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**Forests on the Edge:
A Case Study of Northwest Washington**

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Introduction

The area of developed land within the United States increased by just more than 33% between 1982 and 1997 (USDA NRCS and Iowa State University Statistical Laboratory 2000). Developed land includes urban and built-up land as well as land in rural areas used for roads, railroads, and transportation rights-of-way. Much of this increase in developed land area can be traced to a loss in rural land area. The expansion of developed land, and the loss of rural land, is projected to continue over the next several decades. Future land use conversion will likely continue to impact land uses and land cover in rural areas, including forests, agriculture, and open space.

There are approximately 749 million acres of forest within the U.S.; 57% of which is privately owned. Privately owned forests provide a variety of products and services, including traditional and non-traditional forest and timber products, recreation opportunities, improved water quality, aesthetic landscapes, open space, and wildlife habitat, among others. In an effort to “increase public understanding of the contribution of and pressures on private forests,” the USDA Forest Service initiated the Forests on the Edge project. The focus of phase one of that project was identifying areas of the United States where private forest land will likely undergo increases in housing density by 2030. Based upon phase one analyses, an estimated 44.2 million acres (10%) of private forests in the United States are projected to experience significant increases in housing development by 2030. Nationwide, the greatest increases in housing development in and around private forests are expected to occur in the Eastern United States—where the majority of private forests are located. However, several locations within the Western U.S. are projected to undergo significant increases in residential housing. These include areas along the north coast of California, portions of the Sierra Nevada Mountains, some locations west of the Cascade Mountain Range in Washington and Oregon, and some isolated areas in the Idaho panhandle and northwestern Montana. This case study focuses on northwest Washington.

Northwest Washington

Although the greatest increases in residential development are projected to occur in the Eastern U.S., watersheds in several Western States were also identified as likely to undergo substantial increases in residential development. One such area was northwest Washington. Several watersheds located in the northwestern Washington counties of Snohomish, Skagit, and Whatcom are projected to experience moderate to high increases in residential development by 2030 (fig. 1). Of these watersheds, the greatest increase in residential development is projected to occur within the Strait of Georgia watershed, which spans portions of Skagit and Whatcom Counties. By 2030, an estimated 60,000 forest land acres in this watershed are projected to experience increased residential development. Lesser increases in residential housing density are projected to occur within the Nooksack watershed (increased housing density on approximately 31,800 forest land acres), the Lower Skagit watershed (increased housing density on approximately 36,600 forest land acres), the Snohomish watershed (increased housing density on approximately

10,600 forest land acres), and the Stillaguamish watershed (increased housing density on approximately 10,400 forest land acres).

The conversion of rural land to developed uses results from market forces. Population, income, and economic growth combine to increase demands for land in residential, public infrastructure and commercial and industrial uses. Demands also increase with people's lifestyle choices when, for example, people relocate to rural areas or desire second homes in scenic forest settings. When demands for developed land uses increase, so do the financial incentives some forest land owners have to sell land for development. The incentive is the revenue owners can earn from selling land above what they can earn from maintaining land in forest. When these market forces are at play, some forest land development is inevitable (see Kline et al., 2004 for a further discussion of the market and non-market values of forest land). In this document, the current conditions and recent trends in many of the factors that influence land use and land use change within these five watersheds, the three northwest Washington counties, and the state of Washington are examined.



Figure 1-Northwest Washington watersheds projected to experience moderate to high increases in residential development by 2030.

Conditions and Trends in Washington State

Forest Land and Timberland

There are approximately 22 million acres of forest in Washington state—slightly more than half of the state’s total land area (Smith et al. 2003). Washington’s forest acreage represents about 3% of the total forest acreage in the United States. The area of forest within Washington has declined in recent decades—decreasing by 1.4 million acres (or 6%) since the mid-1970s (Smith et al. 2003). Privately owned forest land accounts for nearly 45% (9.8 million acres) of all forest land in Washington (Smith et al. 2003). More than half of this private forest land (5.5 million acres) is owned by non-industrial private forest (NIPF) landowners (individuals, families, investment groups, etc.). The remainder of private forest land is primarily owned by forest industry.

Seventy-nine percent of the forest land in Washington (17 million acres) is classified as timberland (land able to produce at least 20 cubic feet of timber per acre per year and not legally withdrawn from timber production). Approximately 51% (9 million acres) of timberland in Washington is privately owned—more than half of this private timberland is owned by NIPF landowners. The area of privately owned timberland in Washington has declined by 1.3 million acres since the mid-1970s. Nearly all of this loss in private timberland resulted from a loss in NIPF timberland acreage. The acreage of timberland owned by forest industry has also declined slightly (167,000 acres) in recent decades. It is unknown whether recent and future divestments of forest industry-owned timberland will lead to greater conversion of these timberlands to other land uses.

From 1995 to 2004, annual timber harvest volumes in Washington have been steady to slightly declining (fig. 2). During the period, 71% of total harvest volume originated from privately owned lands. In 2004, 3,053 million board feet (MMBF) were harvested from private forests. Within the state, just more than 75% of the timber volume harvested originates from forests located west of the Cascade Range.

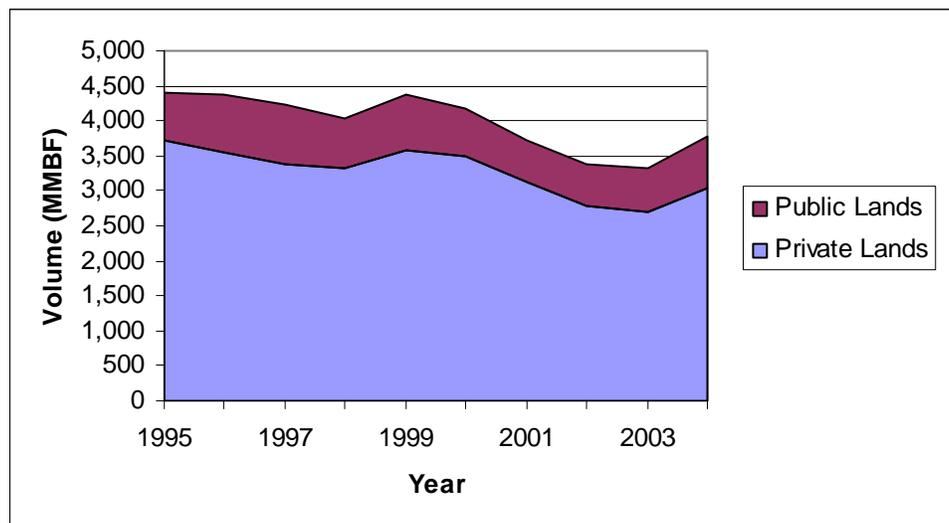


Figure 2-Timber volume (in million board feet) harvested from public and private forests in Washington State, 1995-2004. Data sources: Washington State Department of Revenue N.d.a. and Washington State Office of Financial Management, N.d.

Population and Housing

Between 1990 and 2000, the population of Washington increased by 1 million individuals—from 4.9 million to 5.9 million. This 21% increase was the 10th greatest percentage increase in statewide population in the Nation. During the same period, the number of housing units in the state increased by 400,000 to 2.5 million—an increase of 20%. The state’s population is projected to increase to 6.7 million individuals by 2010 and to 8.4 million individuals by 2030 (WA State Office of Financial Management 2005a).

As result of the increase in population, the population density of Washington rose from 73 people per square mile in 1990 to 89 people per square mile in 2000. Similarly, housing unit density increased from 31 units per square mile in 1990 to 37 units per square mile in 2000. Population and housing unit densities throughout regions of the state differ widely, with population and housing unit densities in western Washington more than double the respective statewide densities.

Conditions and Trends in Northwest Washington

The northwestern Washington watersheds considered here are located in Snohomish, Skagit, and Whatcom Counties. These counties are in the northern Puget Sound region, north of the Seattle metropolitan area and along the Interstate 5 corridor (fig. 1). Snohomish County is just north of the Seattle metropolitan area, and Whatcom County is located along the Canadian border; Skagit County lies between the two. All three counties are classified as “metropolitan” counties, although Snohomish County has a significantly greater population than the other two (Beale 2003).

Timberland Area

In total, there are approximately 630,000 acres of private timberland in the northwest Washington counties—about 6% of the privately owned timberland in Washington (table 1). Whatcom County has less privately owned timberland acreage than either Snohomish or Skagit Counties. Nearly 45% of the private timberland in the three-county area is owned by NIPF landowners. This percentage is slightly lower than that found statewide.

Table 1-Privately owned timberland within three NW Washington counties

County	Timberland Acres
Skagit	239,000
Snohomish	239,000
Whatcom	<u>156,000</u>
Total	<u>634,000</u>

Data source: Gray et al. 2005.

Timber Harvest Levels

On average, slightly more than 200 MMBF of timber was harvested annually from privately owned forests in the three-county study area from 2000 through 2004 (table 2). This represents approximately 7% of the statewide annual harvest volume originating from privately owned lands. Similar to statewide patterns, annual timber harvest volumes from private lands in the three counties have remained steady to slightly declining between 2000 and 2004. Annual timber harvest volumes are greatest in Skagit County and lowest in Whatcom County.

Table 2-Annual harvest volumes (MMBF) from privately owned forests^a

County	2000	2001	2002	2003	2004	5-Year Average
Skagit	114	95	70	65	85	86
Snohomish	93	71	52	53	76	69
Whatcom	65	41	47	57	37	55

^a MMBF = million board feet. Figures include sawtimber, pulp, fiber, and posts. Data source: Washington State Department of Revenue, N.d.a.

Stumpage Values

The predominant timber species in western Washington is Douglas-fir (*Pseudotsuga menziesii*). Stumpage values for Douglas-fir in northwestern Washington have been declining (in real dollars) since the mid to late 1990s (fig. 3). This decline is consistent with the general trend in Douglas-fir stumpage values throughout western Washington. Conversely, stumpage values for the hardwood species red alder (*Alnus rubra*) have been increasing fairly steadily during the same period. Although increasing in popularity, red alder is not grown widely in northwest Washington.

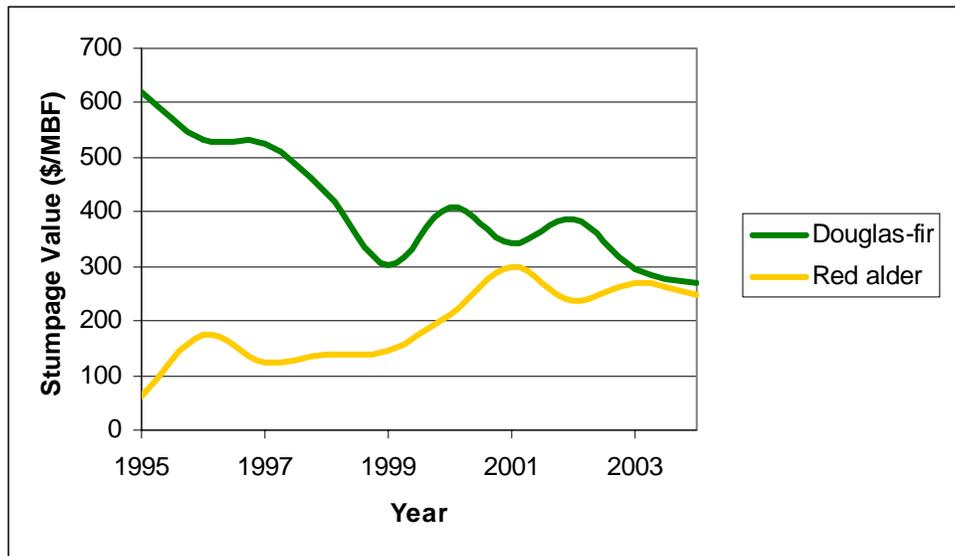


Figure 3-Timber stumpage values (dollars per thousand board feet) in northwest Washington (year 2001 dollars). Data source: Washington State Department of Revenue, N.d.b.

Population and Housing Trends

Of the three northwest Washington counties, Snohomish County (nearest the Seattle metropolitan area) has the largest population and has experienced the greatest increases in population since the 1970s (fig. 4, table 3). Between 1990 and 2000, the population in each county increased by approximately 30%, well above the statewide percentage increase for the period. Most of the increase in population within the three counties can be attributed to gains resulting from net migration (table 3). Net migration in the 1990s was more than 360% of the natural increase in population (births minus deaths) in Skagit and Whatcom Counties and more than 190% of the natural increase in population in Snohomish County. Similar to the statewide pattern, high net migration rates to the northwest Washington counties in the 1990s slowed during the 2000 to 2005 period. This slowdown has been attributed to an economic downturn that began around the year 2000. Subsequent to an economic rebound in 2003, net migration rates for Washington and the northwest Washington counties have again increased (Washington State Office of Financial Management 2005a).

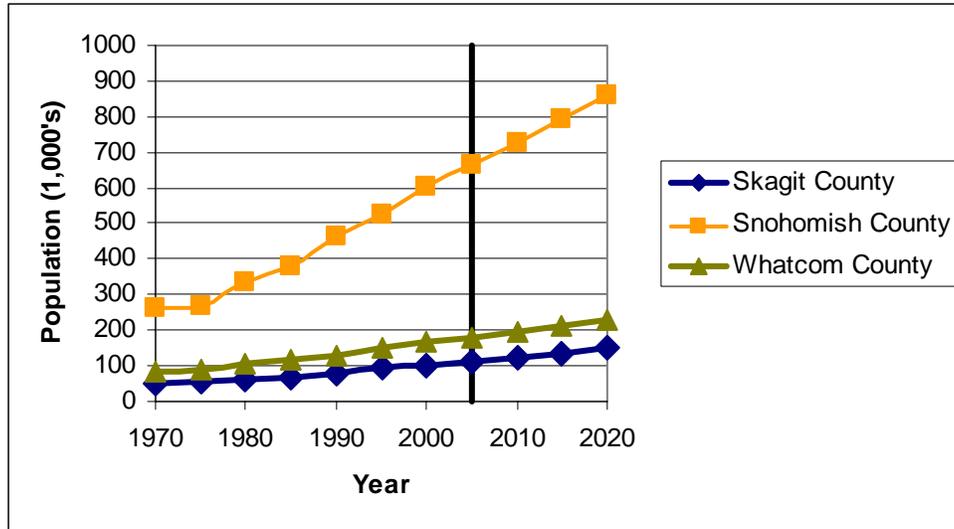


Figure 4-Skagit, Snohomish, and Whatcom County historical and projected populations, 1970–2020. Data source: Washington State Office of Financial Management 2002.

Table 3-Population and net migration for the northwest Washington counties

County	Population			Net migration	
	1990	2000	2005	1990-2000	2000-2005
Skagit	79,545	102,979	110,900	18,634	6,212
Snohomish	465,628	606,024	655,800	92,367	27,314
Whatcom	127,780	166,826	180,800	30,696	10,236

Data source: Washington State Office of Financial Management 2005b

Housing unit densities in each of the three northwestern Washington counties have more than doubled since 1970 (table 4). The highest housing densities occur within the western portions of each county, near Interstate 5 (fig. 5). Southwest Snohomish County (in and around the Snohomish watershed), just north of the Seattle metropolitan area, has the highest housing unit densities within the three-county area. The second highest housing unit densities are found in the Strait of Georgia watershed (the watershed in Washington projected to experience the greatest increases in residential development). Housing unit densities in the Nooksack, Lower Skagit, and Stillaguamish watersheds are generally lower than those found in the Strait of Georgia or Snohomish watersheds.

Table 4-Housing units per square mile, 1970-2000

County	1970	1980	1990	2000
Skagit	11.3	16.0	19.4	24.6
Snohomish	42.8	62.8	88.1	113.1
Whatcom	14.4	22.4	26.3	34.9

Data source: USDC Census Bureau 1990 and USDC Census Bureau 2005a.

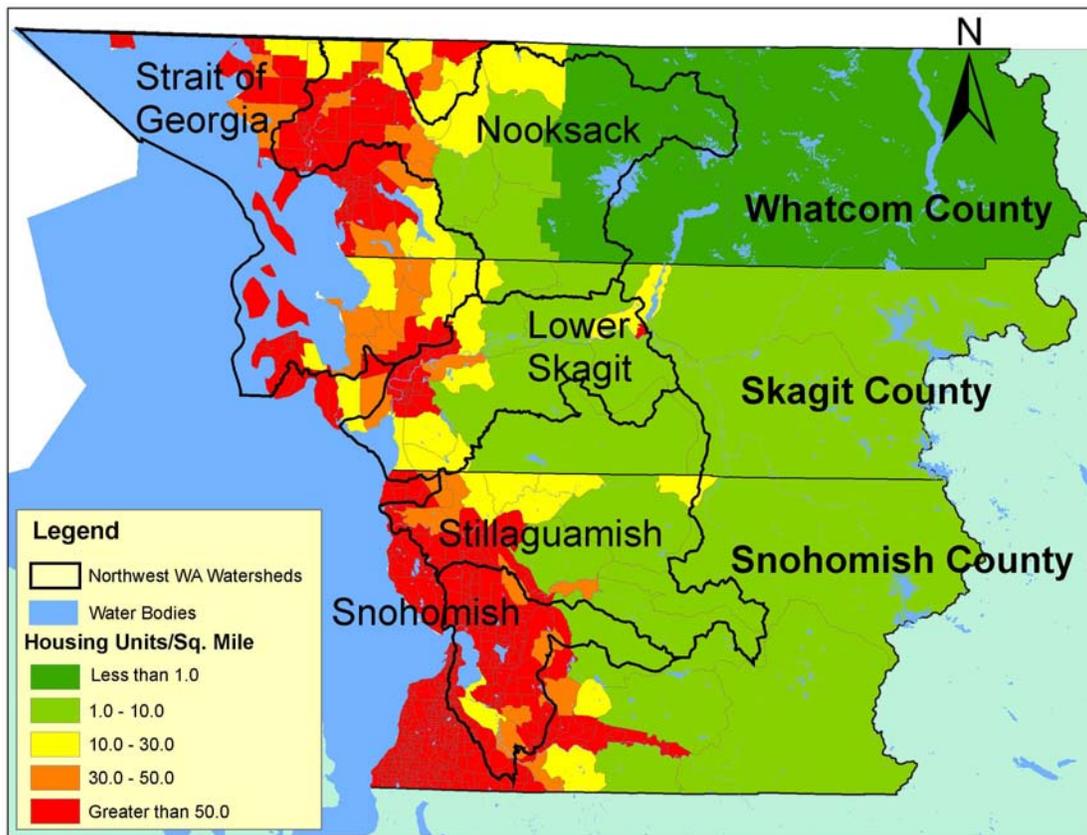


Figure 5-Housing units per square mile by census block group in northwest Washington. Data source: USDC Census Bureau 2005b.

The populations and number of housing units within the northwestern Washington watersheds have increased at faster rates than in Washington state as a whole (table 5). Of the northwestern Washington watersheds, the greatest percentage increases between 1990 and 2000 in population (67%) and housing units (69%) occurred in the Stillaguamish watershed located in northern Snohomish County. The smallest percentage increases

occurred in the Lower Skagit watershed—although these increases were still above those of Washington state as a whole. In the Strait of Georgia watershed, the population increased 31% while the number of housing units increased 34% between 1990 and 2000.

Table 5-Increases in population and housing units in the northwest Washington watersheds and Washington State between 1990 and 2000

	Population	Housing units
Strait of Georgia	31%	34%
Nooksack	35%	35%
Lower Skagit	29%	22%
Stillaguamish	67%	69%
Snohomish	35%	28%
Washington state	21%	20%

Data sources: USDC Census Bureau 1990 and USDC Census Bureau 2005a.

The number of existing home sales occurring annually in the three northwest Washington counties has been steady to increasing since the mid-1990s (fig. 6). Snohomish County has experienced both a greater number of existing home sales annually and a more significant increase in the number of existing home sales during the period than either Skagit or Whatcom Counties. During the same period, the number of building permits issued annually in the three northwestern Washington counties collectively for single-family residences has followed a general increasing trend (fig. 7). In Snohomish County, the number of building permits issued annually has increased nearly every year since the mid-1990s. The numbers of building permits issued annually in Skagit and Whatcom Counties were relatively steady through the latter 1990s but have increased in recent years. The economic slowdown in 2000, 2001, and 2002 had a lesser impact on the number of single-family residence building permits issued in Skagit and Whatcom Counties than in Snohomish County.

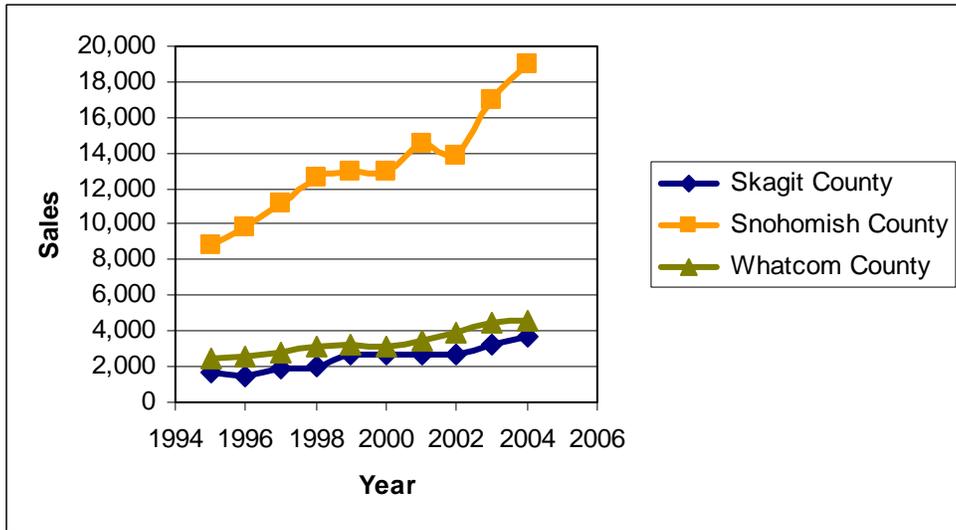


Figure 6-Number of existing home sales occurring annually in northwest Washington counties, 1995–2004. Data source: Washington State Center for Real Estate Research, N.d.a.

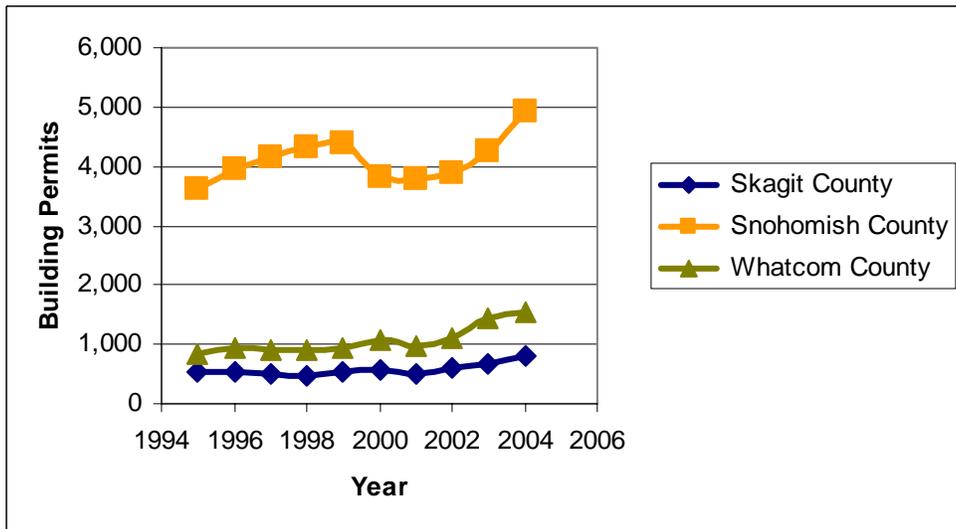


Figure 7-Building permits issued annually for new single family home construction in northwest Washington counties, 1995–2004. Data source: Washington State Center for Real Estate Research N.d.b.

Undeveloped Land Values

Private forest land owners are faced with the opportunity cost of keeping land in its current use rather than selling it, in which case the use of the land may change. Based upon recent market transactions, the value of undeveloped land in Skagit and Snohomish Counties ranges from approximately \$2,500 per acre for parcels larger than 100 acres to more than \$100,000 per acre for parcels smaller than 5 acres (table 6). These prices reflect the current demand for and supply of undeveloped land in the two counties. Future changes in demand or supply will influence the market value of undeveloped land.

Table 6-Average sales price/acre of undeveloped land sold between 2000 to 2003^a

Parcel size	Snohomish County	Skagit County
Larger than 100 acres	\$2,600	\$2,300
10–100 acres	\$18,700	\$13,800
5–10 acres	\$28,000	\$22,300
1–5 acres	\$104,800	\$113,600
Smaller than 1 acre	\$300,900	\$288,800

^aBased upon transaction data for undeveloped parcels with no building improvements in years 2003 through 2005 in Snohomish and Skagit Counties.

Land Use Planning

Under Washington state’s Growth Management Act (GMA), county governments are responsible for developing countywide comprehensive land use plans and for updating them regularly. The countywide comprehensive land use plans and the associated zoning regulations form the approximate boundaries of future land use and land use change within the counties. One component of the GMA is the requirement for many counties to designate long-term commercially important agriculture, forest, or mineral areas as “designated resource lands.” Within these resource lands, minimum allowable parcel sizes are generally relatively high (e.g., minimum parcel size of 80 acres) and other limitations on residential development may exist (e.g., residential development on designated resource lands may only occur in those areas that are part of a fire protection district). Outside designated resource lands, minimum parcel sizes are typically smaller, and there may be fewer limits on residential development.

For the most part, designated forest resource lands within the three counties, as identified in the respective county comprehensive plans, are located adjacent to federal land, within the central portions of the counties (fig. 8).¹ Federal lands constitute the vast majority of land in the eastern portions of all three counties. Skagit County has the largest area of

¹ All three counties are currently in the process of revising their comprehensive plans. The figures presented are based upon the comprehensive plans currently adopted.

designated forest resource land (360,500 acres), followed by Snohomish County (254,400 acres), and Whatcom County (185,200 acres). Within the five northwest Washington watersheds, the greatest total acreage of land classified as designated forest land is within the Nooksack watershed (161,200 acres), and the least acreage is classified in the Snohomish watershed (30,400) (table 7). As a percentage of total watershed area, the Snohomish Watershed has the least land area classified as designated forest resource land (17%), and the lower Skagit watershed has the most (47%). Approximately 25% of the land area in the Strait of Georgia watershed is currently identified as designated forest resource land.

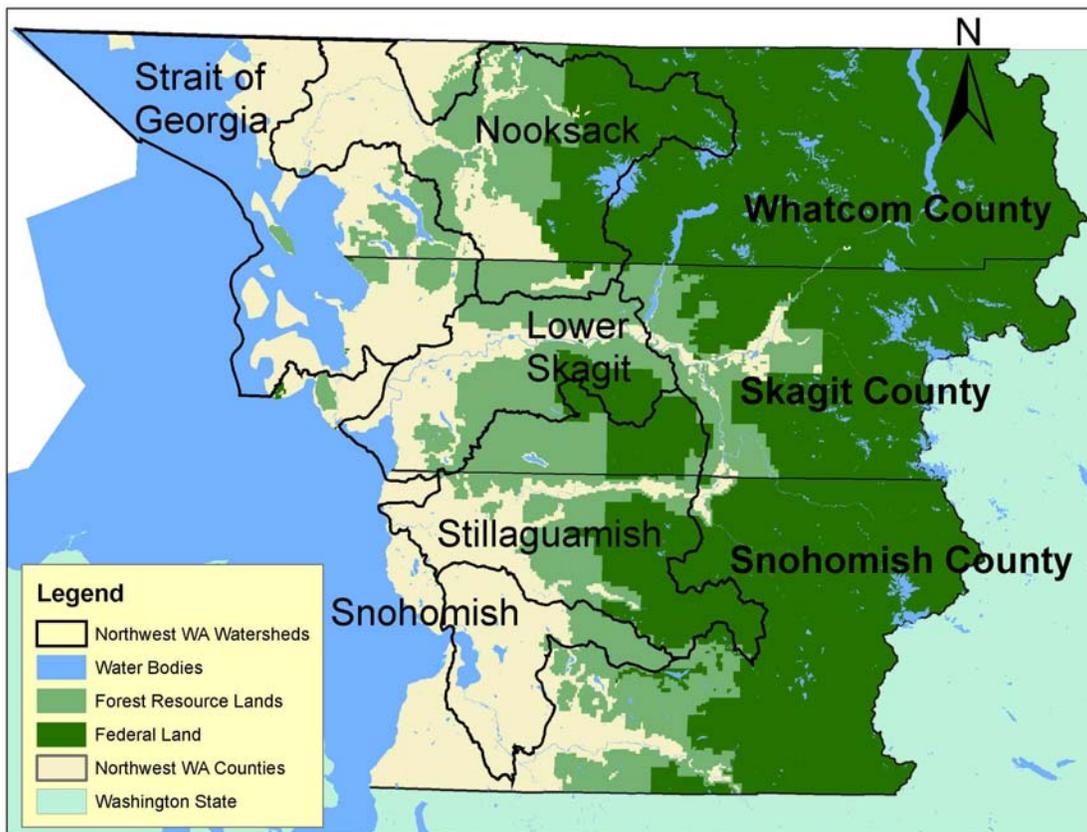


Figure 8-Designated forest resource lands and federal lands as identified in the current comprehensive plans of the three northwest Washington counties. Data sources: Skagit County 2001, Snohomish County Planning and Development Services 2003, and Whatcom County Planning and Development Services 2005.

Table 7-Acres of designated forest resource lands in the five northwest Washington watersheds

Watershed	Forest resource acres	Watershed acres
Strait of Georgia	60,700	584,000 ^a
Nooksack	161,200	498,000
Lower Skagit	134,000	284,000
Stillaguamish	160,400	438,000
Snohomish	30,400	177,000

^aExcluding the Puget Sound, there are approximately 240,000 land acres within the Strait of Georgia watershed.

Current and Projected Residential Development

The current levels of residential development differ considerably across the landscapes of the northwest Washington watersheds (fig. 9). In general, the highest levels of residential development are located in the western portions of the watersheds near Interstate 5 and inland along major travel corridors—areas located near current urban centers and areas offering convenient access to Interstate 5. Some pockets of moderate and high residential development do occur adjacent to federally-owned land. Of the northwestern Washington watersheds, the Snohomish watershed has the greatest concentration of residential development. Currently, the Strait of Georgia watershed has the greatest mixing of high, moderate, and low residential development.

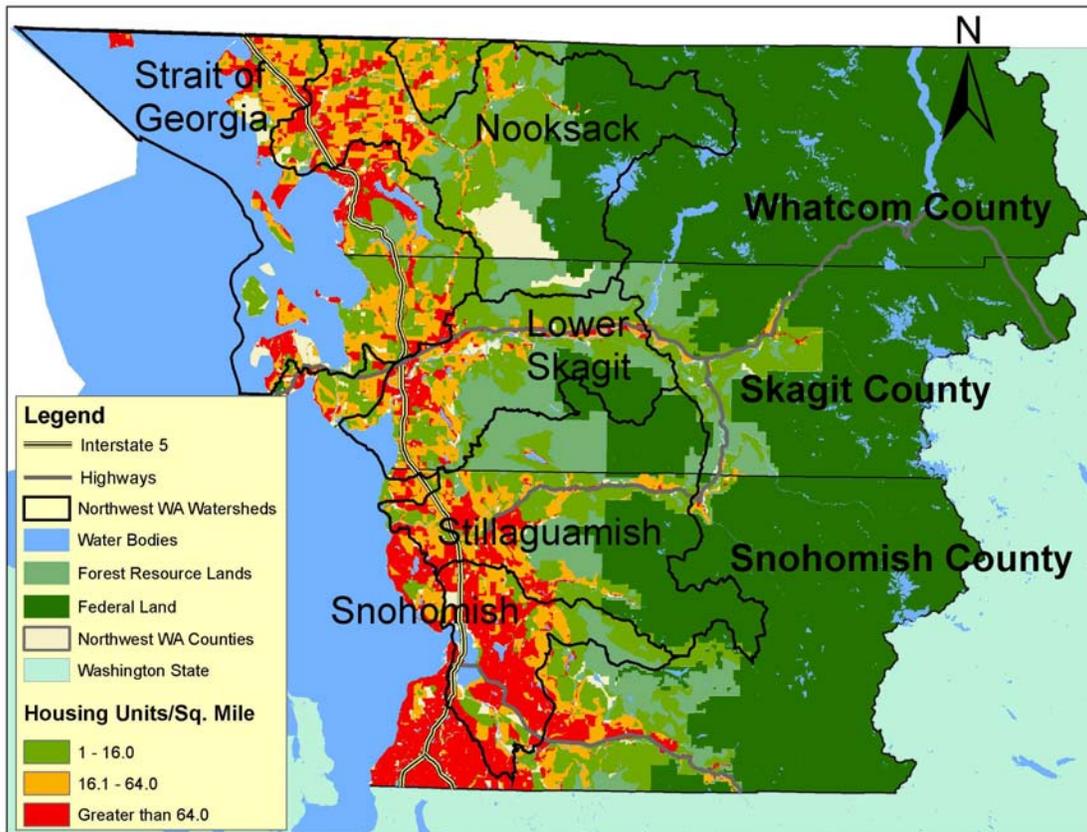


Figure 9-Year 2000 northwest Washington watersheds baseline housing unit density as identified for the USDA Forest Service “Forests on the Edge” project. Data sources: Theobald 2004a, Skagit County 2001, Snohomish County Planning and Development Services 2003, and Whatcom County Planning and Development Services 2005.

In most of the watersheds, current areas of moderate housing density are located adjacent to or near areas classified as designated forest resource lands under the comprehensive land use plans currently adopted. Within the Strait of Georgia watershed, much of the area currently classified as designated forest resource land lies between areas of high and moderate housing unit densities. In the Lower Skagit and Stillaguamish watersheds, linear expansions of exurban and urban housing unit densities pass through areas classified as designated forest resource lands.

Projections of residential development for the year 2030 indicate significant increases in housing unit densities within the westernmost land areas of the northwest Washington watersheds (fig. 10). Most of these increases are projected to occur on the periphery of areas currently having high housing unit densities. By 2030, nearly all of the land within the Strait of Georgia watershed and most of the land in the Snohomish watershed is projected to have housing unit densities above 64 units per square mile. Inland, projected

increases in housing unit densities occur along the major transportation corridors. The most significant increases in travel corridor housing density are projected to occur within the Lower Skagit watershed. The width of these linear expansions of moderate and high residential development generally decreases moving from west to east, from areas of current high development to areas currently more rural. Some increases in housing unit densities are also projected to occur in small developed areas adjacent to federal lands.

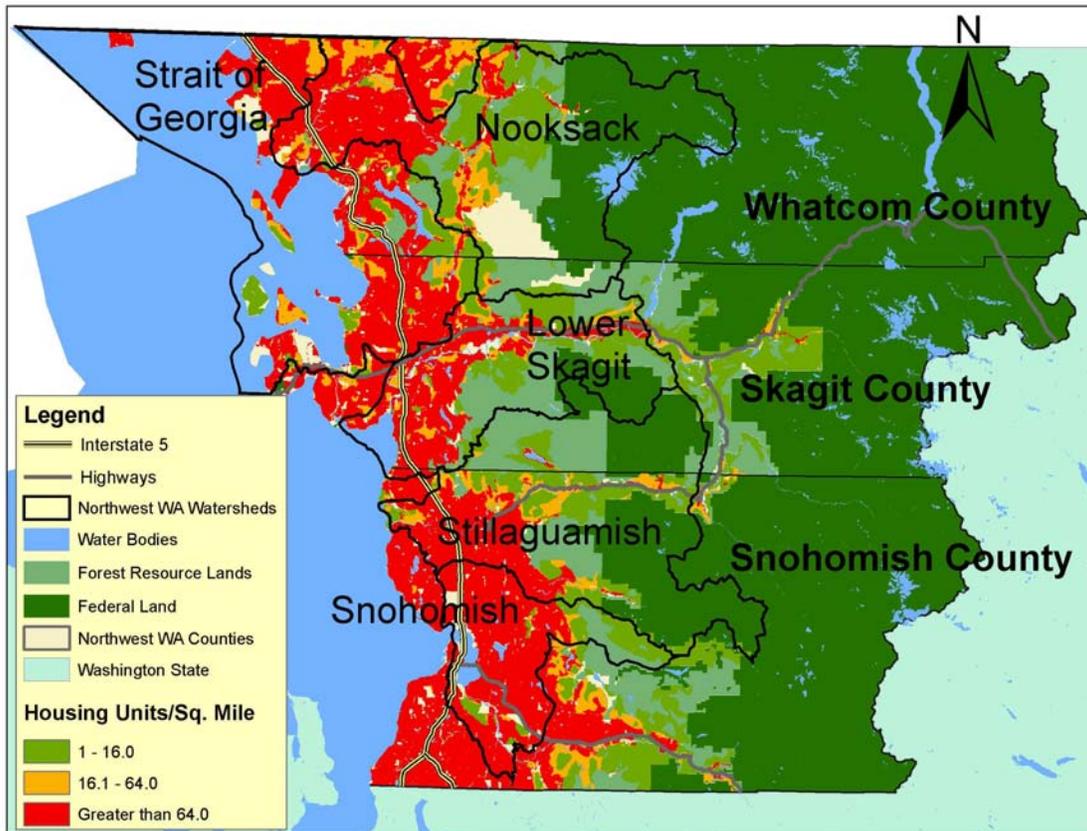


Figure 10-Year 2030 northwest Washington watersheds projected housing unit density as identified for the USDA Forest Service “Forests on the Edge” project. Data sources: Theobald 2004b, Skagit County 2001, Snohomish County Planning and Development Services 2003, and Whatcom County Planning and Development Services 2005.

Areas projected to have housing unit densities of greater than 64 units per square mile in 2030 are frequently adjacent to areas currently classified as designated forest resource lands. Development pressure on forests within designated forest resource lands located nearest to these areas of expanding high housing unit density will likely increase incrementally in the years prior to 2030, if the projections are correct. As these incremental changes occur, policymakers will likely be faced with making choices related to land use along this boundary. Based upon the housing unit projections, designated

forest resource lands located far from major roads and nearest federal land will likely experience the least development pressure.

Summary

The state of Washington, the three northwest Washington counties, and watersheds considered here have experienced increases in population and associated expansions in residential housing over recent decades. These changes can largely be traced to positive net migration to both Washington state and northwest Washington. Populations in northwest Washington are projected to increase through 2030. Statewide, the area of forest and timberland has declined in recent decades. Nearly all of the recent decline in privately owned timberland is associated with losses in the area of timberland owned by NIPF landowners. The impact of recent divestments of forest industry land on future land use change in Washington is unknown. Currently, privately owned timberland in northwest Washington accounts for approximately 6% of the state's total private timberland area.

Annual timber harvest volumes in the state and in northwest Washington have been steady to slightly declining in recent years. Over the same period, the stumpage values for Douglas-fir have been declining. Concomitantly, market value of undeveloped land in Snohomish and Skagit Counties is high, particularly for smaller parcels.

The approximate boundaries of future land use in northwest Washington are identified to some extent by countywide comprehensive land use plans. In current comprehensive plans, large areas of Skagit County, and to a lesser extent, Snohomish County are classified as designated forest resource land. Whatcom County has less area currently identified as designated forest resource land than the other two northwest Washington counties—the area of private timberland in Whatcom County is also less. Approximately 33% of the Nooksack and Stillaguamish watersheds and more than 45% of the Lower Skagit watershed are currently identified as designated forest resource lands. Lesser percentages of the Snohomish and Strait of Georgia watersheds are classified as designated forest resource lands.

Projected increases in population and the anticipated increases in the number of housing units will likely result in expansion of the land area dedicated to residential development in the northwest Washington watersheds. In particular, a substantial increase in the area of high housing unit density is projected in the Strait of Georgia watershed. Moderate expansions of high residential housing densities are projected within the Lower Skagit and Stillaguamish watersheds. There is considerable coincidence of the boundaries of areas of projected high residential development and areas of currently designated forest resource lands. If residential development occurs as projected, there will likely be increased development pressures on those forests located along the periphery of lands currently classified as designated forest resource lands.

Recent trends and projections indicate that the population of northwest Washington and the land area dedicated to developed land uses will continue to increase in the coming

decades. With these changes, it is increasingly important to recognize the importance of the services provided by privately owned forests and to identify appropriate strategies and tools to conserve private forests in the face of increasing land use change.

Metric Equivalents

1 acre = 0.405 hectare
1 acre = 4,046.86 square meters
1 cubic foot per acre = 0.07 cubic meters per acre
1 mile = 1.609 kilometers
1 square mile = 2.59 square kilometers

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