | 0.2 | 44                                     |
| KS                | 1,876              | 0.9  | 2,242              | 1.1  | 366                | 0.2 | 40                                     |
| NM                | 1,425              | 0.5  | 1,949              | 0.6  | 524                | 0.2 | 42                                     |
| UT                | 1,424              | 0.6  | 1,789              | 0.8  | 365                | 0.2 | 41                                     |
| IA                | 1,893              | 1.3  | 2,117              | 1.5  | 224                | 0.2 | 36                                     |
| ME                | 818                | 1.0  | 922                | 1.1  | 104                | 0.1 | 38                                     |
| ID                | 817                | 0.4  | 1,055              | 0.5  | 238                | 0.1 | 45                                     |
| NE                | 1,017              | 0.5  | 1,184              | 0.6  | 167                | 0.1 | 43                                     |
| ND                | 325                | 0.2  | 377                | 0.2  | 53                 | 0.0 | 47                                     |
| MT                | 574                | 0.2  | 675                | 0.2  | 100                | 0.0 | 48                                     |
| SD                | 384                | 0.2  | 436                | 0.2  | 52                 | 0.0 | 46                                     |
| WY                | 389                | 0.2  | 438                | 0.2  | 48                 | 0.0 | 49                                     |
| AK                | 498                | 0.0  | 685                | 0.0  | 187                | 0.0 | 50                                     |
| US48 <sup>b</sup> | 194,908            | 2.5  | 239,742            | 3.1  | 44,833             | 0.6 | NA                                     |
| US50 <sup>c</sup> | 196,164            | 2.1  | 241,336            | 2.6  | 45,173             | 0.5 | NA                                     |

<sup>a</sup> State ranking based on percent of state classified as urban in 2000.

<sup>b</sup> Total km<sup>2</sup> or % urban for the lower 48 states, including District of Columbia.

<sup>c</sup> Total km<sup>2</sup> or % urban for all 50 states, including District of Columbia.

NA, not applicable.

were converted to urban land, 1992 national land cover characterization data (US Geological Survey 2003) were overlaid with urban expansion zones (1990–2000). The land cover types analyzed were forest, agriculture, developed, woody wetland, herbaceous wetland, and others (see Table 3).

### Current Extent of Urban Areas

In 2000, 3.1% of the coterminous United States was classified as urban. Including Alaska and Hawaii, 2.6% of the total United States is classified as urban. The states with the highest percent urban land

are New Jersey (36.2%), Rhode Island (35.9%), Connecticut (35.5%), and Massachusetts (34.2%). Seven of the top 10 most urbanized states are in the Northeast region (Table 1). In comparing urban land by US region (Table 2), the Northeast is the most urbanized (9.7%), followed by the Southeast (7.5%).

### Urban Growth (1990–2000)

Urban land in the coterminous United States increased from 2.5% in 1990 to 3.1% in 2000 (Table 1). States with the greatest

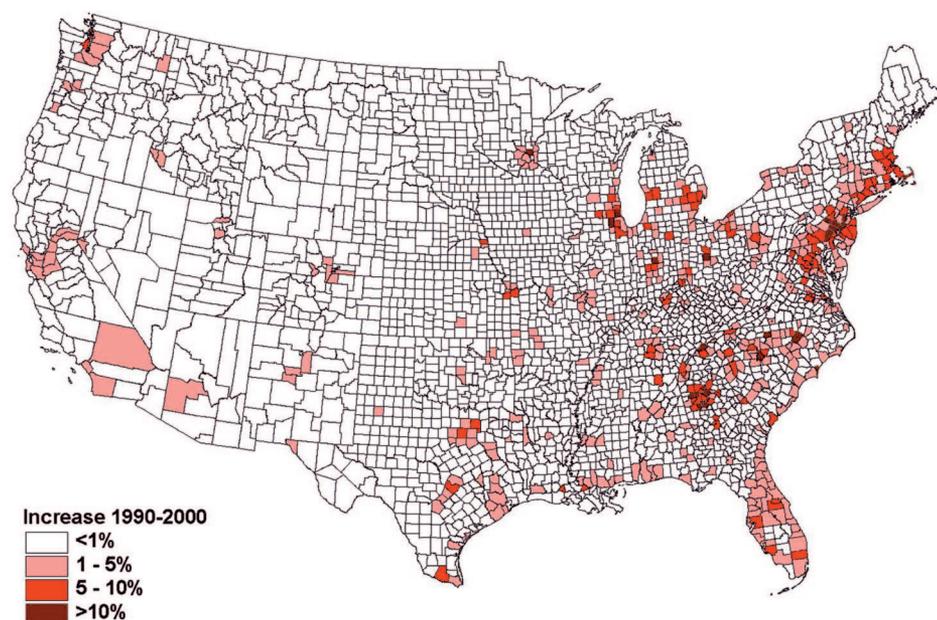
increase in percent urban land between 1990 and 2000 were Rhode Island (5.7%), New Jersey (5.1%), Connecticut (5.0%), Massachusetts (5.0%), Delaware (4.1%), Maryland (3.0%), and Florida (2.5%; Table 1).

Seven of the 10 states with the greatest increase in percent urban land are in the Northeast; the other three states are in the Southeast (Table 1). Much of the increase in the percent urban land by county is clustered in specific areas of the Southeast, Midwest, Northwest, and California, but is particularly evident along the Northeastern Sea-

**Table 2. Urban area and urban growth (1990–2000) by region within the lower 48 United States.**

| Region <sup>a</sup> | Urban 2000 (%) | Increase in percent urban (1990–2000) (%) | Percent increase in urban (1990–2000) (%) | Urban growth (1990–2000) (km <sup>2</sup> ) |
|---------------------|----------------|---|---|---|
| Northeast           | 9.7            | 1.5                                       | 18.8                                      | 8,120                                       |
| Southeast           | 7.5            | 1.8                                       | 33.0                                      | 11,450                                      |
| California          | 5.0            | 0.7                                       | 17.0                                      | 2,984                                       |
| North Central       | 4.2            | 0.7                                       | 19.0                                      | 7,905                                       |
| South Central       | 2.8            | 0.5                                       | 23.2                                      | 8,412                                       |
| Pacific Northwest   | 1.9            | 0.4                                       | 24.2                                      | 1,598                                       |
| Rocky Mountains     | 0.7            | 0.2                                       | 33.2                                      | 3,727                                       |
| Great Plains        | 0.5            | 0.1                                       | 17.7                                      | 637   |
| Total               | 3.1            | 0.6                                       | 23.0                                      | 44,833                                      |

<sup>a</sup> States within region: California, CA; Great Plains, KS, NE, ND, and SD; North Central, IN, IL, IA, MN, MI, MO, OH, and WI; Northeast, CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VT, and WV; Pacific Northwest, OR and WA; Rocky Mountains, AZ, CO, ID, MT, NV, NM, UT, and WY; South Central, AL, AR, KY, LA, MS, OK, TN, and TX; Southeast, FL, GA, NC, SC, and VA.



**Figure 1. Increase in percent urban land (1990–2000) by county.**

board (Figure 1). In the aggregate, the Southeast had the greatest increase in percent urban land between 1990 and 2000 (1.8% of the land area), followed by the Northeast (1.5%; Table 2).

The increase in percent urban land within counties (1990–2000) tended to increase with percent of the county classified as urban in 1990, with counties with 40–60% urban land having the greatest increase in percent urban land (Figure 2). This pattern suggests that as a county increases in percent urban land, the increase in percent urban land over time also increases. This increasing percent urban land tends to occur until the county is mostly urbanized and then the increase in percent urban slows because most of the available land is already urban and there is relatively little room to expand. This

pattern helps explain why the most urbanized states in the Northeast (1990) are also the states with the greatest increase in percent urban land between 1990 and 2000.

This pattern of urban expansion seems reasonable because as urban areas grow, the frontier of urbanization on which growth occurs becomes proportionally larger. Consider the example of an expanding circle. If a 1-in.-diameter circle increases by 1 in. to a 2-in.-diameter circle, the area of the circle increases from 0.79 to 3.14 in.<sup>2</sup>, a 2.35-in.<sup>2</sup> increase. However, if a 2-in. circle increases the same amount (1 in.), its area increases from 3.14 to 7.07 in.<sup>2</sup>, a 3.93-in.<sup>2</sup> increase. As the area of the circle increases and the borders extend outward the same distance, more area is encompassed by the expansion. This difference suggests that substantial ur-

ban growth is likely to continue to occur in many parts of the United States as the boundaries of urban areas continue to expand in the coming decades.

## Land Cover Types Affected by Urban Growth

As urban lands expand into surrounding areas, natural resources often are affected or displaced. Between 1990 and 2000, most of the urban expansion across the United States occurred in forested (33.4% of the expansion) or agricultural (32.7%) land (Table 3). Within each state, urban areas expanded into various cover types in differing proportions. States where greater than 60% of urban land expansion occurred in forests were Rhode Island (64.8% of urban expansion), Connecticut (64.1%), Georgia (64.0%), Massachusetts (62.9%), West Virginia (62.2%), and New Hampshire (61.3%). States where greater than 60% of urban land expansion occurred in agricultural lands were Nebraska (68.9%), Indiana (66.8%), Illinois (64.8%), and Wisconsin (62.0%). The largest proportion of woody wetland areas encompassed by urban expansion was in Florida (14.4%), New Jersey (8.6%), and Rhode Island (7.9%), and expansion into herbaceous wetland areas was most common in Minnesota (7.4% of urban expansion), Maine (6.3%), and Florida (6.1%). Nevada (77.8%), New Mexico (73.8%), Arizona (60.7%), and Wyoming (60.2%) were dominated by urban expansion into “other” land types (Table 3). Urban growth with potentially increasing expansion rates has particularly important implications for the management of forests and other ecosystems in many parts of the United States in the years ahead. This expansion is likely to be concentrated near the 3.1% of the coterminous United States that was classified as urban in 2000. Areas of developed use in the United States have been projected to increase by about 70 million acres by 2030 (Alig and Plantinga 2004).

## Implications of Urban Growth for Forest Management

Urban expansion can result in the direct transformation or loss of forestland, but also influences forests and their management in a myriad of other ways. Current threats to forest sustainability (Bosworth 2003), such as fire at the wildland-urban interface, exotic pest infestations, unmanaged outdoor recreation, and forest fragmentation, are strongly connected to

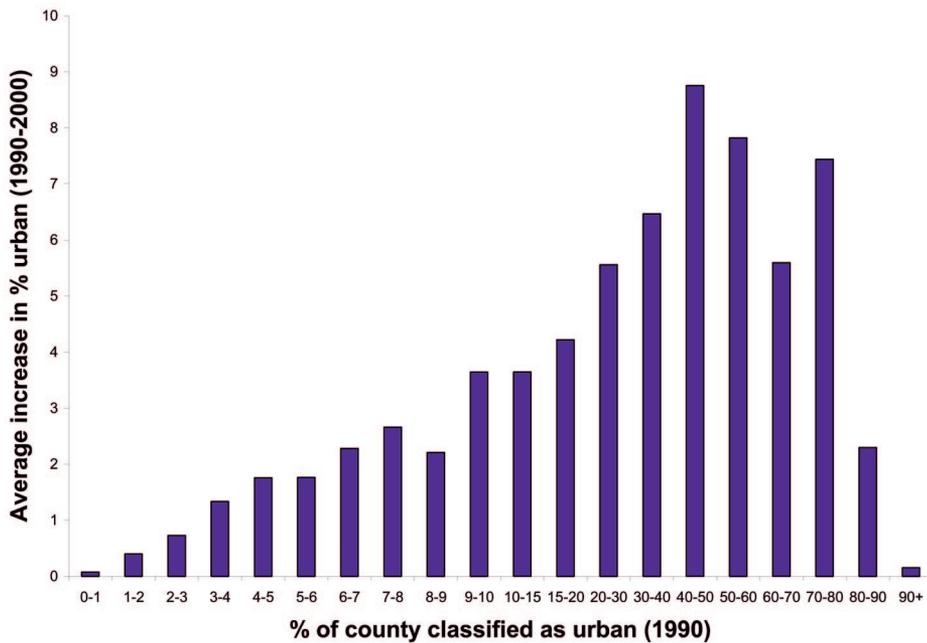


Figure 2. Average increase in percent of county classified as urban (1990–2000) categorized by percent of county that was urban in 1990.

expanding urbanization. As urban communities and their associated developments expand into forests, management and policy decisions concerning fire protection, recreational uses, scenic views, wildlife, and other issues become more complex, with more stakeholders and more at stake than ever before (e.g., Bradley [1984]). These challenges are likely to become increasingly significant and complicated as urban land continues to increase and expand outward, likely at higher rates than in the past.

#### **Urban-Wildland Interface and Fire.**

As urban communities expand outward into the countryside and the amount of urban-wildland interface increases, the risk of damage to buildings and the threat of loss of life from forest fires often increase. Bosworth (2003) believes that fire risk is one of the most important forest management issues of our time, with the potential to send human and ecological systems into disarray: “Coupled with the growing wildland/urban interface, the fire and fuels situation today has become a national emergency, as the huge fire seasons of 2000 and 2002 demonstrated. The fire and fuels situation critically affects many aspects of forest sustainability, including biodiversity, productivity, water quality, carbon sequestration, and social and economic expectations.”

**Exotic Pests.** Recently, there has been a substantial increase in attention to exotic pests that have the potential to spread from urban areas to adjacent forests. Once they invade forests, these pests can have a signifi-

cant impact on forest health and, therefore, forest management. Urban areas are particularly likely to suffer from exotic pest invasions because imports from around the world often enter the country through urban ports. In addition, the relatively high mobility of the urban human population increases the risk of spreading pests into forests outside of cities, especially because many urban residents travel to exurban areas for outdoor recreation and other experiences. Three recently introduced insects of concern include the Asian longhorned beetle (*Anoplophora glabripennis*), which has been found in New York City, Chicago, and New Jersey (USDA Forest Service 2005a), the citrus longhorned beetle (*Anoplophora chinensis*), currently found in the Puget Sound area of Washington (Washington State Department of Agriculture 2005), and the emerald ash borer (*Agrilus planipennis*), which has attacked thousands of trees in southeastern Michigan, northwest and central Ohio, and northeast Indiana (USDA Forest Service 2005b). As global markets and urbanization expand, the risk of exotic pests entering the United States through urban areas and then infesting surrounding forests is likely to increase.

**Forest Fragmentation and Management.** As new buildings, roads, and other infrastructure are constructed in forested areas, the area of individual forest stands become smaller, creating new forest edge and increasing the exposure of forests to urban stresses (Medley et al. 1995). This fragmen-

tation can significantly affect plant and wildlife populations, forest biodiversity, forest health, and management programs. Expansion of the human population across the landscape also can affect timber management and harvests. As urban areas expand outward and population densities increase, it becomes less likely that timber harvesting will be practiced. For example, as population densities increase from 20 to 70 people per square mile, the odds of timber harvesting being practiced locally has been shown to decrease from 75 to 25% (Wear et al. 1999). Although proximity to good roads increases the likelihood of harvesting, proximity to development and higher population densities leads to reduced timber harvests (Barlow et al. 1998). Also, with the expansion of urban communities, outdoor recreation activity often accelerates in nearby forests. In some instances, unmanaged uses (such as operation of off-road vehicles) pose a challenge to managers and threaten forest health.

**Urban Forest Influences.** As urbanization increases, so does the influence of urban trees and forests on the lives of the vast majority of people who reside in urban areas. Trees in these areas directly provide a host of social and ecological services that improve human health and well being (Nowak and Dwyer 2000). By enhancing urban and community forest management, the livability of cities can be improved. In turn, if environmental quality and livability can be improved in existing urban areas, larger numbers of urban residents may choose to remain in cities, potentially slowing future urban expansion. Although urban forestry and enhanced livability alone will not stop urban expansion, they can complement other measures designed to help reduce urban growth (e.g., ordinances, Smart Growth programs). In addition, concerns have grown about the loss of forestland to development, leading to both public and private efforts to preserve forestland as open space (Kline et al. 2004).

Along with enhancing livability, urban and community forests and forestry also offer the opportunity for public discussion of forestry issues. Because most of the nation’s voting power and political influence are concentrated in urban areas, urban residents can have a significant influence on the management of our nation’s forests through political means. A population that is more familiar with forestry issues in the United States could help improve the discussion of forest management options, possibly reducing management and policy conflicts and en-

**Table 3. Percent of total urban growth (1990–2000) by state that occurred within selected cover types as they existed in 1992.**

| State           | Cover type subsumed by urbanization |                          |                        |                    |                            |                                 |
|-----------------|-------------------------------------|--------------------------|------------------------|--------------------|----------------------------|---------------------------------|
|                 | Forest <sup>a</sup>                 | Agriculture <sup>b</sup> | Developed <sup>c</sup> | Other <sup>d</sup> | Woody wetland <sup>e</sup> | Herbaceous wetland <sup>f</sup> |
| AL              | 55.5                                | 30.2                     | 8.8                    | 1.1                | 4.2                        | 0.2                             |
| AR              | 36.8                                | 44.8                     | 16.3                   | 0.6                | 1.1                        | 0.4                             |
| AZ              | 8.4                                 | 19.2                     | 11.6                   | 60.7               | 0.0                        | 0.0                             |
| CA              | 9.3                                 | 20.1                     | 11.3                   | 58.9               | 0.1                        | 0.4                             |
| CO              | 10.3                                | 26.1                     | 15.0                   | 48.6               | 0.0                        | 0.0                             |
| CT              | 64.1                                | 11.5                     | 16.2                   | 0.9                | 5.8                        | 1.7                             |
| DE              | 28.4                                | 45.6                     | 15.3                   | 1.4                | 5.2                        | 4.0                             |
| FL              | 18.8                                | 17.9                     | 28.9                   | 13.8               | 14.4                       | 6.1                             |
| GA              | 64.0                                | 18.8                     | 8.9                    | 3.1                | 4.0                        | 1.3                             |
| IA              | 12.1                                | 52.3                     | 25.4                   | 8.0                | 1.7                        | 0.6                             |
| ID              | 3.1                                 | 54.6                     | 15.5                   | 26.0               | 0.5                        | 0.2                             |
| IL              | 15.2                                | 64.8                     | 15.2                   | 1.8                | 2.4                        | 0.7                             |
| IN              | 15.2                                | 66.8                     | 14.9                   | 0.8                | 1.9                        | 0.5                             |
| KS              | 8.3                                 | 46.8                     | 19.6                   | 23.7               | 0.1                        | 1.4                             |
| KY              | 38.1                                | 46.1                     | 13.3                   | 0.4                | 1.9                        | 0.2                             |
| LA              | 36.3                                | 38.7                     | 16.5                   | 1.1                | 4.4                        | 3.1                             |
| MA              | 62.9                                | 7.6                      | 17.7                   | 1.4                | 6.1                        | 4.2                             |
| MD              | 43.5                                | 40.7                     | 9.5                    | 2.6                | 2.7                        | 0.9                             |
| ME              | 54.8                                | 7.7                      | 26.1                   | 1.3                | 3.7                        | 6.3                             |
| MI              | 31.2                                | 47.5                     | 12.2                   | 2.1                | 6.1                        | 1.0                             |
| MN              | 17.7                                | 52.4                     | 17.6                   | 1.1                | 3.7                        | 7.4                             |
| MO              | 28.6                                | 44.7                     | 19.0                   | 6.5                | 0.8                        | 0.3                             |
| MS              | 41.9                                | 39.5                     | 11.6                   | 1.0                | 5.4                        | 0.6                             |
| MT              | 5.5                                 | 37.4                     | 30.9                   | 23.9               | 1.9                        | 0.3                             |
| NC              | 55.9                                | 22.8                     | 14.5                   | 1.1                | 5.0                        | 0.6                             |
| ND              | 3.3                                 | 32.7                     | 42.9                   | 19.5               | 0.1                        | 1.5                             |
| NE              | 3.2                                 | 68.9                     | 14.4                   | 12.4               | 0.2                        | 0.8                             |
| NH              | 61.3                                | 10.2                     | 20.7                   | 1.3                | 4.2                        | 2.4                             |
| NJ              | 48.4                                | 28.0                     | 12.7                   | 1.0                | 8.6                        | 1.3                             |
| NM              | 3.2                                 | 11.4                     | 11.0                   | 73.8               | 0.4                        | 0.1                             |
| NV              | 0.8                                 | 7.7                      | 13.5                   | 77.8               | 0.1                        | 0.1                             |
| NY              | 51.2                                | 28.1                     | 17.5                   | 0.5                | 1.9                        | 0.7                             |
| OH              | 31.6                                | 50.8                     | 14.3                   | 0.4                | 2.3                        | 0.6                             |
| OK              | 16.9                                | 38.5                     | 19.8                   | 24.4               | 0.3                        | 0.1                             |
| OR              | 26.3                                | 41.3                     | 17.3                   | 14.2               | 0.3                        | 0.5                             |
| PA              | 42.7                                | 45.5                     | 9.7                    | 1.4                | 0.4                        | 0.2                             |
| RI              | 64.8                                | 5.7                      | 19.0                   | 0.8                | 7.9                        | 1.9                             |
| SC              | 52.9                                | 21.4                     | 15.4                   | 2.3                | 6.0                        | 1.9                             |
| SD              | 5.5                                 | 50.6                     | 22.2                   | 19.9               | 0.4                        | 1.4                             |
| TN              | 48.0                                | 37.6                     | 12.4                   | 0.6                | 1.4                        | 0.1                             |
| TX              | 21.2                                | 40.9                     | 14.3                   | 22.1               | 0.5                        | 0.9                             |
| UT              | 6.8                                 | 40.5                     | 11.1                   | 41.1               | 0.5                        | 0.1                             |
| VA              | 48.4                                | 28.1                     | 13.9                   | 3.4                | 4.5                        | 1.7                             |
| VT              | 39.7                                | 28.1                     | 22.4                   | 1.7                | 5.5                        | 2.6                             |
| WA              | 46.5                                | 20.4                     | 18.4                   | 13.9               | 0.7                        | 0.1                             |
| WI              | 18.3                                | 62.0                     | 14.5                   | 2.2                | 2.2                        | 0.6                             |
| WV              | 62.2                                | 25.4                     | 10.4                   | 1.8                | 0.2                        | 0.1                             |
| WY              | 1.8                                 | 11.1                     | 24.5                   | 60.2               | 0.9                        | 1.5                             |
| US <sup>g</sup> | 33.4                                | 32.7                     | 15.1                   | 14.0               | 3.5                        | 1.4                             |

<sup>a</sup> Deciduous, evergreen or mixed forests; tree canopy accounts for 25–100% of the cover.

<sup>b</sup> Pasture/hay, row crops, small grains, or fallow (75–100% of the cover); or orchards/vineyards/other nonnatural woody (25–100% of the cover).

<sup>c</sup> Areas characterized by a high percentage (30% or greater) of constructed materials (e.g., asphalt, concrete, buildings) or vegetation (primarily grasses) planted in developed settings for recreation, erosion control, or esthetic purposes (75–100% of the cover).

<sup>d</sup> Bare/rock/sand/clay, quarries/strip mines/gravel pits, transitional, shrubland (25–100% of the cover), or grasslands/herbaceous (natural/seminatural; 75–100% of the cover).

<sup>e</sup> Areas where forest or shrubland vegetation accounts for 25–100% of the cover and the soil or substrate is periodically saturated with or covered with water.

<sup>f</sup> Areas where perennial herbaceous vegetation accounts for 75–100% of the cover and the soil or substrate is periodically saturated with or covered with water.

<sup>g</sup> Percent for lower 48 states.

Source: Adapted from US Geological Survey 2003.

hancing forest stewardship across the landscape. Thus, urban and community forests are likely to be the most influential forests of the 21st century. In addition, because numerous dimensions of urbanization affect forest management, and because the expansion of urban land will likely increase, urbanization (either directly or indirectly) will have a significant influence on US forests in this century.

## Conclusion

Urbanization in the United States is increasing and has the potential to increase at an even greater rate in the years ahead. Many areas of the United States are showing rapid urban expansion, particularly the Northeast and parts of the Southeast, Midwest, Northwest, and California. Many of the areas with large urban expansion are heavily forested. A number of fac-

tors associated with urbanization influence forest management and are likely to have even greater effects in the future. Currently, many threats to forest sustainability are strongly connected to expanding urbanization. Additional dialogue on forest management and its outcomes in urban areas could help decrease the spread of urbanization, minimize detrimental effects of urbanization on forests, improve the urban environment and the qual-

ity of urban life, and help reduce forest management conflicts.

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