A CLOSER LOOK AT FORESTS ON THE EDGE

FUTURE DEVELOPMENT ON PRIVATE FORESTS IN THREE STATES

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ABSTRACT

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Privately owned forests provide many public benefits, including clean water and air, wildlife habitat, and recreational opportunities. By 2030, 44.2 million acres of rural private forest land across the conterminous United States are projected to experience substantial increases in residential development. As housing density increases, the public benefits provided by private forests can be permanently altered. We examine factors behind projected patterns of residential development and conversion of private forest land by 2030 in northwestern Washington, southern Maine, and northwestern Georgia. Some key factors affecting the extent of future residential housing include (1) population growth from migration into an area; (2) historical settlement patterns, topography, and land ownership; and (3) land use planning and zoning.

Keywords: Private forests, residential development, Washington, Maine, Georgia.

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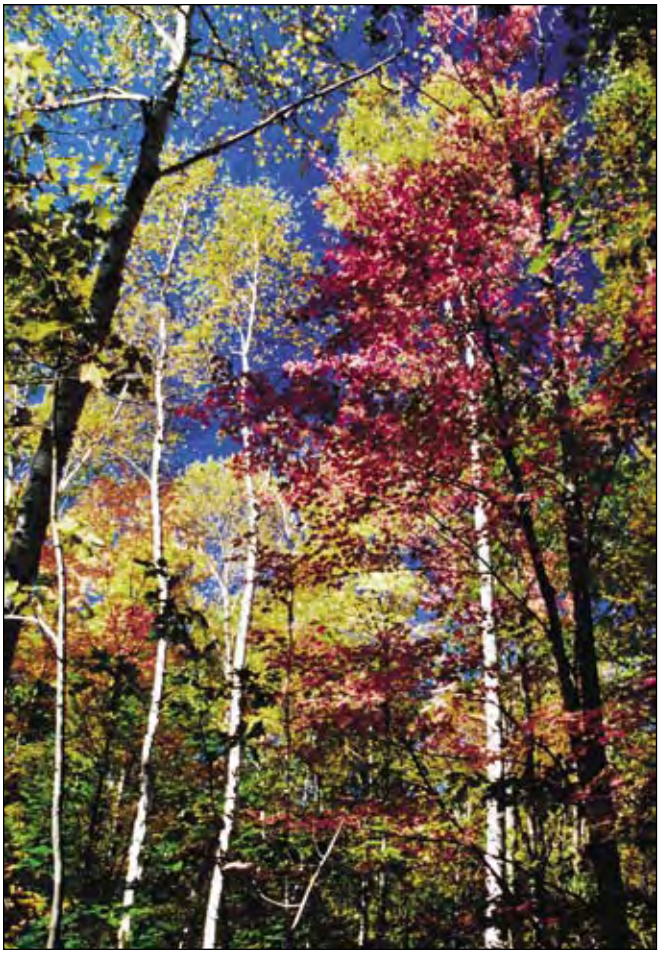
Cover photographs: top, Pete Pattavina, U.S. Fish and Wildlife Service; bottom left, Terry DeWan, DeWan and Associates; bottom middle, Dave Herr, U.S. Forest Service, and bottom right, Brenda Cunningham.



Steve Katovich, U.S. Forest Service

PRIVATE FORESTS: A NATIONAL ASSET

From the urban dweller who turns the tap to fill a glass with clear, clean water to the salamander living under a mossy rock beside a wooded stream, we all benefit from fully functioning forest ecosystems. Some of the many products and ecosystem services provided by forests include clean water, wildlife habitat, timber, nontraditional forest products, recreational opportunities, clean air, open space, and many others.

Of the 749 million acres of forest land in the United States, about 57 percent is privately owned (Butler, in press; Smith et al. 2004). As a group, private forest owners own forest land for a variety of reasons (Butler, in press). The forest industry typically owns forest land for the primary purpose of timber production. Individuals and families may own forest land for reasons that may or may not involve active forest management or traditional timber production. Nonforest industry corporations frequently own land for investment purposes. Owners care for their land in ways that help achieve their own objectives, and although privately owned, these forest lands provide services that benefit the public across the Nation.

FOREST LAND CONVERSION

Between 1992 and 1997, nearly 1 million acres of non-federal forest land were converted to developed uses each year (Kline et al. 2004a). This conversion included development for residential, commercial, industrial, and other purposes. By the year 2030, additional residential development is projected to occur on 44.2 million acres of currently rural private forest land (Stein et al. 2005). Unlike other forest disturbances such as harvests or fire, houses and other buildings generally represent long-lasting modifications of the landscape that can permanently alter the benefits once provided by the forest, in part because of the effects related to forest parcelization and fragmentation.

Key determinants in land conversion are increasing human populations, rising personal incomes, and changing societal preferences (Alig et al. 2004, Cho et al. 2005). Population increases lead to the need for more housing, a factor that is exacerbated by the decreasing household size observed in recent decades—from 3.14 people per housing unit in 1970 to 2.43 in 2000 (USDC Census Bureau 2002); more housing units are now needed to accommodate the population than in previous decades. Rising incomes enable people to build larger primary homes as well as second homes. And society increasingly shows a preference for forested settings, including areas around public lands, as popular locations for new first and second homes (Garber-Yonts 2004, Johnson and Stewart 2007, Radeloff et al. 2005). Housing density is projected to increase substantially on more than 21 million acres of rural lands adjacent to national forests and grasslands between 2000 and 2030 (Stein et al. 2007).

As demands for developed land uses increase, so do the incentives to sell land for development. The financial incentive to convert lands now in traditional rural uses (e.g., timber or agriculture production) to developed uses becomes greater as the value of the land in rural uses declines relative to the value of the land for developed uses (such as residential or commercial use). For forest land, decreases in the demand for timber, as a result of changing market conditions in the forest product sectors and other factors, can reduce the value of the land for timber production. Other reductions in the demand for nontimber services from forest land, such as decreasing demand for private land hunting leases, can also reduce the value of land in forest use. Tax structures have also been a factor in land tenure and ownership, in turn influencing current and potential future land use conversion (Hickman 2007).

Changing Ownerships: The Future of Private Forests

The number of forest land owners is increasing by approximately 150,000 every year as existing forested parcels are subdivided and sold (Sampson and DeCoster 2000), resulting in private forests that become parcelized and fragmented. **Parcelization** refers to the division of land into smaller parcels that are distributed among more owners. **Fragmentation** is generally discussed in a biological context and refers to the negative impacts on wildlife and forest processes that occur when large contiguous tracts of forest are broken into smaller, disconnected tracts. Research has identified several implications of forest land parcelization, fragmentation, and development:

- Smaller parcels of forest land are generally thought less likely to be managed for timber production (Butler, in press; Cleaves and Bennett 1995; Dennis 1990; Row 1978; Thompson and Jones 1981). About 77 percent of nonindustrial forest owners manage fewer than 20 acres, and 96 percent manage fewer than 100 acres (Birch 1996).
- Residential development on neighboring parcels and population increase can reduce the propensity for implementation of forest management activities (such as tree planting, precommercial thinning) and timber harvesting on existing forest parcels (Kline et al. 2004b, Wear et al. 1999). However, these relationships are complex and require further study.
- Fragmentation has a number of biological implications, including spread of invasive species and impacts on wildlife species that depend on interior forest habitat (Danielson et al. 1997, Riley et al. 2003, Singleton et al. 2002).

Terry DeWan, DeWan & Associates

Eric White, U.S. Forest Service

Finally, as long-term forest land owners age, forest parcels may be divided and sold. A third of America's private forest land owners are 65 years of age or older (Butler, in press); as new generations of owners inherit or purchase these lands, there is increased potential for land use conversion and changes in landowner objectives.

ABOUT FORESTS ON THE EDGE AND THIS REPORT

Because of the many public benefits that private forests provide, the Forests on the Edge project, sponsored by the U.S. Department of Agriculture Forest Service, State and Private Forestry, Cooperative Forestry Staff, seeks to improve our understanding of the potential impacts of increases in housing density in private forests and potential effects on the contribution of America's private forests to timber, wildlife, water, and other resources. In this report, we focus on three regions of the country: northwestern Washington, southern Maine, and northwestern Georgia.

These areas were selected for detailed study because the first Forests on the Edge study (Stein et al. 2005) revealed that they each contain watersheds that were nationally ranked as high in terms of the percentage of watersheds containing private forest projected to be developed. The previous study, which was based on available data at the national level, served to raise awareness of watersheds across the country where private forests are projected to experience increased housing densities by 2030. This closer look at three individual regions was informed by more site-specific data and can help facilitate a better understanding of the conditions and trends that influence land use at local levels. Although residential development is projected to be high in all three case study areas in the upcoming decades, the factors that contribute to the trend differ by region.

METHODS

We use housing density as the measure for projected increases in residential development, with a primary interest in development projected to occur on rural land. As with previous Forests on the Edge reports (Stein et al. 2005, 2007), we use the following housing density categories:

- Rural I—lands with 16 or fewer housing units per square mile.
- Rural II—lands with 17 to 64 housing units per square mile.
- Exurban/urban—lands with 65 or more housing units per square mile.

We quantify increases in housing density as an increase in the number of housing units per square mile sufficient to shift the land to a higher housing density category—for example, from rural I to rural II. Because this study focuses on rural lands, further housing density increases on private lands already developed to densities above 64 housing units per square mile are not reflected in the analysis. Additionally, this analysis does not include other forms of urbanization, including development of rural lands for commercial, industrial, and transportation uses.

The housing projections used in this analysis are based on past and current statistics on housing density and population, road density data, past growth patterns, proximity to urban

areas, and other factors (Stein et al. 2007, Theobald 2005). We use human population estimates for the United States of 276 million for the year 2000 (USDC Census Bureau 2001a) and 385 million for the year 2030 (NPA Data Services, Inc. 2003).

The study described here uses watersheds as the unit of analysis to emphasize the connection between water quality and private forests.

To complete these case studies, data were gathered from national, state, and local sources. In most cases, comparable data were available for the three case study regions. Individuals with knowledge of local natural resource and land use conditions in all three case study regions were contacted to identify local issues related to residential development and natural resources.

Scott Horn, U.S. Forest Service

Making the Connection: Watersheds and Forests

Aquatic systems have been shown to be affected by urbanization and residential development (Atasoy et al. 2006, Pijanowski et al. 2002, Roth et al. 1996). Storm runoff from streets, driveways, and rooftops can be laden with pollutants. Additionally, rather than filtering through the forest floor, runoff may enter waterways more quickly via sewer systems. Sediment, contaminants, and removal of streamside vegetation can all affect the characteristics and function of aquatic ecosystems.

CASE STUDIES

Northwestern Washington: Attracting New Residents in a Changing Forest Resource Base

More than half the state of Washington (22 million acres) is forested. Since the mid-1970s, the total amount of forest land in the state has declined by 6 percent (1.4 million acres). The state's growing population (10th highest percentage population increase in the Nation from 1990 to 2000 [USDC Census Bureau 2001b]) and robust economic development have pushed the housing boom and triggered much of the loss in forest land (Alig and White 2007). Nearly 45 percent of the state's forests are privately owned, with individuals, families, and investment groups owning slightly more than half, and the forest industry owning the rest.

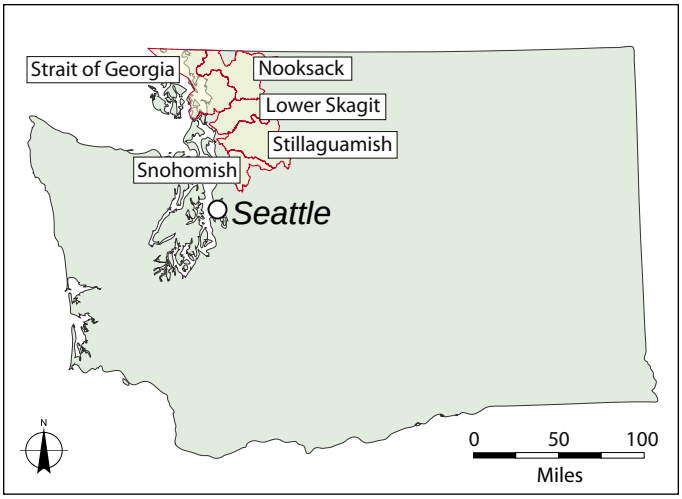


Figure 1—Watersheds included in northwestern Washington case study.

In this case study, five watersheds were examined: the Strait of Georgia, Nooksack, Lower Skagit, Stillaguamish, and Snohomish (fig. 1). These watersheds lie north of the Seattle metropolitan area, along the Interstate-5 corridor, which is the main north-south transportation route in the western part of the state. The three counties that encompass these watersheds contain about 6 percent of the state's privately owned timberland; about 45 percent of this is owned by nonindustrial private owners.

Jeff Kline, U.S. Forest Service

Recent trends—

- **Domestic migration of new residents to these counties accounted for most of the population increase.** Between 1990 and 2000, the population in the three counties of northwestern Washington increased by 36 percent, surpassing the 21 percent growth experienced statewide. Most of this increase came from people moving into the case study area rather than from natural increase (births over deaths). In each of the three northwest Washington counties, population increase from net domestic migration was more than double the natural increase in population during the 1990s (Washington State Office of Financial Management 2007). As the population has increased in the case study watersheds, so has the number of housing units (table 1).
- **Timber harvests and the value of standing timber (stumpage value) have been decreasing in recent years.** Between 2000 and 2006, timber harvests on privately owned forests in the three counties declined, mirroring longer term trends statewide (fig. 2); the stumpage value—the amount of money a seller receives per 1,000 board feet—has also declined for the dominant species, Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) (Washington State Department of Revenue, n.d.).
- **Undeveloped lands command high real estate prices.** Rising values for lands sold for development are an incentive for some private landowners to sell forested lands. In recent years, sale prices for undeveloped lands with potential for development in northwestern Washington have been high (Alig and Plantinga 2004, Alig and White 2007). For example, in Snohomish County near the Seattle metropolitan area, the average selling price for undeveloped parcels between 1 and 5 acres sold between 2003 and 2005 was $104,800 per acre.

Future increases in housing density—

Of the northwest Washington case study watersheds, the area with highest projected residential growth is the Strait of Georgia watershed near the cities of Bellingham and Mount Vernon. More people are expected to continue moving to northwestern Washington in general, and higher levels of residential development are projected to expand outward from current population centers (fig. 3). Approximately 165 square miles of currently rural, forested lands are projected to reach exurban-urban housing densities (more than 64 housing units per square mile) by 2030. Several areas of moderate and low housing density away from population centers are also projected to increase in housing density by 2030.

Table 1—Percentage increases in population and housing units in the northwestern Washington case study watersheds and Washington state between 1990 and 2000

Watershed	Increase in population	Increase in housing units
	Percent	
Strait of Georgia	31	34
Nooksack	35	35
Lower Skagit	29	22
Stillaguamish	67	69
Snohomish	35	28
Case study watersheds, average	36	33
Washington state, overall	21	20

Data sources: USDC Census Bureau 1990, 2005a.

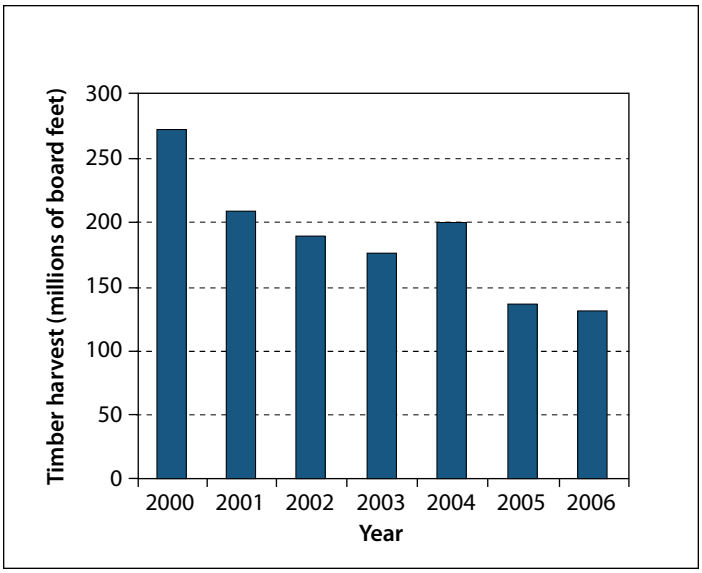


Figure 2—Annual harvest volumes (million board feet) from privately owned forests in northwestern Washington. Data sources: Washington State Department of Revenue, n.d., and Washington State Office of Financial Management, n.d.

Several factors may help explain the projected pattern of growth in northwestern Washington:

- Population centers are currently located on and along main transportation routes and future development will likely take advantage of these existing networks.
- Topography and the location of private land in northwestern Washington concentrate growth; the spread of residential development is confined by the Puget Sound to the west and the Cascade Range and associated public lands to the east.
- Washington's land use planning regulations encourage urban growth in existing urban areas.

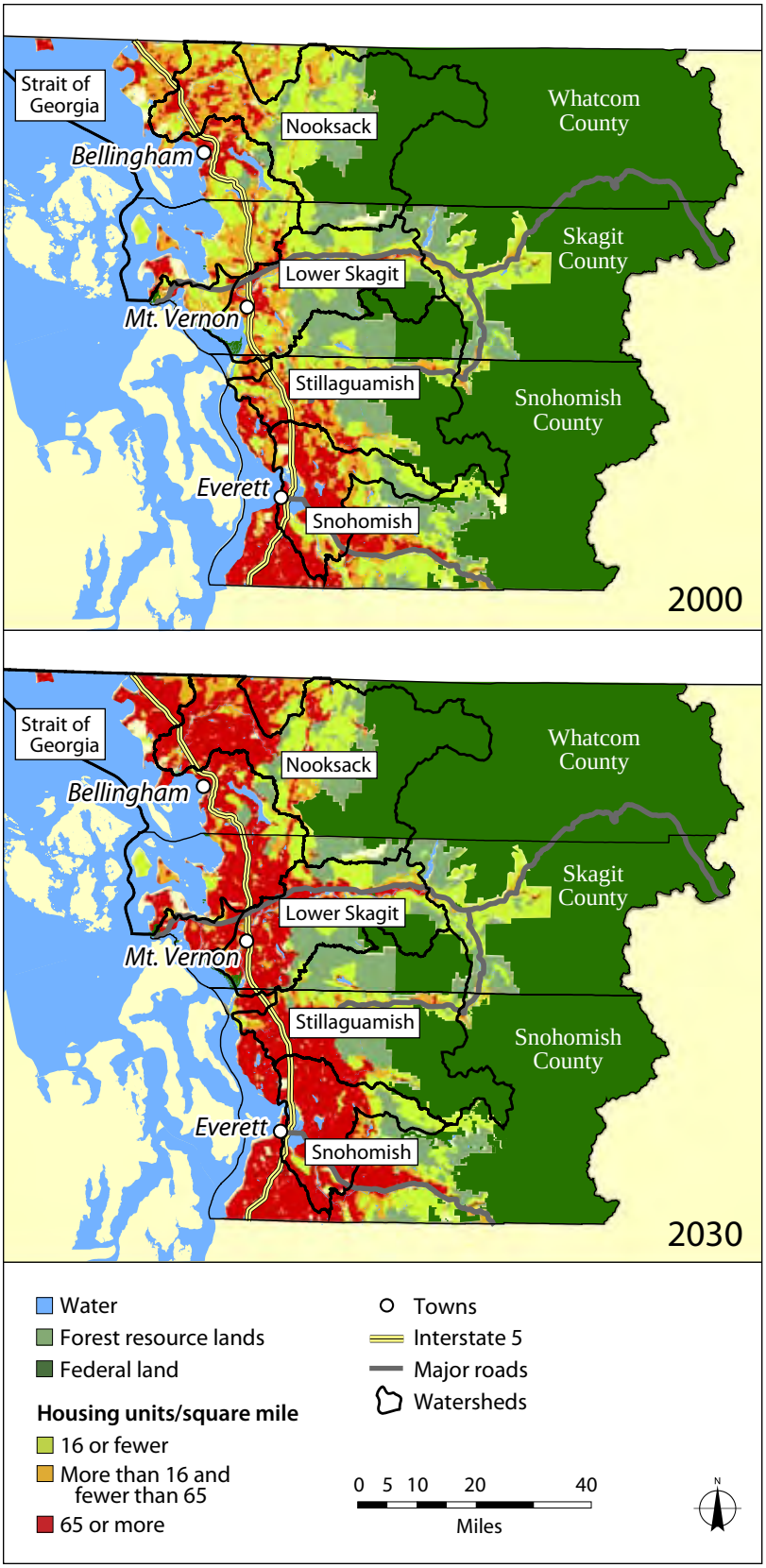


Figure 3—Year 2000 and projected 2030 northwestern Washington housing unit density. Data sources: Skagit County 2001, Snohomish County Planning and Development Services 2003, Theobald 2004a, 2004b, and Whatcom County Planning and Development Services 2005.

Policies, planning, and future growth— Land use planning regulations influence where and how future development occurs. Washington's Growth Management Act encourages growth in existing urban areas, or in their proximity, where it can be supported by urban services (WA CTED, n.d.). Urban growth areas work in tandem with the act's requirement that many counties identify commercially important agricultural land, forests, and mineral areas as "designated resource lands." Residential development is generally not allowed in the designated forest resource lands. In the housing projections for 2030, the boundaries of areas projected to have considerable residential development frequently abut the boundaries of currently designated forest resource land. This convergence indicates the likelihood of future development pressure on currently designated forest lands in northwest Washington.

Watershed function and land use are closely linked in this region of Washington. Puget Sound chinook salmon (*Oncorhynchus tshawytscha*), summer chum (*O. keeta*), and steelhead trout (*O. mykiss*) are protected under the Endangered Species Act (ESA), and the Puget Sound salmon recovery plan aims to restore salmon runs that have suffered declines, in part owing to past land uses (Shared Strategy for Puget Sound 2007). Because these watersheds are projected to become more urbanized during the next decades, efforts currently underway to protect and restore salmon habitat should account for this expected additional development of the rural landscape.

Roger Peters, U.S. Fish & Wildlife Service

Terry DeWan, DeWan & Associates

Southern Maine: Housing Increases Outpace Population Growth

In Maine, approximately 90 percent (17.8 million acres) of the state's land area is forested; 94 percent of that forest is privately owned (McWilliams et al. 2005). Just one-third of the private forest is owned by families and individuals; the remainder is owned by the forest industry, investment groups, and Native American tribes (McWilliams et al. 2005). Forest land in the northern portion of the state is owned primarily by forest industry (Butler 2005); accordingly, most timber harvest occurs there. Most of the family-owned land is in the southern portion of the state, where most of the population lives. This pattern of land use is evident in the five watersheds included in this case study (fig. 4). In the northern portions of the Lower Kennebec, Lower Penobscot, and Lower Androscoggin watersheds, the land is generally owned by forest industry in parcel sizes larger than 1,000 acres, and most of the timber harvest occurs there. The southern portions of the Presumpscot, Androscoggin, and St. George-Sheepscot watersheds have less timber harvest, more forest parcel sizes that are smaller than 50 acres (Butler and King 2005), and greater housing density.

Recent trends—

- The number of housing units increases at a faster rate than population growth. Although Maine had one of the smallest population increases in the Nation between 1990 and 2000 (4 percent), the number of housing units in the state expanded more rapidly (11 percent) than the population growth. Much of the increase in housing units can be traced to second home development. Maine has the highest percentage of second homes in the Nation (USDC Census Bureau 2004a). In 2000, there were more than 100,000 second homes in the state, representing 16 percent of the housing stock; nationally, second homes represent just 3 percent of housing stock (USDC Census Bureau 2004a). In Maine, second homes are most common in the northern and "downeast" portions of the state, areas that are on the peripheries of the case study watersheds.
- Transitions in forest land ownership. In recent years, the forest industry in Maine has been divesting its forest land holdings. In the course of this divestment, the area of forest land owned by investment groups and nonforest industry corporations has increased by 60 percent (McWilliams

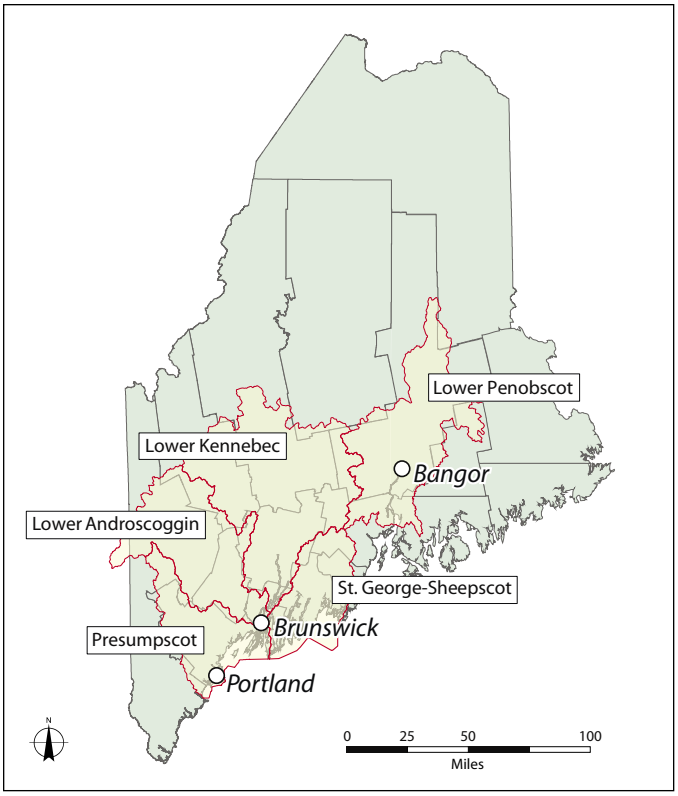


Figure 4—Watersheds included in southern Maine case study.

et al. 2005). The divestment of industry-owned lands to other landowners has increased the uncertainty in future land use in traditional forest industry areas of the state.

Rates of increase in population and housing differed among the watersheds between 1990 and 2000 (table 2). Most of the growth was focused around cities, such as Portland in the Presumpscot watershed; Brunswick, which lies mostly in the Presumpscot watershed; and Bangor, in the Lower Penobscot watershed. Housing density also increased around many lakes and rivers. In all the Maine case study watersheds, the percentage of increase in housing units was more than double the percentage of increase in population. In all Maine watersheds except the Lower Androscoggin, the percentage of increase in second homes was greater than the percentage of increase in housing units generally. The decline in second homes in the Lower Androscoggin may have resulted from the conversion of second homes to primary homes.

The volume of timber harvest in Maine—most of which comes from private land—remained constant or declined slightly between 1996 and 2005 (fig. 5). Stumpage values for saw logs have increased, but they have stayed steady for hardwood pulpwood (Maine Forest Service 1998–2005b). Although most of the land harvested for timber remains in forest uses after harvest, the area that is harvested and then converted to more developed uses has been increasing since 1996. In 2004, most

Table 2—Increases in population, housing units, and second homes in the southern Maine case study watersheds and the state of Maine between 1990 and 2000

Watershed	Increase in population	Increase in housing units	Increase in second homes
		Percent	
Lower Penobscot	2	10	14
Lower Androscoggin	-2	2	-7
Lower Kennebec	4	14	31
St. George-Sheepscot	11	18	25
Presumpscot	10	13	14
Case study watersheds, average	5	11	15
State of Maine, overall	4	11	15

Data sources: USDC Census Bureau 2005a, 2005b.

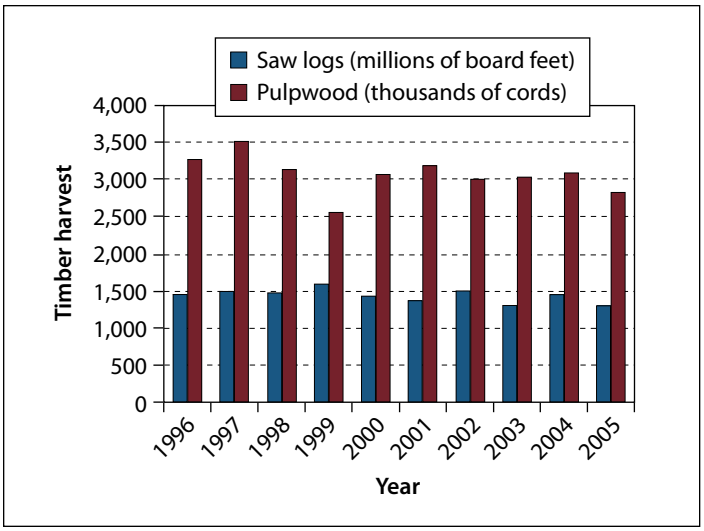


Figure 5—Timber volume harvested from forests in Maine, 1996 to 2005. Data sources: Maine Forest Service 1998–2006c.

of the 8,000 acres that were converted to developed uses after being harvested were owned by nonindustrial owners (Maine Forest Service 1998–2005a).

Future increases in housing density—

The Lower Kennebec and Lower Penobscot watersheds are among the 15 watersheds in the Nation projected to experience the greatest increases in housing density on private forests by 2030 (Stein et al. 2005). Most of the housing development projected to occur by 2030 is in the southern portion of the case study watersheds, in areas where forest land is typically owned by individuals or families (fig. 6). Approximately 980 square miles of currently rural, forested lands are projected to reach exurban-urban housing densities (more than 64 housing units per square mile) by 2030.

Several factors may help explain the projected pattern of residential expansion within this area:

- Current urban centers, which are in the southern portion of the study area, in areas where forest lands are owned by individuals and families, will likely continue to attract new development.
- Compared to northwestern Washington, the Maine watersheds have extensive road networks, large amounts of private lands, and favorable topographies that are less of a limiting factor to development. This indicates that a greater extent of watershed area is likely feasible for residential development.

Proximity to the natural amenities typical of rural landscapes probably plays the major role when people choose the location for second homes than when they choose the location for primary homes. When deciding where their primary residence will be established, people emphasize factors such as proximity to workplace, presence of government and utility services, and school quality, among others; such factors likely exert less influence on the choice of second-home location. Because second homes are more likely than primary homes to be located in rural landscapes, increases in the number of second homes are likely to disproportionately affect rural landscapes compared to increases in primary homes.

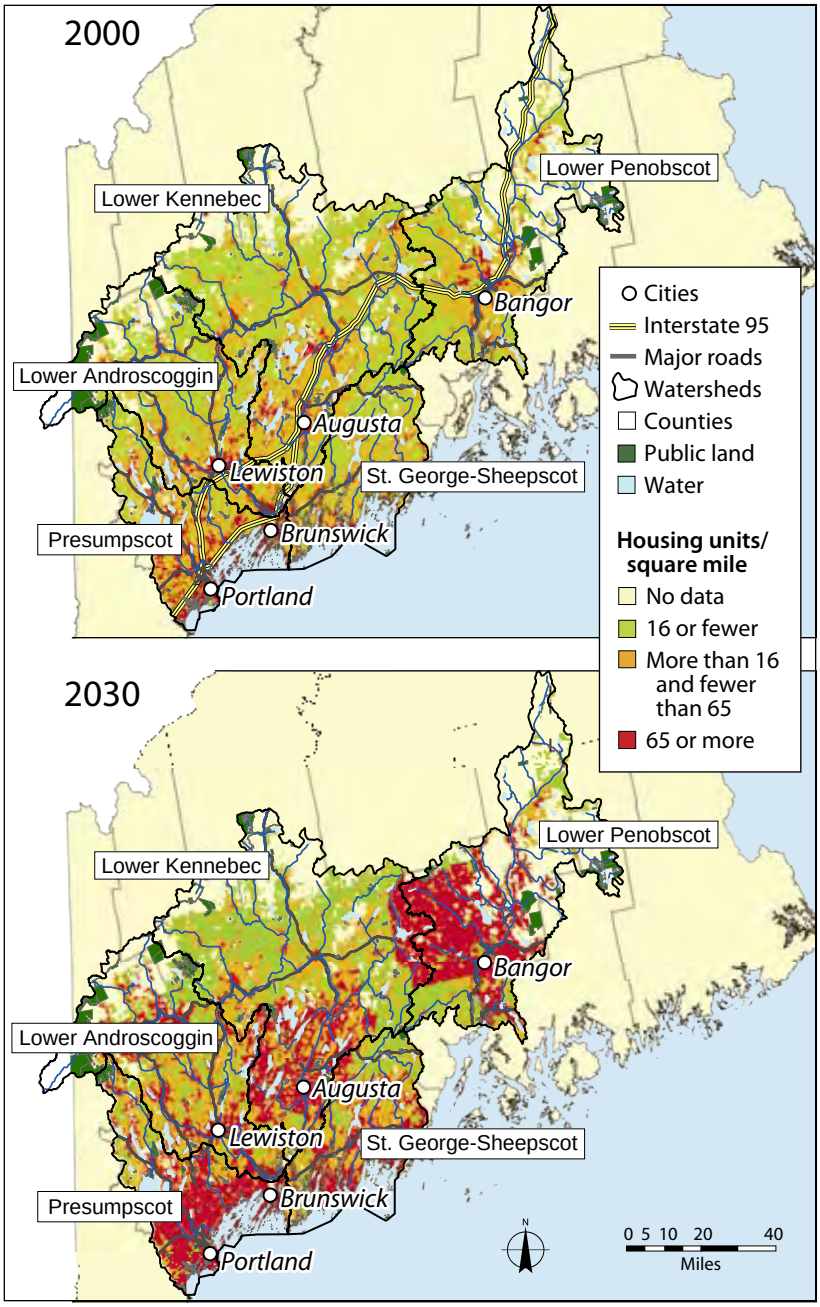


Figure 6—Year 2000 and projected year 2030 housing unit density in southern Maine. Housing data sources: Theobald 2004a, 2004b.

Policies, planning, and future growth— In Maine, land use planning and zoning are primarily the responsibility of local municipalities, although technical assistance is available from regional councils that are funded by the state. In unincorporated areas or areas with no local government, the state assumes responsibility for developing any zoning ordinances.

The Penobscot River flows through some of the forested watersheds projected to experience substantial increases in residential development by 2030. The river and its tributaries are home or spawning grounds for many commercially and culturally important fish species, such as the federally protected Atlantic salmon (*Salmo salar*). The Penobscot River also has several hydroelectric dams, which over time have impeded fish passage, slowed waterflow, and altered nutrient levels. A partnership has formed among the PPL Corporation hydropower company, the Penobscot Indian Nation, conservation groups, and state and federal agencies around the Penobscot River watershed to restore 11 sea-run fish species while maintaining power generation (Penobscot River Restoration Trust 2007). As a result of this partnership, the lowermost two dams on the Penobscot River are slated to be removed.

Maine Forest Service

Northwestern Georgia: Experiencing High Rates of Migration to the State

Georgia and other states in the South are now the Nation's "wood basket." More timber is harvested in this region than in any other part of the country (Adams et al. 2006). Approximately 1.2 billion cubic feet of timber were harvested annually in Georgia between 1992 and 2005 (Johnson et al. 2007). At the same time, Georgia is one of the fastest growing states; between 1990 and 2000, the state's population increased by 26 percent, ranking it 6th nationally in terms of percentage of increase in population (USDC Census Bureau 2001b). Domestic migration to the area played a major role in this increase (Perry 2006), and this trend is expected to continue.

Ninety-two percent of Georgia's timberland is privately owned: 58 percent by families and individuals and the remainder by the forest industry and other corporations (USDA Forest Service and Georgia Forestry Commission 2006). The South has an extensive forest resource, and Georgia's holdings are an important part of the region's timberland base (USDA Forest Service 1988), with significant impacts from land use and forest ownership change (Alig 1986). Between 1972 and 2004, 3.98 million acres of timberland in Georgia were converted to other land uses, including urban development and agriculture uses (Harper et al., n.d.; Sheffield and Johnson 1993; Sheffield and Knight 1984; Thompson and Thompson 2002). Since 1989, tree planting on former agriculture lands—often through programs such as the federal Conservation Reserve Program (see "Policies and Programs" section on page 14)—has offset the amount of forest land lost to other land uses. Consequently, Georgia forest land, on a statewide level, has experienced a net increase of 600,000 acres (Thompson and Thompson 2002, USDA Forest Service and Georgia Forestry Commission 2006). However, most of the tree planting has occurred in the central and southern regions of the state, away from the Atlanta metropolitan area. In northern parts of the state, the area of forest land converted to urban and developed uses has been increasing for a number of decades. Statewide, between 1989 and 2004, more than 900,000 acres of forest land were converted to residential and developed uses (Harper et al., n.d.; Thompson and Thompson 2002).

Four watersheds were analyzed for this case study: Oostanaula, Conasauga, Coosawattee, and Etowah (fig. 7). These watersheds are located north of the Atlanta metropolitan area. Interstate 75 traverses the western portion of the study area north to south.

John and Karen Hollingsworth, U.S. Fish and Wildlife Service

Figure 7—Watersheds included in northwestern Georgia case study.

Most forest land within this area (58 percent) is owned by individuals and families, and nearly equal percentages (12 percent each) of forest land are owned by the forest industry and public ownership groups. The remaining forest land acres are owned by nonforest industry corporations. Differences in behavior among owners have important implications for timber supply (Alig 1990) and for other forest-based resources.

Recent trends—

- **Migration is driving population growth in the state.** Between 2000 and 2004, Georgia had the country's fourth highest level of net domestic migration (Perry 2006). Domestic migration to the Southern States in general is far greater than that to any other region in the country; as people continue to move to Georgia in particular, additional housing will be required.
- **The average number of people per housing unit remains high in Georgia.** In Georgia, the number of individuals per housing unit has not declined as precipitously as in other parts of the country. In 2000, there were 2.48 people per housing unit in Georgia, a rate slightly greater than that found nationwide. Population expansions in Georgia require slightly fewer housing units than elsewhere in the Nation.

Population and housing units increased at different rates within the four Georgia watersheds between 1990 and 2000 (table 3). Etowah and Coosawattee are closest to the Atlanta metropolitan area and experienced population growth rates that were well above the statewide average. In the Oostanaula watershed, population and housing percentage increases were near the statewide average and well above the national average (13 percent). Population and housing increases in the Conasauga watershed were below the statewide average, but the population increase was still above the national average.

Table 3—Percentage increases in population and housing units in the northwestern Georgia case study watersheds and the state of Georgia between 1990 and 2000

Watershed	Increase in population	Increase in housing units
	Percent	
Etowah	62	58
Coosawattee	64	66
Oostanaula	24	23
Conasauga	16	9
Case study watersheds, average	51	47
State of Georgia, overall	26	27

Data sources: USDC Census Bureau 2005a, 2005b.

Timber harvests in northwestern Georgia have increased between 1992 and 2005 (fig. 8). The highest annual timber

Scott Horn, U.S. Forest Service

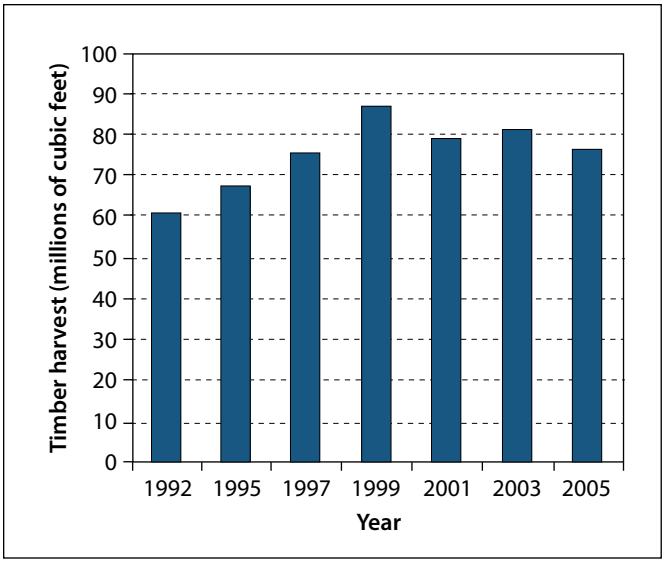


Figure 8—Timber volume harvested from northwestern Georgia, 1992 to 2005. Data sources: Johnson et al. 1997, 2007; Johnson and Wells 2002, 2005.

harvest generally occurred in the southwest portion of the case study area where housing density was lowest, whereas the lowest annual timber harvest occurred in the eastern portion of the study area and Cobb County, nearest the Atlanta metropolitan area. Between 1996 and 2004, stumpage prices for sawtimber remained relatively steady for pine species (*Pinus* spp.) and slightly increased for oak species (*Quercus* spp.) (Prestemon 2006). Stumpage prices for softwood pulpwood have declined while prices for hardwood pulp-wood have increased.

Future increases in housing density—

The pattern of expansion in northwestern Georgia more closely resembles that in southern Maine than that in northwestern Washington (fig. 9). This is likely a reflection of the extensive road network and amount of private land, which provide the opportunity for development to occur across a broader area. Approximately 503 square miles of currently rural, forested lands are projected to reach exurban-urban housing densities (more than 64 housing units per square mile) by 2030.

Several factors may help explain the projected pattern of residential expansion within this area:

- The population in Georgia and the study area is expected to continue increasing over the coming decades—largely owing to continued migration. In fact, the state is projected to become the 8th most populous U.S. state by 2030 (USDC Census Bureau 2004b).

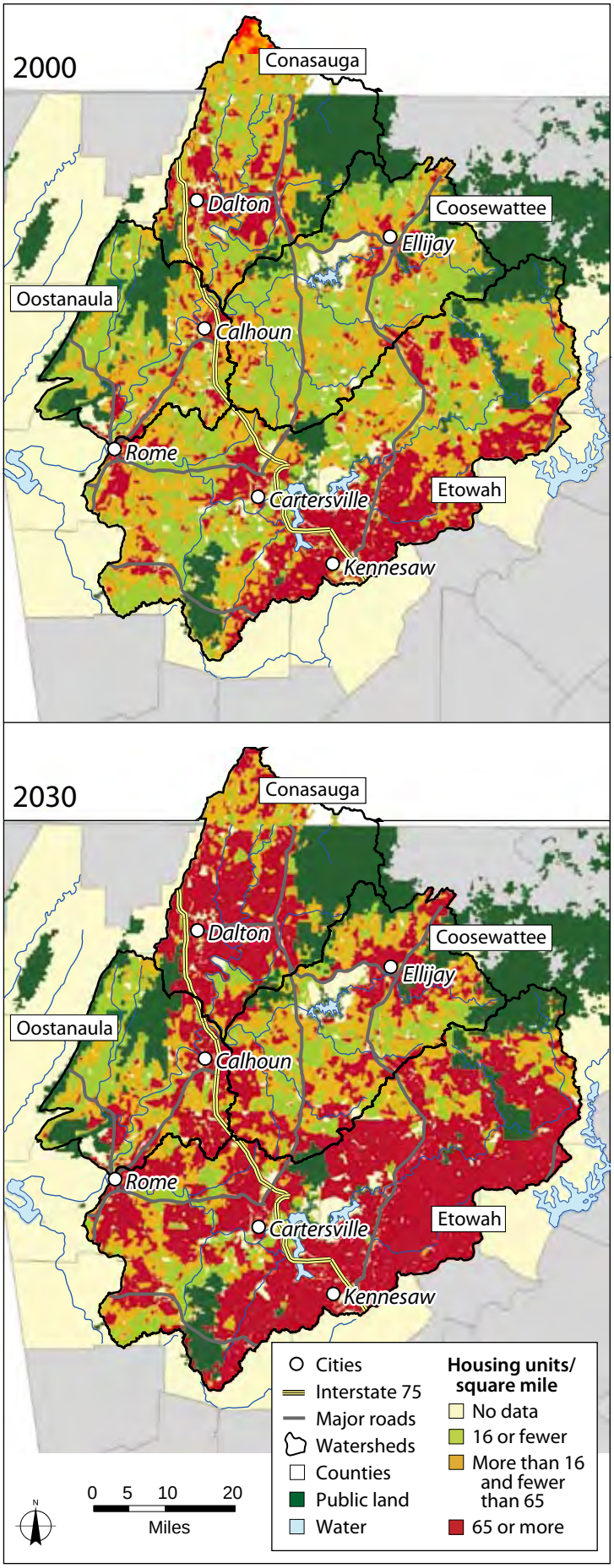
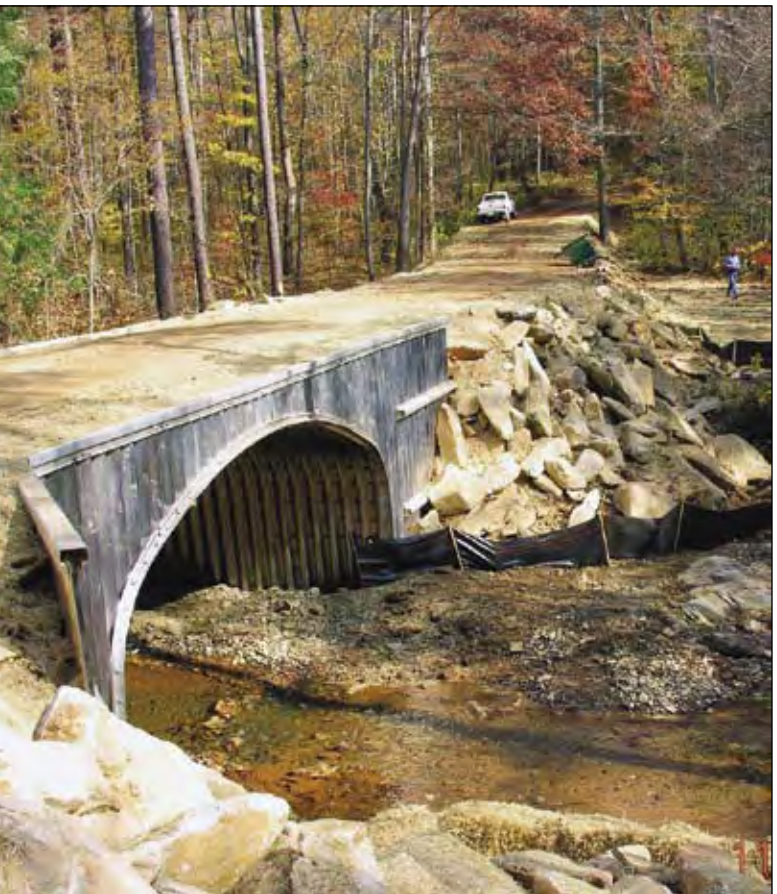


Figure 9—Year 2000 and projected 2030 housing unit density in northwestern Georgia. Housing data sources: Theobald 2004a, 2004b.

- The Atlanta metropolitan area will continue to influence population increases in the case study area. The area of greatest projected residential development is in the portion of the Etowah watershed nearest the Atlanta metropolitan area. The southernmost watersheds in the case study area, the Etowah and the Upper Oconee watersheds, are among the top 15 watersheds in the Nation projected to experience the greatest increases in housing density on private forests by 2030 (Stein et al. 2005).
- Similar to the pattern in Maine, extensive transportation networks and existing population centers will likely support continued dispersed residential development in other areas of northwestern Georgia.

Policies, planning, and future growth—
Georgia has established a number of statewide goals for land use planning. Municipalities and county governments complete comprehensive plans and are required to meet the state's minimum standards for planning. Regional development centers are available to assist local governments with this planning. Regional and statewide planning also exists in Georgia, with emphasis on a broader perspective and focus on issues that are beyond the jurisdictions of local governments.

As with the other case study areas, watershed function and land use are closely linked. The Etowah watershed, for example, is home to three species of darters (*Etheostoma* spp.) that are protected under the ESA. An effort is underway to write a habitat conservation plan, as permitted under the ESA, so that both regional growth and the habitat needs of the darters can be accommodated. It will include guidelines for managing byproducts of development, such as controlling storm water runoff and erosion and installing culverts or bridges designed to facilitate fish passage (Etowah Aquatic HCP Steering Committee 2007).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POLICIES AND PROGRAMS TO REDUCE THE LOSS OF FOREST LAND

The numerous benefits provided by forest land have prompted federal, state, and private agencies to create mechanisms—either through regulation or incentives—to encourage private landowners to keep forest land forested, and to plant trees on other land.

Land use planning and associated zoning provide a key regulatory mechanism. Of the three case studies, Washington has the most state-structured land use planning; the urban growth boundaries and the specifically designated resource land are conscientious efforts by the state and counties to guide land use. Maine and Georgia have less defined frameworks at the state level for guiding development but have used other means to reduce the amount of private forest land converted to other uses.

Maine, for example, has nearly 1.5 million acres under state and local conservation easements, the most in the Nation (Land Trust Alliance 2005). A conservation easement is a legal agreement between a landowner and a private organization or public agency in which the landowner agrees to forfeit certain rights associated with his or her property—often the right to develop or subdivide—typically for the purpose of protecting particular conservation values associated with that land. Conservation easements often entitle the landowner to qualify for certain tax benefits in compliance with Internal Revenue Service rules. The Forest Legacy Program, managed by the U.S. Forest Service in partnership with states, supports the efforts of Maine and other states to protect environmentally sensitive forest lands through the acquisition of conservation easements. Maine has also enacted legislation (PL 416, 122nd session) that provides for a graduated reduction in the capital gains tax associated with the sale of forested lands to provide incentive for long-term ownership of sustainably-managed forest land.

Georgia has benefited from the federal Conservation Reserve Program (CRP), which offers landowners financial incentive to replant erodable crop land to tree cover. As a result of tree planting efforts, including efforts supported by the CRP, the

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number of forested acres in Georgia increased after 1989 (Thompson and Thompson 2002). Under CRP, a cost-sharing arrangement reduces the costs to farmers to plant former agricultural land susceptible to erosion with trees or other native vegetation. After planting, farmers receive an annual payment for using their land in this way, and the land remains in tree cover, providing wildlife habitat, greenways, and buffering aquatic systems.

All three case study states have implemented modified tax assessment programs to ease the tax burden on forest landowners (National Timber Tax Website, n.d.). However, the implementation of modified assessments differ among the states. In all three states, forest land can be taxed according to its current use (rather than market value, which often is higher), based on the productivity of the land for timber production. Landowners in Georgia may place a maximum of 2,000 acres of land into conservation use taxation, whereas in Washington and Maine there is no maximum acreage per individual landowner. Washington and Maine landowners are required to have a current forest management plan for the property, but a forest management plan is not required in Georgia. When timber is harvested, Washington and Georgia both assess a tax on the value of harvested timber; Maine does not have a timber yield tax.

CONCLUSIONS: DEVELOPMENT FACTORS

Previous Forests on the Edge reports focused on national-level housing density data and are best suited for use at national or regional levels; these case studies present a glimpse into some factors influencing development at local levels. Several conclusions can be drawn from this closer look at several states:

- Population growth from migration is a key factor in Washington and Georgia but is less of a factor in Maine where much of the residential development appears to be related to demand for second homes.
- Ownership of forest land is changing in all three areas. Based on past patterns and potential changes as aging landowners pass land on to future generations, forest lands owned by nonindustrial private forest landowners will likely undergo the greatest conversions to developed uses. It is not yet clear what impact divestment of forest land by the forest industry may have on forest land conversion rates.
- The legacy of different patterns of historical settlement continues to influence current development trends. In all three regions, future development is projected along existing transportation networks. However, in Maine and

Georgia, these networks are much more extensive than in Washington, thus supporting more dispersed development in some areas of those states. The amount of public land in Washington, and the state's topography, also influence the pattern of residential development there.

- Land use planning mechanisms in the three states will influence the pattern of housing density in each study area.

Similarities and differences among the watersheds in these three states underscore the level of complexity at work across the Nation as housing density increases affect private forests, their resources, and benefits. Other watersheds, in other states, are likely to be affected differently. In many places, more houses will also mean increases in other kinds of development: more schools, more commercial and industrial buildings, and more infrastructure such as roads and bridges. It is at the local level where scientists, resource managers, landowners, and communities will contend with the challenges of planning for sustainable growth while conserving the ability of private forests to provide valuable ecosystem services and economic opportunity far into the future.

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METRIC EQUIVALENTS

When you know:	Multiply by:	To get:
Miles	1.609	Kilometers
Acres	.405	Hectares
Square miles	2.59	Square kilometers

Terry DeWan, DeWan & Associates

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FORESTS ON THE EDGE

Sponsored by the U.S. Department of Agriculture, Forest Service, State and Private Forestry, Cooperative Forestry Staff, Forests on the Edge aims to increase public understanding of the contributions of and pressures on America's forests, and to create new tools for strategic planning. The first report, *Forests on the Edge: Housing Development on America's Private Forests* (Stein et al. 2005), identified private forested watersheds most likely to experience housing development. The second, *National Forests on the Edge: Development Pressures on America's National Forests and Grasslands* (Stein et al. 2007), identified national forests and grasslands most likely to experience increased housing density on rural private lands on their borders. This third report focuses on projected patterns of development and conversion of private forest land on selected watersheds in three states.

Future studies will examine:

- Watersheds where pressure from development may affect the ability of private forests to provide public benefits, and where development impacts may be exacerbated by additional pressures of fire, insect pests and disease, and air pollution.
- Implications for wildlife from housing development on private forests.
- Areas where urban forests across the Nation may experience increased development.
- Development projections for private forest lands in Alaska, Hawaii, Puerto Rico, the Virgin Islands, and the Pacific Islands.
- Implications of development on ecosystem services, in more detail.

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