

WASHINGTON'S FORESTS, TIMBER SUPPLY, AND FOREST-RELATED INDUSTRIES

Overview

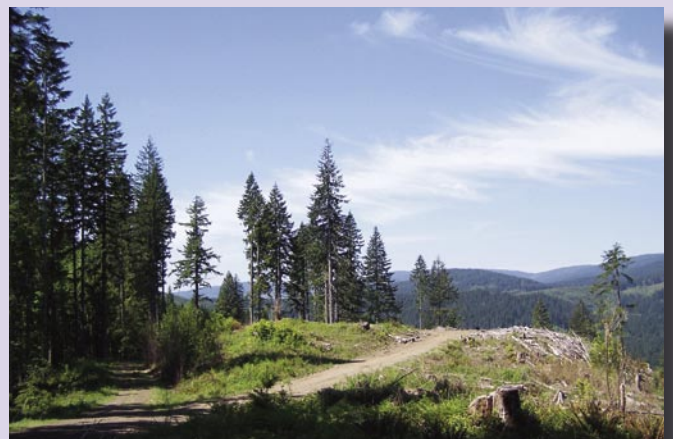
The economic health of Washington's forest-related industries today is a function of

- the amount of land in timber production;
- the growth, mortality, and loss of use of these forest lands;
- management costs including costs of taxes and regulatory compliance;
- the strength of domestic and international markets for forest products;
- perceived risks due to markets and regulations;
- attractive investments in alternative uses of capital and land;
- and varying management objectives of very diverse types of owners.

Traditional market drivers also are important, such as production costs. Also important are the availability and quality of timber and other forest products and services from Washington's commercial forest lands, as well as from alternative global, national, and regional markets. Forest industries are themselves important drivers of economic activity in Washington State, both in the rural areas where timber is harvested and in communities where sawmills and other processing facilities are located.

The ecological health of Washington's forests is greatly influenced by the actions of forest land owners responding to a variety of market forces and public policy decisions. These can range from public decisions to preserve "old growth" on publicly owned national forests, to private decisions by industrial or family owners of commercial forest land to thin or not thin densely-crowded second growth forests.

This portion of the Future of Washington Forests project report describes major study findings on timber supply and forest structure, on Washington's market competitiveness, and on the state and local economic contributions of the forest-related industries. Recent trends are summarized in all these areas, including major factors influencing timber supply, market demand, and investments in manufacturing facilities.



The forest sector of Washington's economy has undergone major restructuring in the past fifteen years. This is a result of changing federal land management policies, the transition to harvesting second-growth timber, changing regulatory standards, changes in international markets, and loss of forest land to non-forest uses. The result has been a major decline in harvest levels, decline in log exports, closures of small rural sawmills, and reinvestment and growth in large modern mills. Despite fifteen years of difficult change, the forest sector has begun to grow again, contributing \$15.6 billion to the state's economy in 2005, and remains the dominant employer in many rural communities. These trends can continue if forests currently available for harvest remain so. Or, increased dependence on supplying the U.S. housing market could expose marginal producers to the cyclical downturns in that market. Meanwhile, Washington's forests continue to provide environmental and social benefits valued by Washington residents, including clean water and air, fish and wildlife habitat, natural open space, and recreation opportunities.

Following this section are several focus areas, which give special attention to an emerging forest health crisis in eastern Washington, the costs and implications of new stream protection regulations, the competitive outlook for sawmills, the latest findings about innovative ways to use thinnings to manage overcrowded forests to improve both habitat and commercial timber, and the implications of forest management decisions for energy and climate change issues.

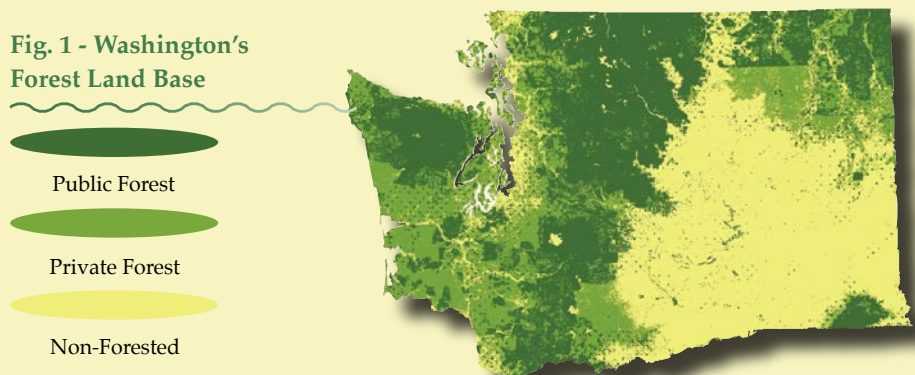


Washington Forests, Ownerships, Condition, and Productivity

The forests of the Evergreen State range from the rainy Olympic Peninsula coast, dominated by Sitka spruce and western hemlock, to interior western Washington forests dominated by Douglas fir and western hemlock, up the Cascade slopes through forests containing true firs and subalpine species, to dryer eastern Washington foothills where pine forests predominate. Forest lands in western Washington are more productive than those in eastern Washington, producing two to four times the timber volume per acre. Of Washington State's 43 million acres of land, approximately 21 million acres are forested.

Washington's forests grow on lands owned by a wide range of landowners. Public forests include federal government lands in national forests, national parks, and military reservations. Washington state-owned forest lands are mostly "trust" lands, an endowment managed by law to provide revenue for construction of public schools and other public buildings, and to financially support counties and their junior taxing districts. Local government-owned forest lands are usually watersheds for towns and cities. Private forest lands have historically been classified as industrial (meaning they are owned by companies which also own sawmills or other processing facilities), or are non-industrial. Non-industrial private lands have traditionally been thought of as parcels 5,000 acres or less, owned by families or individuals. However, these small parcels now make up only about half of non-industrial private forest land. Native American tribes are a major private owner of forest lands, treated as non-industrial in this report. Private forest ownership is undergoing a transformation, as the integrated industrial ownerships are

Fig. 1 - Washington's Forest Land Base



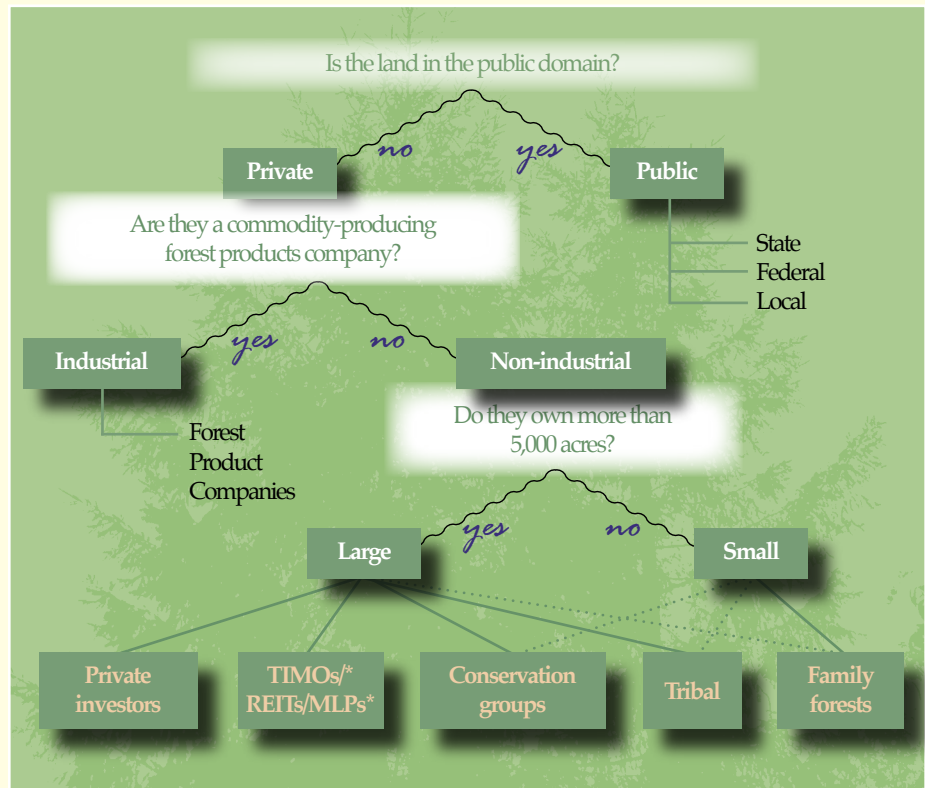
Source: National Land Cover Data (forest cover) and compilation of federal and state ownership boundaries (public lands.) Ara Erickson, Rural Technology Initiative, 2005

sold or restructured such that many large forest parcels are now owned by non-industrial institutional investors interested in financial returns from land and timber more than timber as a manufacturing input.

Some private timber lands have been removed from commercial production by land-use changes that have converted forest lands to residential and commercial uses or led to forest fragmentation. In response to these trends, private conservation groups and land trusts are beginning to purchase some private timberland that comes on the market, and manage that land as private entities for conservation purposes which may include some timber harvesting.

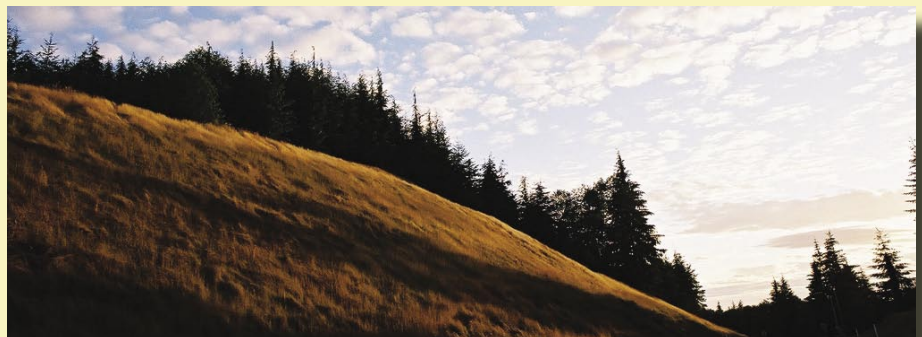
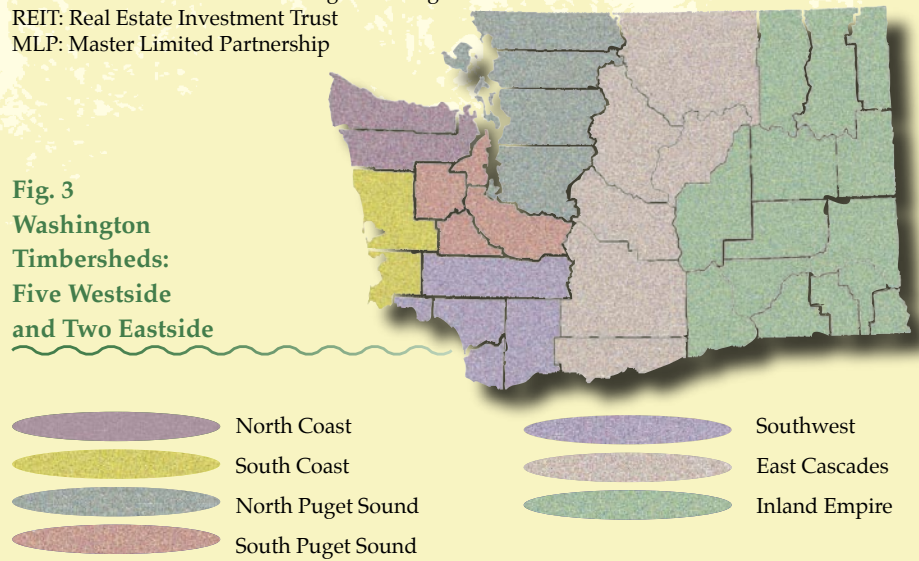
In this report, the term “timbersheds” is sometimes used to refer to common timber supply areas. These timbersheds are based on clusters of contiguous counties that have some common characteristics. There are five timbersheds in western Washington and two timbersheds east of the Cascade crest. Historically, timber may have been harvested and processed within the same timbershed or “tributary area,” calling to mind a “flow” of timber downhill to mills. In recent decades, timber travels much further for processing, across timbersheds and even across state or national boundaries. Timbersheds range in size from 1.2 million acres for the north coast, to 4.4 million acres for the east Cascades. Ownership also varies significantly across timbersheds, with 60 percent of the East Cascade timbershed in federal ownership, 41 percent of the Inland Empire timbershed in non-industrial private ownership, and 37 percent of the Southwest timbershed in industry ownership.

Fig. 2 - Classifying Working Forest Land by Landowner Groups



*TIMO: Timber Investment Management Organization
 REIT: Real Estate Investment Trust
 MLP: Master Limited Partnership

**Fig. 3
 Washington
 Timbersheds:
 Five Westside
 and Two Eastside**





MANY OF WASHINGTON'S UNRESERVED TIMBERLANDS ARE RESTRICTED BY FEDERAL OR STATE LAWS WHICH MANDATE PROTECTION OF SENSITIVE AREAS AND HABITATS SUCH AS STREAMSIDE BUFFERS.



Washington's forest land base also varies in its contribution to commercial timber production. Of the state's 21 million forested acres, 18 million acres are classified as "timberland" on the basis of soil productivity -- capable of producing 20 cubic feet or more of volume growth per acre per year. Within this area, two million acres are dedicated by law to purposes prohibiting timber harvest, such as parks and wilderness areas, leaving 16 million acres of "unreserved" timberlands with potential for management as working forests. Many of these lands are further restricted, such as by federal policy on national forests, or by federal or state environmental laws such as the Federal Endangered Species Act or the State Forest Practices Acts, which mandate protection of sensitive areas and habitats such as streamside buffers.

Fig. 4 - Western Washington Unreserved Timberlands

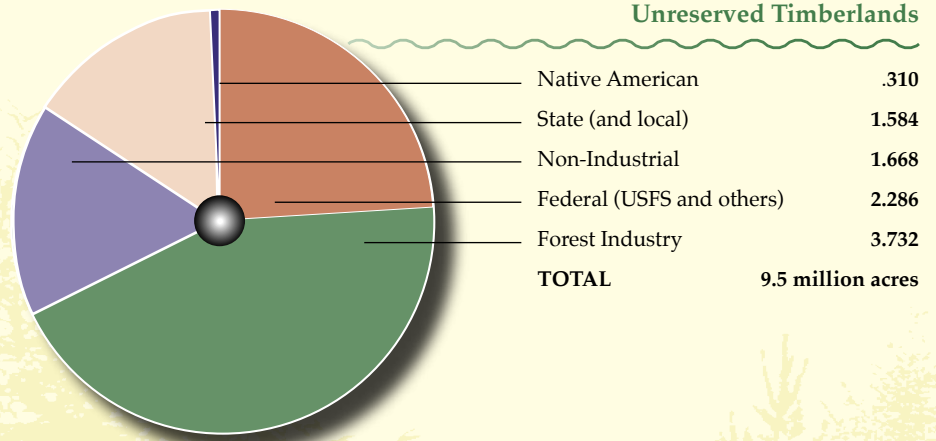


Fig. 5 - Eastern Washington Unreserved Timberlands

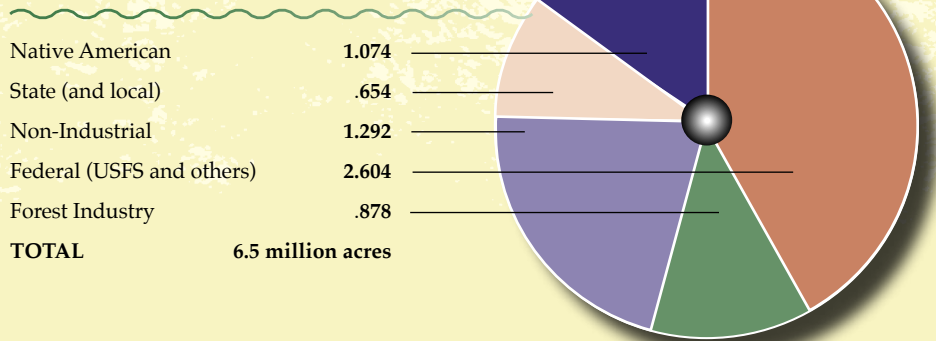
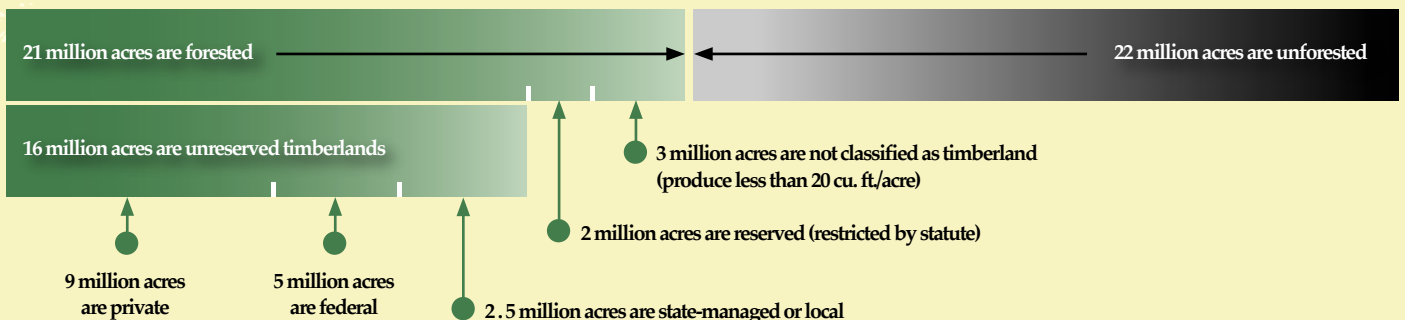
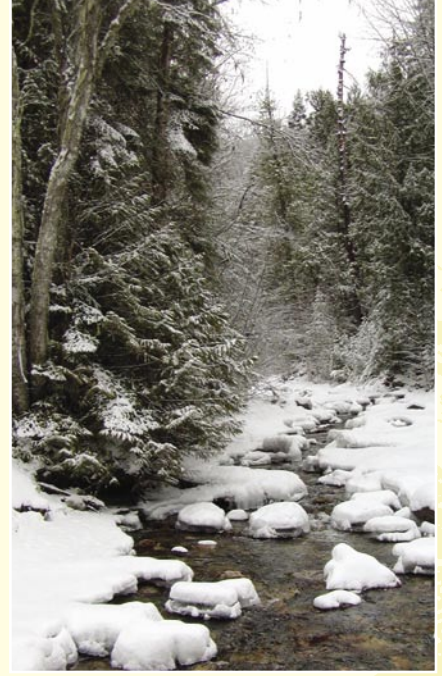


Fig. 6 - Washington State's Total Unreserved Timberlands

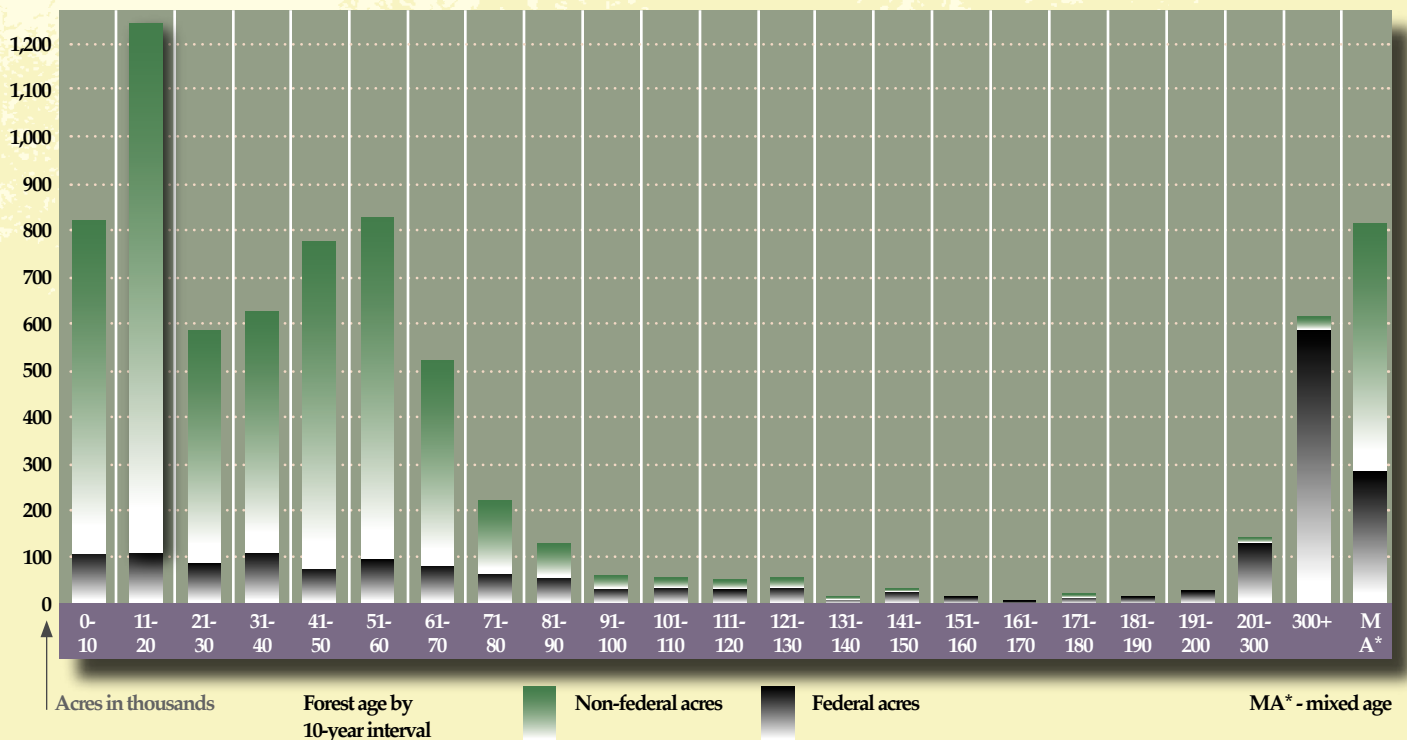




Past logging, natural disturbances and changing management approaches have produced wide variation in the average age of today's forests. In western Washington, about 75 percent of forest lands are younger than 100 years old, indicating that in the past 100 years there've been major disturbances, such as fires, windstorms, or timber harvests. About 45 percent of western Washington's forests are less than 40 years old, which is currently the optimal economic harvest age for intensively-managed commercial forests on highly productive sites in western Washington. About 30 percent are between 40 and 100 years old, constituting western Washington's significant areas of mature second growth forest. And about 25 percent are older than 100 years, including about 10 percent greater than 200 years old. However, older age alone does not necessarily indicate more "pristine" conditions, even for older forests. A century of fire suppression has left many of the older stands much more crowded than in earlier generations. Also, most of the younger second-growth and third-growth stands have been planted with commercial objectives in mind, resulting in trees spaced much closer together than would occur under natural conditions.

Forest ages vary dramatically by ownership and geographic location. In western Washington, a large majority of forests older than 100 years are on national forests. On national forest lands, almost 50 percent are older than 100 years. The balance is dramatically reversed on all other ownerships, with about 99 percent of all non-federal lands less than 100 years of age in western Washington. This shows that the opportunities for old growth protection exist overwhelmingly on national forests, and that other landowners essentially manage second and third growth forests.

Fig. 7 - Federal and Non-Federal Forest Age in Western Washington 1992



Overall, the picture of Washington's forest lands at present is one of great diversity in species, productivity, ownership, age, stand volume, and potential to contribute to timber harvest and other forest values. Because recent trends are for increasing protection of forests from logging on all ownerships and especially on national forests, the result is that in aggregate, Washington's forests are now getting older and increasing in standing volume. However, they are also much more crowded than pre-settlement forests. At the same time, permanent forest clearing for agriculture or real estate development is reducing the total forest area on private lands in western Washington by about one percent per year. The opportunity to maintain a stable commercial timber land base is limited by land reserved from harvesting on one hand and land lost to development on the other hand.



WASHINGTON'S FOREST LANDS HAVE GREAT DIVERSITY IN SPECIES, PRODUCTIVITY, OWNERSHIP, AGE, STAND VOLUME, AND POTENTIAL TO CONTRIBUTE TO TIMBER HARVEST AND OTHER FOREST VALUES.



Timber Harvest

Commercial timberlands in Washington are managed for the sustainable harvest of timber primarily for a North American market, with smaller but important international markets as well. In addition, a variety of non-timber products and services are also produced from these lands, including clean and abundant water, fish and wildlife habitat, a wide range of public recreational activities, floral greens, and biomass for energy. Many of these non-timber products and services are discussed in later sections of this report.

The volume of timber harvested from Washington's forests has declined dramatically in the past two decades (See Fig. 9). For western Washington's timberlands, total timber harvest volumes declined from 4.65 billion board feet in 1990 to 2.67 billion board feet in 2002, a 43 percent decline. This change was most pronounced on national forests, where harvest volumes as a percentage of total state harvest, dropped from 11 percent to 1 percent during this 12-year period (See Fig. 8). The share of total state harvest from industry lands increased from 62 percent to 73 percent, even though the industry level of harvest fell from 2.97 to 1.94 billion board feet, a 35 percent decline, during this same period. The shares of total harvest from non-industrial private lands, state trust lands, and tribal lands remained fairly stable, although actual volumes dropped for all.



Fig. 8 - Western Washington Ownership and Harvest Share Change from 1990 to 2002

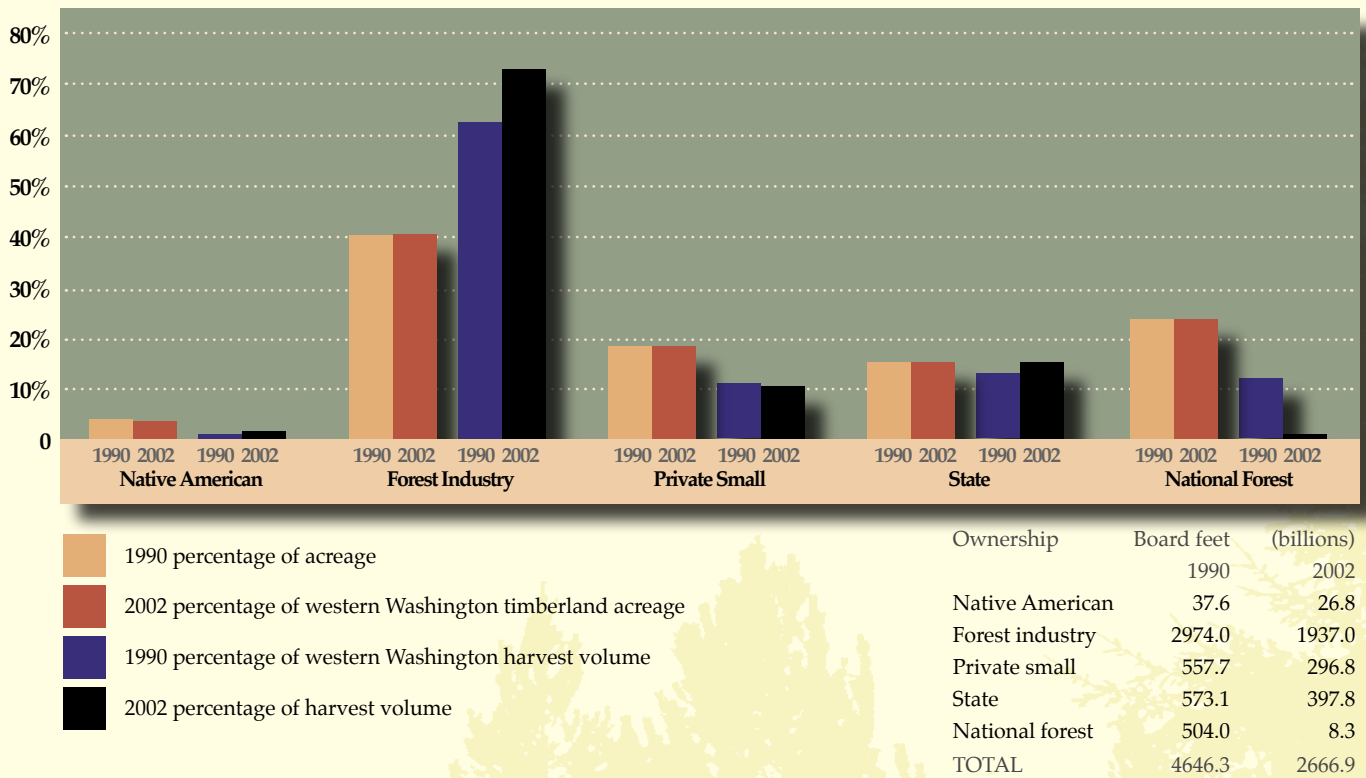
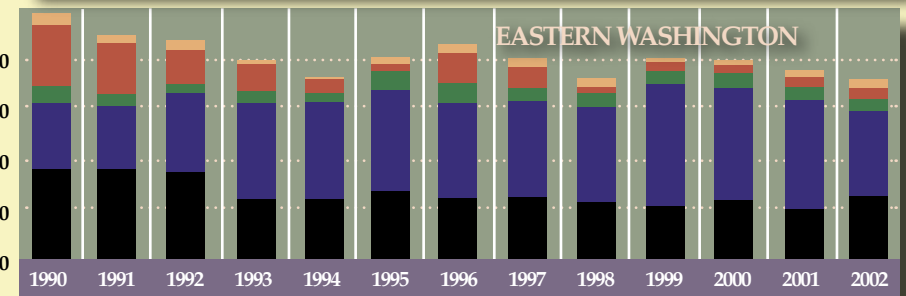
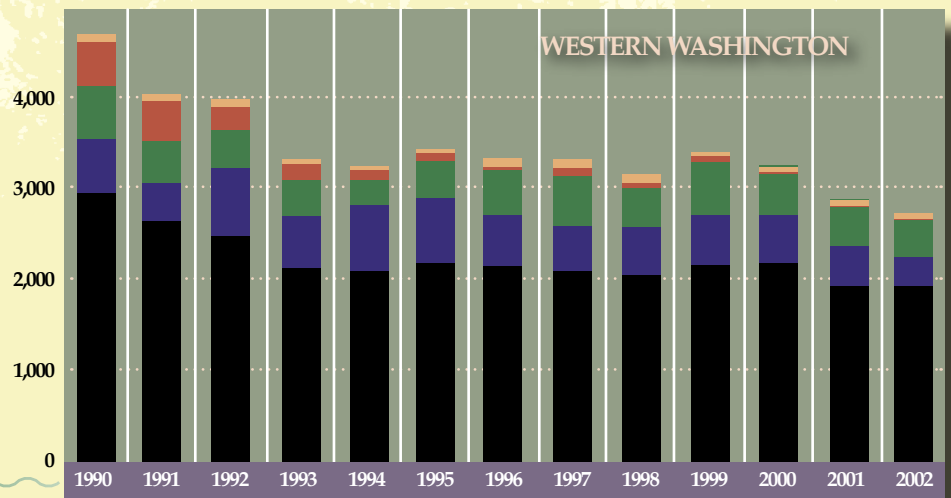
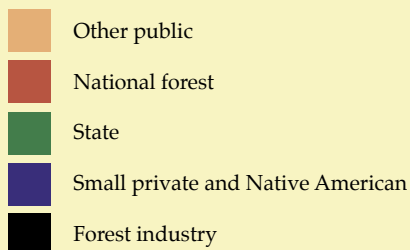


Fig. 9
Timber Harvest by Owner Type



Volume (board feet in millions)



ACTUAL HARVEST FOR THE PERIOD 1998-2002 SHOWED A 45% DECREASE FROM PRE-1990 LEVELS IN WESTERN WASHINGTON. EASTERN WASHINGTON POSTED A 29% DECLINE.



Another way to look at the declines in harvest volume is to compare the harvest projections estimated in the last major timber supply study for western Washington that was conducted in 1992 with actual harvest results during the projection period. Tables 1 and 2 show the actual harvest from the various ownerships in western and eastern Washington compared to projections, and the degree of error from previous projections. In the 1992 projection, the harvest from federal lands in western Washington was projected to decline by 74 percent from the pre-1990 average, while the harvest on state trust lands was projected to increase by 3 percent, and on private lands a 5 percent decrease was projected. Instead, actual harvest for the period 1998-2002 shows a decrease from the pre-1990 average of 97 percent for federal lands, 41 percent for state trust lands, and 34 percent for private lands. Overall, actual harvest levels in western Washington were 36 percent below projections and 45 percent below the pre-1990 level.

Eastern Washington, the subject of a previous 1995 projection, showed a similar pattern of lower-than-projected harvest volumes on all ownerships, led by an 85 percent decline on federal lands, to a level only half of what was projected. Tribal and non-industrial private landowners in eastern Washington actually increased

Table 1
Western Washington Harvest History
15 Year Prediction and Variance (million board feet)

	PRE-90'S 86-89	PREDICTED 05 +/-	CHANGE PREDICTED	LAST 4 YRS. ACT. 98-02	ACTUAL CHANGE	ERROR IN PREDICTED
INDUSTRY	2481	2571		1447		
SMALL PRIVATE	1292	1089		1044		
TRIBAL	62	0		27		
TOTAL PRIV.	3836	3661	-5%	2518	-34%	-31%
STATE	826	848	3%	487	-41%	-43%
FEDERAL	906	238	-74%	31	-97%	-87%
ALL OWNERS	5567	4746	-15%	3036	-45%	-36%

Table 2
Eastern Washington Harvest History
15 Year Prediction and Variance (million board feet)

	PRE-90'S 86-89	PREDICTED 05 +/-	CHANGE PREDICTED	LAST 4 YRS. ACT. 98-02	ACTUAL CHANGE	ERROR IN PREDICTED
INDUSTRY	371	248		188		
SMALL PRIVATE	190	318		294		
TRIBAL	189	305		300		
TOTAL PRIV.	751	871	16%	782	4%	-10%
STATE	122	162	33%	81	-34%	-50%
FEDERAL	431	133	-69%	65	-85%	-51%
ALL OWNERS	1305	1166	-11%	928	-29%	-20%

their harvest, although not quite as much as projected, and to some extent made up for declines in harvest from federal and industrial forest lands.

Federal policy changes associated with the 1994 adoption of the Northwest Forest Plan explain the dramatic harvest declines on federal lands. The declines on state trust lands are associated with the state's 1997 adoption of a federally-approved Habitat Conservation Plan for those lands, to comply with the federal Endangered Species Act. Changes in the degree and extent of management activities on private lands, as well as increases in state regulatory requirements to protect threatened salmon species may explain much of the decline for private lands.



SEVERAL FACTORS
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Markets for Washington Forest Products

Washington State's timber supply is primarily consumed by domestic sawmills producing lumber and other building products. In 2002, sawmills consumed about 61 percent of Washington's timber harvest from combined ownerships. Veneer and plywood mills consumed another 11 percent. Poles and pilings, shake and shingle mills, and chipping mills producing chips for pulp mills consume another 6 percent. Pulp and paper mills also consume wood residues from sawmills as well as recycled paper. The remaining 22 percent of the timber supply is exported as logs. These forest industry sectors compete to supply a domestic and global demand for forest products, mainly lumber and newsprint.

Log exports have significantly declined as a percentage of Washington timber production since the 1990s, as a consequence of federal and state policy decisions, restructuring in the Japanese markets, global market competition and global

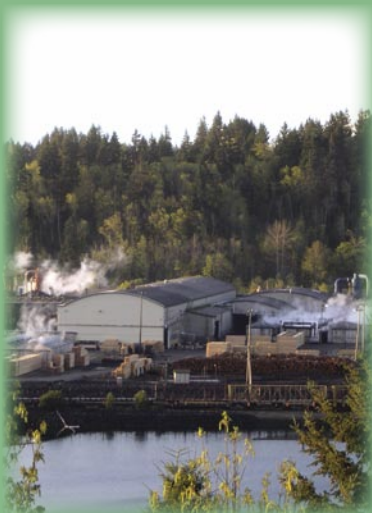


Fig. 10
Use of Washington
Industrial Roundwood (2002)

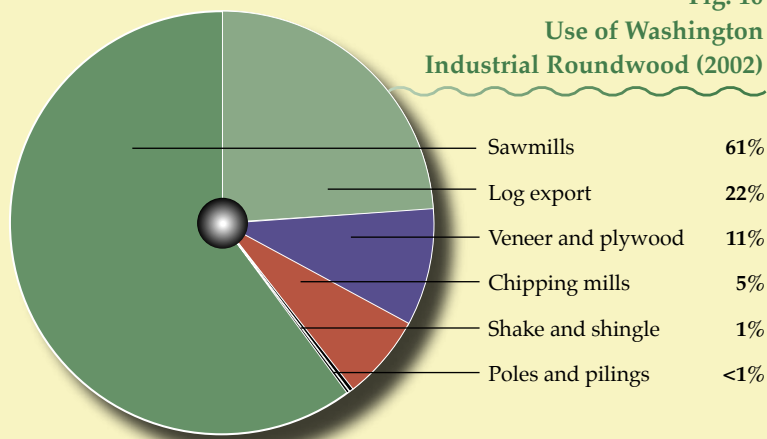


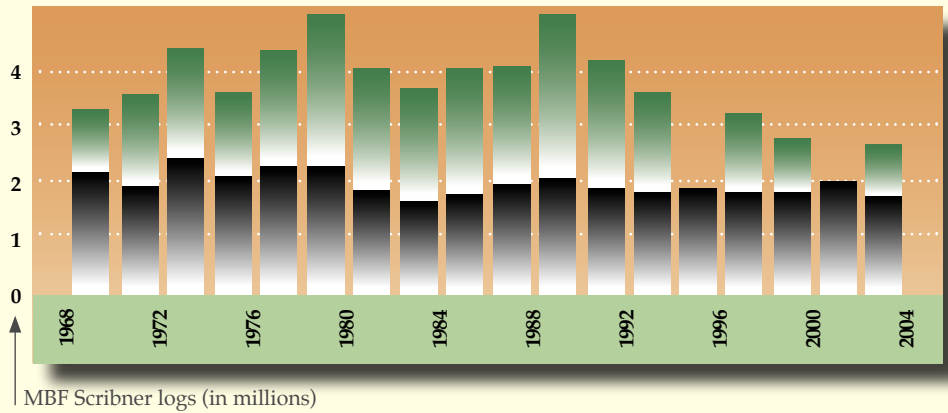


Fig. 11
Western Washington
Log Consumption Levels
(by Western Washington Sawmills
and Log Exporting Sector)

 Logs exported
 (1994 and 2002 data missing)
 Logs used by lumber mills



THE VAST MAJORITY OF THE LUMBER PRODUCED BY WASHINGTON SAWMILLS IS SOLD TO MARKETS IN NORTH AMERICA. U.S. MARKETS ARE THEREFORE OF PRIMARY IMPORTANCE IN EVALUATING MARKET OPPORTUNITIES.

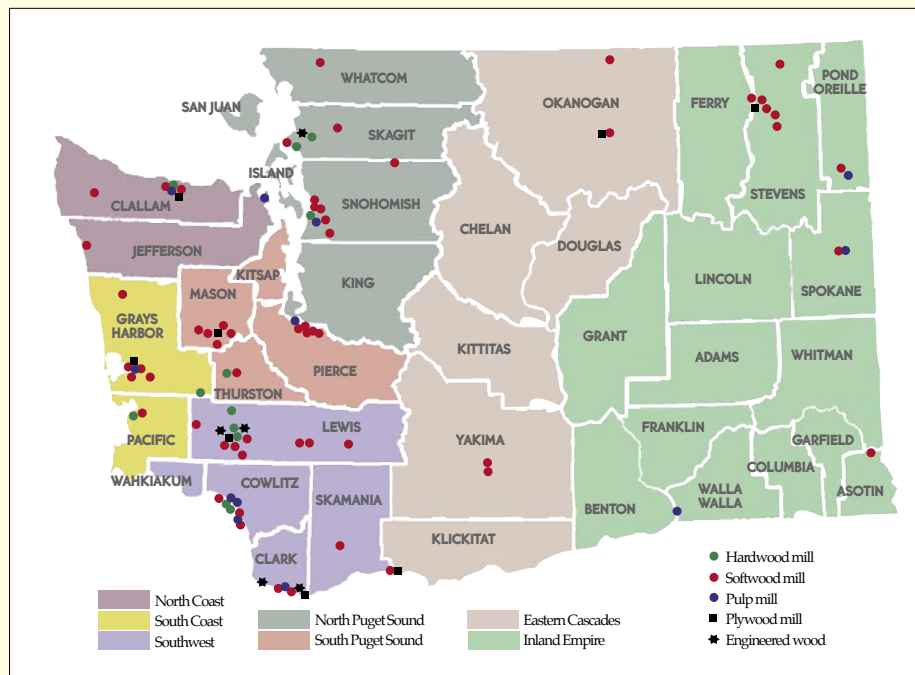
financial changes. Meanwhile, the volume of timber going to sawmills has declined only slightly and has increased as a percentage of the declining overall timber supply. The vast majority of the lumber produced by sawmills within the state is sold to markets in North America. Major forest products competitors to Washington include Oregon, with its distance advantage to California markets; Canada with its distance advantage to the Midwest; and the U.S. Southeast, with its distance advantage to southern and eastern markets. In general, as supply has decreased from Washington timberlands, it has increased from the Southeast and from Canada.

The U.S. as a whole is the world's largest producer of forest products and the world's largest consumer as well, accounting for roughly one-quarter to one-third of both world production and consumption. U.S. markets therefore are of primary importance in evaluating the market opportunities for Washington State forest products. Housing represents the major source of demand for softwood lumber in the U.S. International markets for Washington forest products include Japan, Canada, China, Mexico, and other countries to a lesser degree. Demand for Washington forest products from international markets declined over the past decade.





Fig. 12 - Washington State Wood Processing Facilities by Timbershed



MIRRORING THE DECLINE IN TIMBER HARVEST IN WASHINGTON STATE IN THE PAST 15 YEARS, THE NUMBER OF SAWMILL, VENEER AND PLYWOOD, AND PULP AND PAPER MILLS HAS ALSO DECLINED.

Processing Facilities

Investment by value-adding wood industries is critical to sustaining forest ownership in Washington State. Changes in forest ownership suggest forestland is increasingly being viewed as a financial rather than an industrial asset. However, the absence of a diversified and competitive industrial infrastructure to process the logs, small-diameter timber and thinnings from Washington forests, would undermine the value of Washington forests, and constrain landowners' ability and options for managing for ecological and economic health.

Mirroring the decline in timber harvest in Washington State in the past 15 years, the number of sawmill, veneer and plywood, and pulp and paper mills has also declined. Between 1987 and 1993, numerous sawmills closed, and softwood lumber production decreased by 23.5 percent. Between 1994 and 2005, the net number of sawmills continued to decline. Much of this decline can be attributed to the closure of older, inefficient small sawmills that relied on large, old-growth logs coming from the federal forests.

Fig. 13 Washington State Primary Forest Products Manufacturing Mills

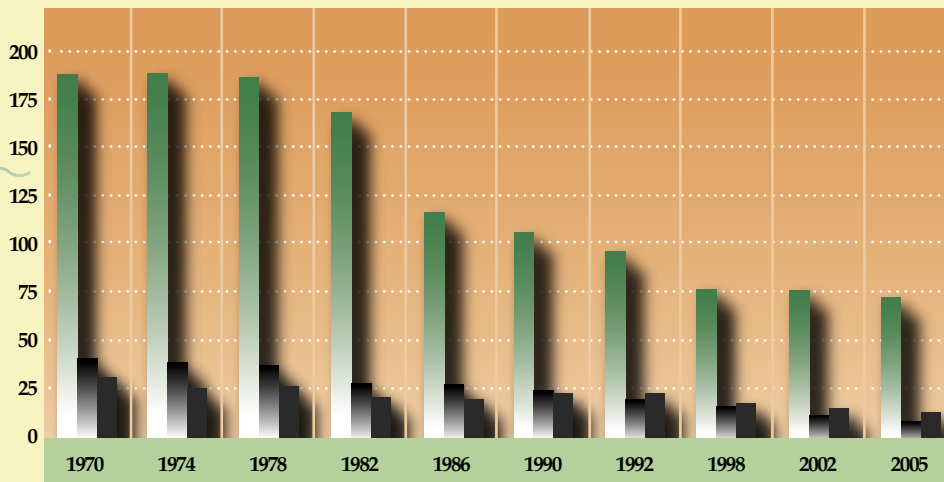
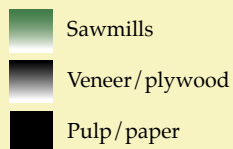
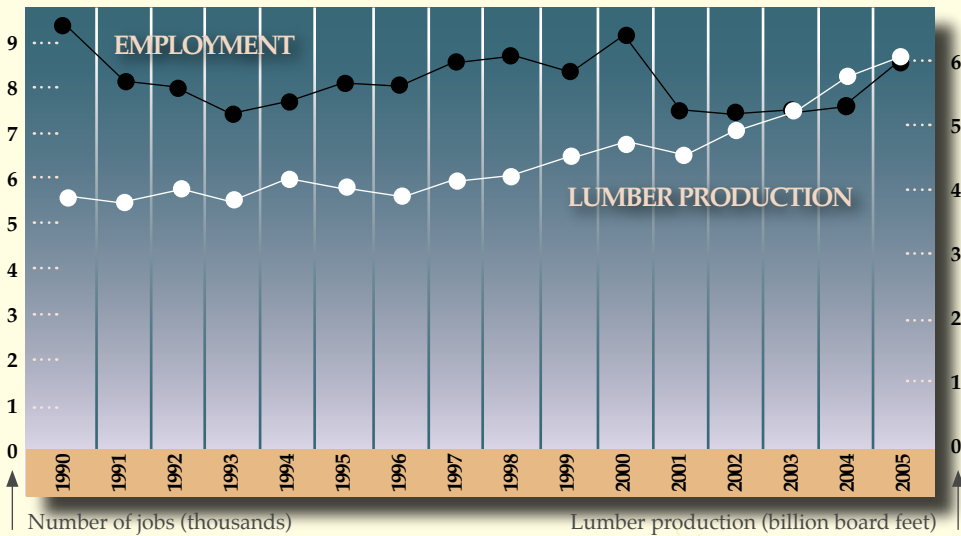


Fig. 14 - Lumber Production vs. Employment



During this time, overall sawmilling capacity and production actually increased as larger, more productive modern mills were built closer to major transportation corridors. Since 1991, softwood lumber production has increased by almost 60 percent. Job losses in the sawmill sector were a result of a complex set of factors including timber harvest declines; closure of older, small sawmills; opening of larger modern mills; and increased productivity of those mills. The net effect, for the sawmill sector only, from 1987 to 2002, was a loss of approximately 1,600 jobs. These job losses were disproportionately felt in rural areas, where older sawmills were closing. Across the forest industry during this period, decreases in timber harvest had much greater impacts on logging, trucking, and related jobs, estimated to be greater than 10,000 jobs. However, data interpretation is difficult because of how jobs are grouped and counted in state economic tracking systems.

The plywood industry in Washington, previously the largest in the U.S., has been in decline since 1962, declining from 35 mills to 8. The pulp and paper sector has also declined. From 1988 to 2003, the number of Washington pulp and paper mills declined from 26 to 15, accompanied by a 45 percent reduction in domestic production and a 75 percent reduction in exports. Because the state sawmill industry relies upon the sale of processing residuals to pulp and paper mills, the decline in this industry sector could have broad implications. Pulp and paper mills are also the largest non-hydroelectric contributor to renewable energy in Washington.

Closures of forest products manufacturing facilities have had a dramatic impact on processing capacity within specific timbersheds, which in turn limits the options of forest managers in those areas. This problem is particularly evident in the East Cascades, where there are no longer any mills located between one sawmill operating in central Okanogan County and two sawmills operating in central Yakima County, a distance of about 200 miles. This distance imposes substantial transportation costs, especially for lower-value residuals and small diameter timber derived from thinning operations.

JOB LOSSES IN THE SAWMILL SECTOR WERE A RESULT OF A COMPLEX SET OF FACTORS INCLUDING TIMBER HARVEST DECLINES; CLOSURE OF OLDER, SMALL SAWMILLS; OPENING OF LARGER MODERN MILLS; AND INCREASED PRODUCTIVITY OF THOSE MILLS.



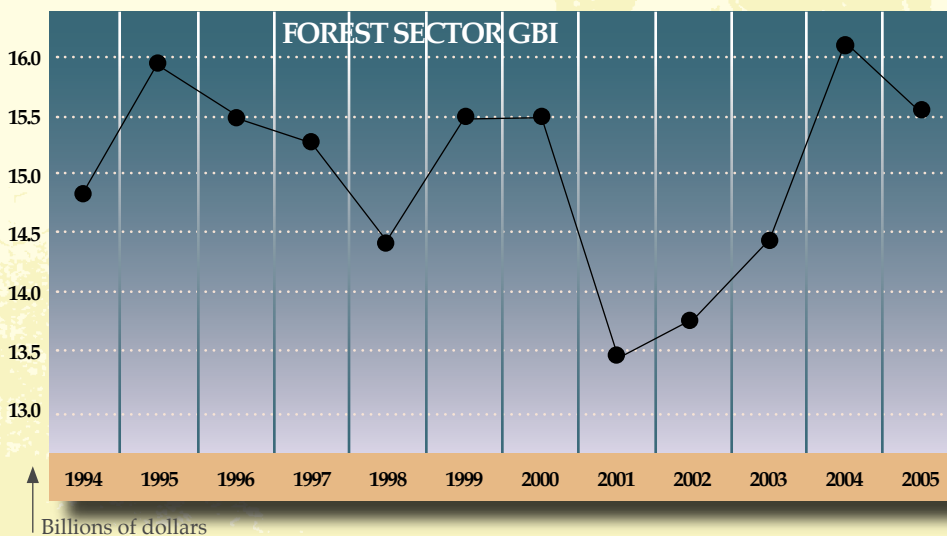
Economic Contribution to State and Local Economies

Despite the declines in harvest volume and sawmills over the past fifteen years, the forestry and forest products industries continue to make a significant contribution to the state's economy, particularly in rural, timber-dependent communities. Washington's forest products industry is one of the most dynamic in the United States. Washington's timber lands have the highest average per-acre yield of any state in the country. This contributes to Washington having the country's second highest level of capital investment in wood products manufacturing. Washington ranked second and fourth among U.S. states in 2005 in the production of softwood lumber and plywood, respectively.

Between 1994 and 2005, employment in sawmills actually increased from 7,721 to 8,565 as larger, more modern and efficient sawmills were built to replace those being closed, and Washington producers shifted their marketing efforts from lumber exports to domestic lumber production. Since 1991, lumber production in Washington increased by 58 percent, and Washington's share of U.S. lumber production increased from 10.3 percent to 14.2 percent. A similar trend has occurred for plywood mills, with larger mills surviving, production per mill increasing 163 percent, and total production declining much less than the total number of mills.

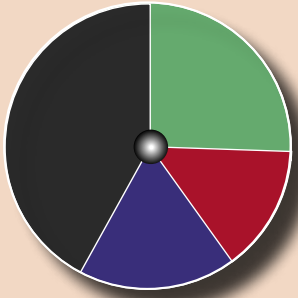
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Fig. 15 - Forest Sector Income



In fact, since 2001, Washington's forest industries have played an increasingly significant role in the state economy, due primarily to a very strong U.S. housing market. Not only did this sector provide more than 45,000 jobs in 2005, it also generated approximately \$16 billion in gross business income (GBI), and paid out more than \$2 billion in wages. This sector accounts for about 15 percent of Washington manufacturing jobs statewide, about 1.5 percent of total state employment, and about 3.2 percent of GBI within the private sector. Forestry and forest products GBI as a percentage of total GBI within individual timbersheds climbs to 22 percent in the south coast timbershed and 15 percent in the southwest timbershed. Similarly, forestry and forest product employment as a percentage of total employment is 8.5 percent and 6.9 percent in these two timbersheds, respectively. Annual wages are relatively high in this sector, averaging close to \$50,000.





FORESTRY AND FOREST PRODUCTS INDUSTRY SECTORS:

- FORESTRY AND LOGGING
13% EMPLOYMENT
- WOOD MANUFACTURING
42% EMPLOYMENT
- PAPER MANUFACTURING
27% EMPLOYMENT
- FURNITURE MANUFACTURING
17% EMPLOYMENT

The forestry and forest products industry is composed of four main sectors: forestry and logging, wood manufacturing, paper manufacturing, and furniture manufacturing. Wood manufacturing is the largest employer with 42 percent of industry employment, followed by paper manufacturing with 27 percent, furniture manufacturing with 17 percent, and forestry and logging with 13 percent. On the basis of GBI, wood manufacturing is also the largest, followed by paper manufacturing, forestry and logging, and furniture manufacturing.

Fig. 16 - Forest Sector Gross Business Income and Percentage of Total GBI

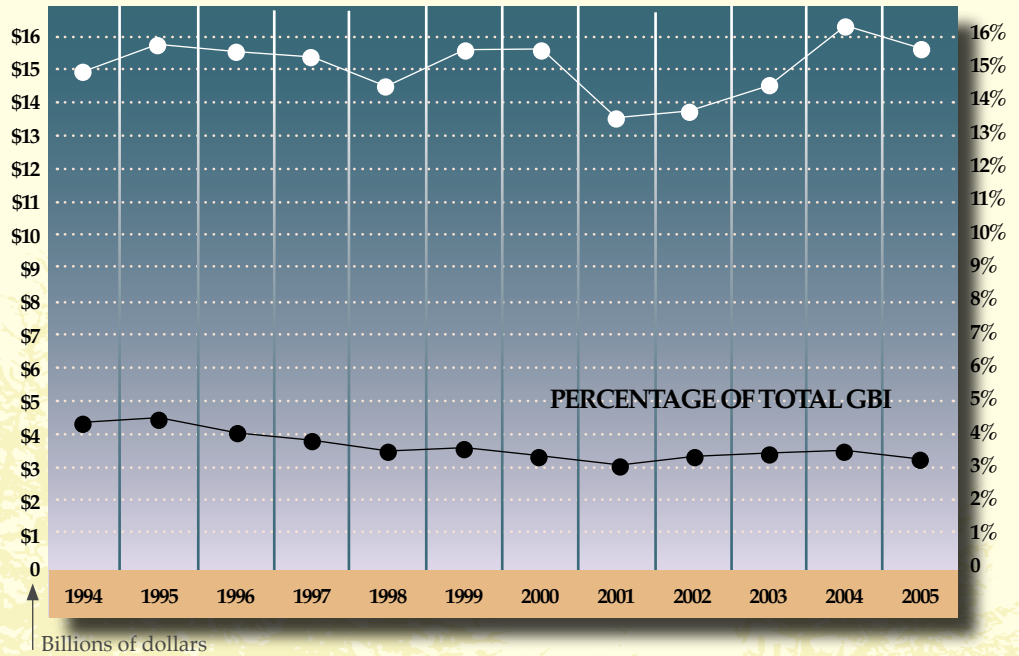


Fig. 17 - Ratios of Forestry and Forest Products Manufacturing Jobs and Gross Business Income to Total Jobs and GBI in Washington

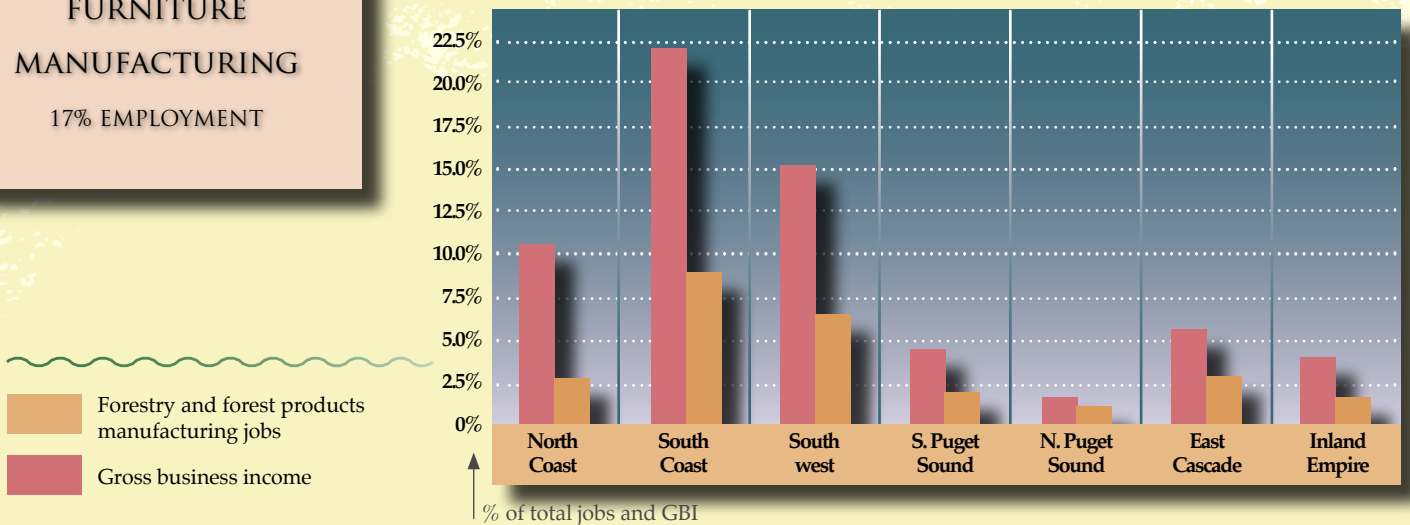




Fig. 18 shows the trends in GBI for these four sectors, while Fig. 19 shows the trends in employment. GBI has increased recently in all sectors except pulp and paper. Employment has increased in furniture and wood manufacturing while declining in pulp and paper as well as forestry and logging.

Fig. 18
Washington State
Gross Business Income (real)
by Sector

- Wood manufacturing sector
- Pulp and paper manufacturing sector
- Forestry and logging sector
- Wood furniture manufacturing sector

Source: WA State Department of Revenue website 2006.

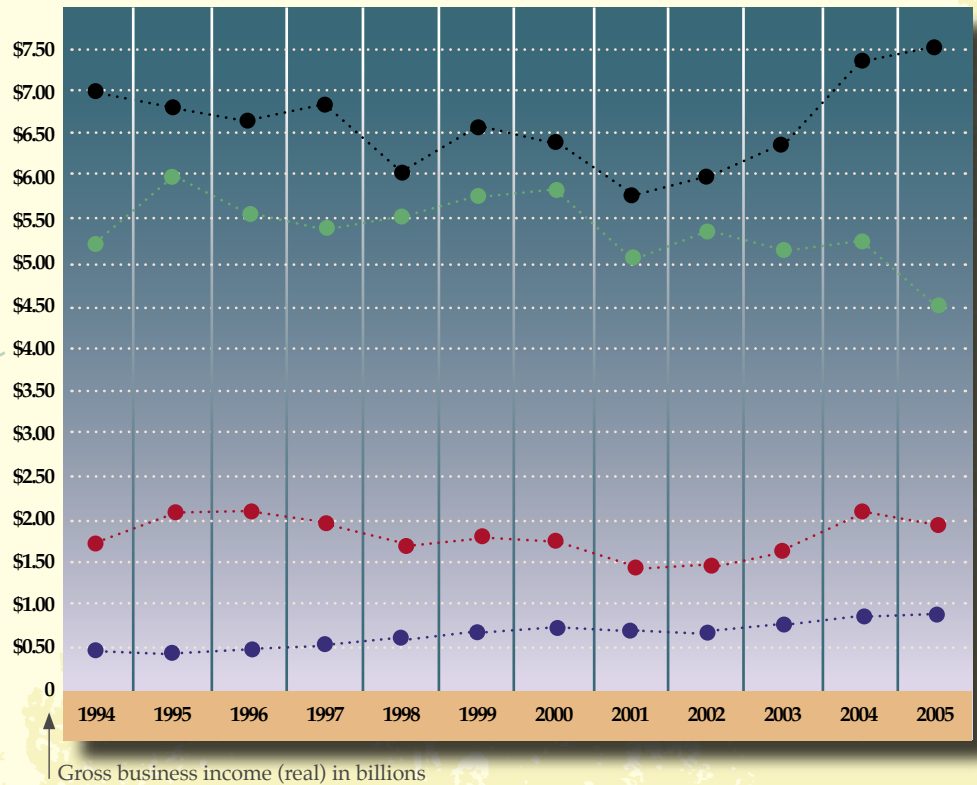
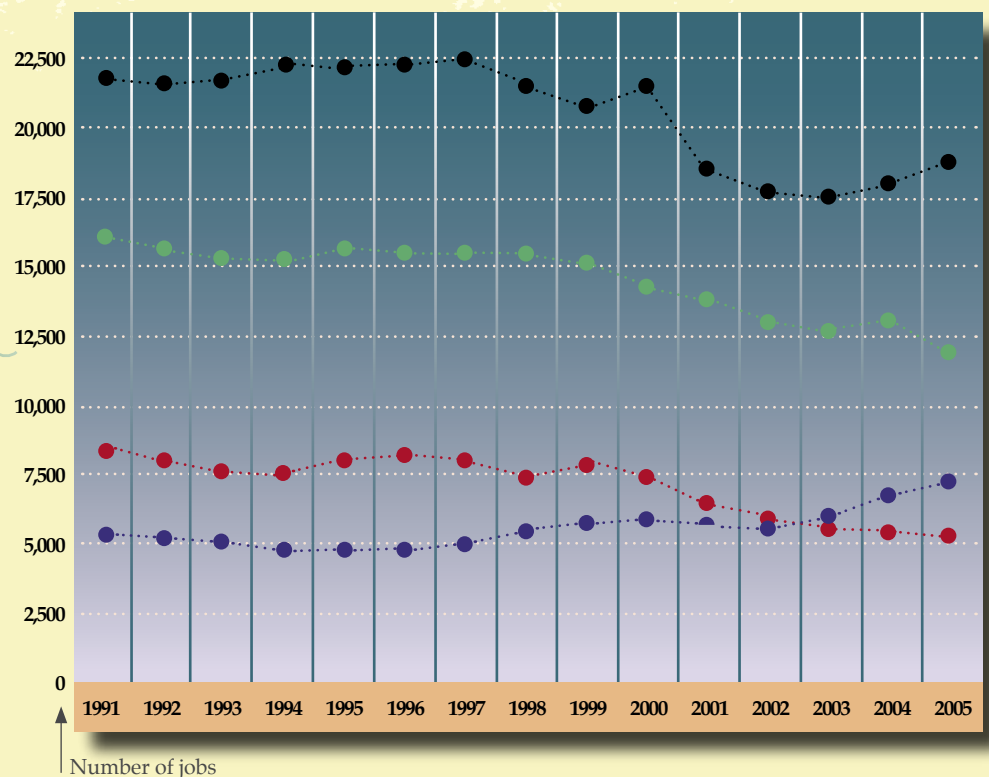


Fig. 19
Washington State
Employment by Sector

- Wood manufacturing sector
- Pulp and paper manufacturing sector
- Forestry and logging sector
- Wood furniture manufacturing sector

Source: WA State Department of Revenue website 2006.



There is an important geographic relationship between the forestry and forest products industries across timbersheds. Logs from the coastal timbersheds generally provide raw material for processors in other timbersheds. Waste by-products from sawmills are shipped to paper manufacturers in other timbersheds. While the forest industry is still a major factor in the economies of rural areas, especially the south coast and southwest timbersheds, these regions have lost employment as manufacturing capacity has shifted to major transportation corridors.



Private Forest Land Ownership Changes

A recent trend in restructuring private forest land ownership may have a potentially significant effect on Washington’s forest-based economy, affecting the incentives driving the large companies owning a major share of Washington’s forest land.

Traditionally, a major portion of Washington’s private timberlands was owned by vertically-integrated companies which operated sawmills and paper mills and owned large areas of timberland to ensure raw material self-sufficiency. These could be publicly-traded corporations such as Weyerhaeuser or privately-owned companies like Simpson. Most other private timberland was owned by “non-industrial private forest” landowners, a phrase previously synonymous with owners of small parcels.

The private timberland ownership picture has always been dynamic, as private industrial land owners buy and sell land and undertake restructuring to improve their business position. In recent decades, however, a greater emphasis on shareholder returns has led some industrial timberland owners to sell their timberland to improve returns, often retaining agreements with the purchasers to continue to supply timber to the mills of the original owner.

Beginning in the 1980s, large blocks of timberland began to be purchased by firms managing financial investments for large institutional clients, such as pension funds. These firms came to see timberland investment as a good long-term fi-



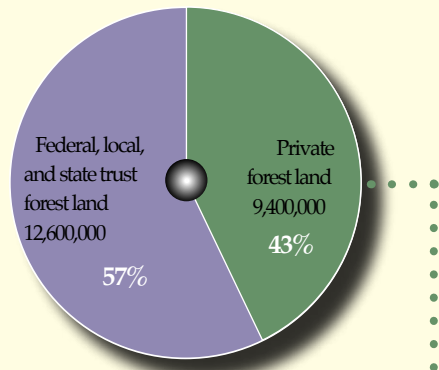
TIMBER
INVESTMENT
MANAGEMENT
ORGANIZATION
(TIMO):

FINANCIAL FIRM
THAT PURCHASES
TIMBERLAND AS
INVESTMENT
FOR LARGE
INSTITUTIONAL
CLIENTS AS
PART OF A
LONG-TERM
DIVERSIFICATION
STRATEGY

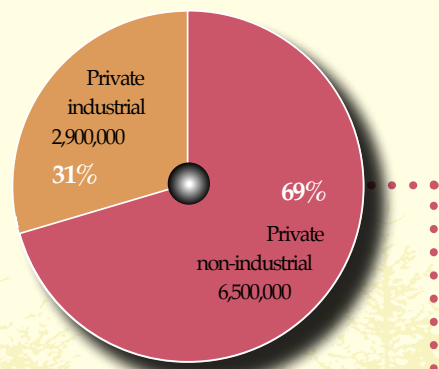


Fig. 20
Who Owns the Forest Land?

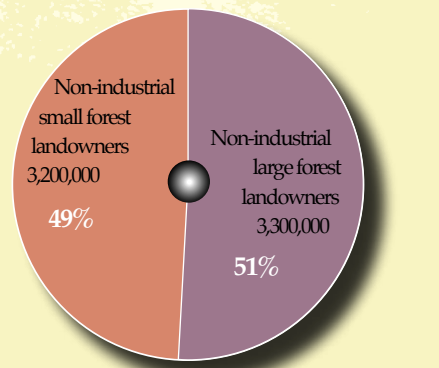
Total forest land in Washington
22,000,000 acres



Subset of private land
9,400,000 acres



Subset of non-industrial land
6,500,000 acres



* Due to different data sources the overall amount of forest land for the analysis on this page is 22 million acres, compared to 21 million acres used elsewhere in the report.

financial diversification strategy, due to timberland’s appreciation and its tendency to experience financial returns counter-cyclical to the stock market. These firms, called Timber Investment Management Organizations (TIMOs), hold timberlands for the financial value of the land and timber rather than as a source of raw material for company-owned mills. An example is the Hancock Timber Resource Group, which first acquired timberland in Washington in 1985 and made headlines in 2003 when it purchased the 104,000-acre Snoqualmie Tree Farm from the Weyerhaeuser Company. Other major TIMOs in Washington are The Campbell Group and Forest Capital Partners, which recently purchased eastern Washington timberland formerly owned by Boise Cascade.

Provisions of federal tax laws are also driving restructuring of private timberland ownership. For a vertically-integrated timberland-owning company, timberland income is taxed at the corporate rate, which can be relatively high. Meanwhile, for owners of timberland alone, earnings distributed directly to shareholders are taxed at the lower capital gains rate. This has led some timber companies to separate ownership of timberlands from ownership of manufacturing facilities to gain the lower tax rates. The timberland is often then owned as a Real Estate Investment Trust (REIT). Under the laws governing REITs, whose shares are publicly traded on a stock exchange, 90 percent of timberland returns must be distributed to shareholders annually. Therefore – like industrial timberland owners and unlike TIMOs – REITs seek to raise current income for shareholders. Major timber companies in Washington State who have converted their timberland ownership to REITs include Plum Creek, Rayonier, and Longview Fiber, which converted to a REIT in 2006.

In Washington, 9.4 million acres (43 percent) of the 22 million acres of forest land are privately owned. Of that private acreage, 3.2 million acres are owned in small ownerships of less than 5,000 acres, leaving 6.2 million acres in large ownerships. Although traditionally the majority of this large private acreage was owned by industrial companies, those companies now own about 2.9 million acres. The other 3.3 million acres are owned by TIMOs, REITs, and other non-industrial owners including corporations, private individuals or families, Indian tribes, and conservation groups. Given ongoing transactions, these numbers should be expected to continually change, to some degree.



Although further restructuring of private timberland ownership could occur, with major speculation centering on whether Weyerhaeuser will convert to a REIT, much of this restructuring has already been concluded and the process appears governed by forces outside direct Washington State influence. Several implications for Washington's forests arise, particularly concerning whether the new large non-industrial owners will sell off parcels of their forest blocks which have high value for development. Certainly REITs' need to generate annual returns to shareholders can and have led them to split off and market developable parcels. The same, however, can be said of traditional industrial owners, some of which have operated real-estate divisions for many years. In the case of TIMOs, their focus on long-term investments appears to moderate pressure for rapid land sales.

Because a great deal of the income for both TIMOs and REITs will come from sales of timber for manufacturing, their economic health is critically dependent on the availability of independently-owned sawmills and other timber processing facilities to purchase the timber. Conversely, the health of those processing facilities is dependent on security of timber supply, including from these new private ownerships.



Forest Habitat Values

Forests in the state provide important habitat for diverse communities of plants, fish, and wildlife. Forest-related animal species in Washington depend on a full range of forest conditions, from recent clearings to deep old growth forest. Old forests, which have declined significantly from pre-European settlement conditions, contain structural complexity important as habitat to some declining species, such as the northern spotted owl. Structural complexity includes comparatively low tree densities with larger trees, vertical layering of shrub and tree crowns, the presence of standing dead trees and down logs, the horizontal patchiness of closed and open areas, and the larger-scale patchiness of forests of different ages or species across a broad landscape. In addition to structural complexity, the presence of streams, rivers, lakes, and wetlands increases the diversity of plant communities and habitat.

In general, several trends have been affecting forest habitat. After decades of declines, almost all of the remaining old growth forests are being protected from harvest as a consequence of the Northwest Forest Plan on national forests, and the adoption of DNR's Habitat Conservation Plan which provides protection for most of the modest amounts of old growth on state trust lands. Currently, about 13-18 percent of western Washington's forest area is estimated to be in an old growth condition, 80 percent of which is on national forests. Although currently off-limits to harvest, these forests are nevertheless at risk from large wildfires, windstorms, and insect and disease infestations.

Outside old growth areas, second growth forests in many areas have been increasing in age, sometimes reaching 80-100 years old or more, although not necessarily having experienced the natural disturbances which create complex structure. In other areas, younger second growth forests have been relatively unattended and have therefore become overcrowded with dense stands of small trees, in which little light reaches the forest floor, habitat value is low and in some locations susceptibility to infestations of forest insect pests and disease can be high. Finally, industrial plantations may be intentionally managed to higher than natural densities and harvested at a relatively young age, usually between 40-60 years. For all these reasons, forests with comparatively higher density than in pre-European settlement times are much more prevalent across the landscape. Almost all timber harvest is occurring in second and third-growth forests in Washington.

On all ownerships, streams are required to be protected with buffers to protect water quality and in-stream habitat for salmon and other aquatic species. In these buffers, trees are intended to grow older and also be thinned to achieve some degree of structural complexity to provide improved habitat for species relying on streamside forests. However, as discussed in the Focus Area on page 49, the streamside forest thinning intended to achieve this improvement in structure may not occur on many private lands due to its cost and poor economic return. Instead, the streamside buffers may be left in an overcrowded condition.

A final trend is that forest habitat is being permanently lost in areas converted from forest cover to residential or commercial development in urbanizing areas of the state, or is being degraded by fragmentation of continuous forest cover. This is discussed in the following section and covered in detail beginning on page 59.

Major Influences on Future Supply, Markets, and Economic Contribution

Major Factors Affecting Future Timber Supply

Washington's future timber supply depends on the amount and productivity of forest land in timber production; growth, mortality, and loss of use of timber stands; forest management costs; the price of timber sold; and the land management practices of different categories of landowners.



FOREST-RELATED ANIMAL SPECIES IN WASHINGTON DEPEND ON A FULL RANGE OF FOREST CONDITIONS, FROM RECENT CLEARINGS TO DEEP OLD GROWTH FOREST.

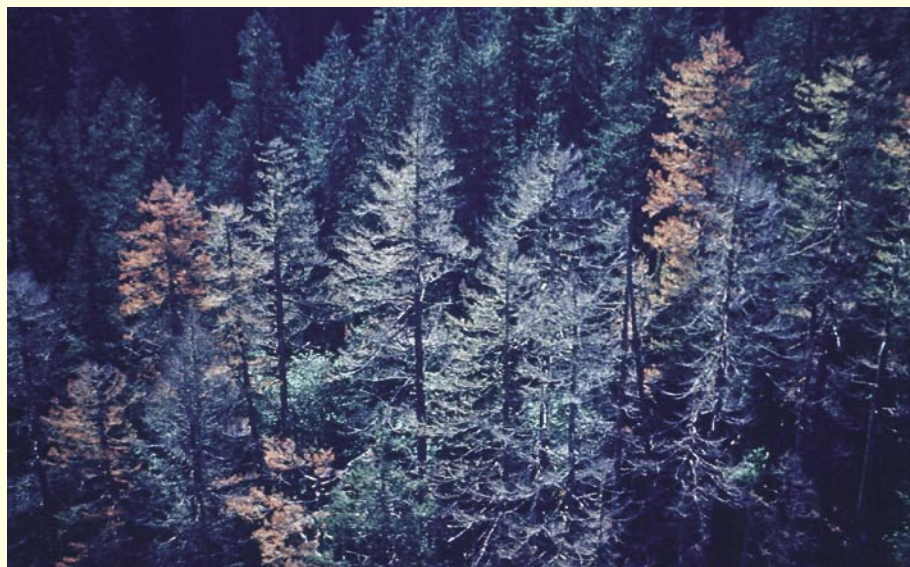


FOREST HABITAT IS BEING PERMANENTLY LOST IN AREAS CONVERTED FROM FOREST COVER TO RESIDENTIAL OR COMMERCIAL DEVELOPMENT.



FACTORS AFFECTING WASHINGTON'S FUTURE TIMBER SUPPLY:

- › AMOUNT AND PRODUCTIVITY OF FOREST LAND IN TIMBER PRODUCTION
- › GROWTH, MORTALITY, AND LOSS OF USE OF TIMBER STANDS
- › FOREST MANAGEMENT COSTS
- › PRICE OF TIMBER SOLD
- › LAND MANAGEMENT PRACTICES



Growth, Mortality, and Loss of Working Forests

As previously stated, Washington has some of the most productive forest land in the nation, where temperate climate, abundant rainfall and deep soils result in a high growth per acre. Productivity, meaning the timber growing potential of soils, varies across the state and within areas of varying slope, elevation, and orientation.

Forest growth is considerably greater in western than in eastern Washington, except on federal lands where the stands in the western Cascades are older and growth has slowed. Rates of growth are greatest in the younger forests on industry lands, which tend to be concentrated on lower elevation areas with the most productive soils, especially in western Washington. In the 1990s, western Washington rates of forest growth as a percent of total standing forest volume ranged from 1-2 percent per acre per year on federal lands and to almost 7 percent per acre per year on industry lands. Across all ownerships in western Washington, growth rates average about 4 percent per year. The rate of growth is only modestly lower in eastern Washington at 3 percent per year, although the standing volume per acre of timber in eastern Washington is substantially lower than in western Washington, so the actual growth per acre is also lower. Across all ownerships western Washington growth per acre was 690 board feet per acre per year compared to 320 board feet per acre per year for eastern Washington.





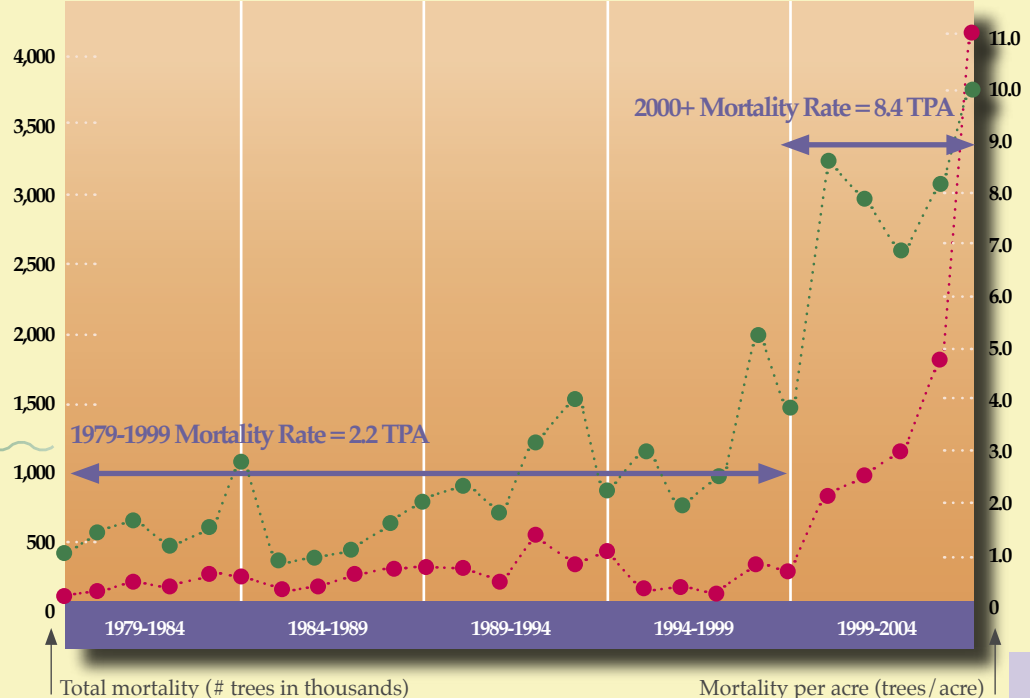
Forest trees are subject to many natural causes of damage, disease, and death. The most common causes include fire, windstorms, flooding and landslides, loss of light due to shading by taller trees, eating of tree seedlings by forest herbivores, a variety of insect pests, and a variety of tree diseases caused by fungi and other disease agents. Commercial forest management attempts to control natural mortality so that a majority of tree growth can be captured in valuable products.

In general, natural mortality is higher in eastern than in western Washington, especially on state trust and federal lands. Natural mortality is typically less than one percent per acre per year as a percentage of total standing forest volume. It can range widely, from 10 to 30 percent as a percentage of annual growth in western Washington, to more than 50 percent of annual growth in eastern Washington. In general, natural mortality increased from the 1980s to the 1990s across all ownerships and in both eastern and western Washington. The greatest increases in natural mortality were for state trust lands in both eastern and western Washington, where natural mortality more than doubled. This period preceded the heavy beetle infestation that is now accelerating in eastern Washington. Since 2000, pine mortality per acre has been almost four times that of the 1980s and 1990s, and almost 20 times higher in total tree mortality.

A major finding of the Future of Washington Forests project has been the severe threat to forest health occurring primarily in eastern Washington as a result of unprecedented outbreaks of pine beetles and other insects. (See Focus Area: Eastern Washington Forest Health, page 52.) This situation not only kills trees directly, but increases dry and dead material in forests, leading to an increased risk of devastating wildfires. Historically, these stands experienced frequent grass and brush clearing wildfires that provided natural thinning and understory growth control. Today's forest health crisis is a result of overcrowded forests due to decades of suppression of natural fires and to decreased harvest, especially on national forests, and a result of the recent occurrence of dry and hot summers outside of the 100-year range of recorded data. This forest health situation poses a significant threat to future timber supply, forest habitats and biodiversity, and to public safety.

Fig. 21
Mortality by Mountain Pine Beetle in Ponderosa and Lodgepole Pine in Eastern Washington from 1979-2004 (tallied 1980-2005)

● Number of trees killed by mountain pine beetle
 ● Number of trees per acre killed by mountain pine beetle





Because the significant decline in timber supply from national forests mentioned previously has already occurred, further loss of forest land for timber production is more likely to occur as a result of private commercial forest land converting to land uses inconsistent with commercial timber production, such as agriculture, residential use, or more intensive development. This is discussed in more detail in the section on Forest Land Conversion beginning on page 59. In some cases, the cost of forest management, including the cost of complying with forest practices regulations, that may eliminate a significant portion of forestry investment return for some landowners, can contribute to landowners' decision to sell their land for more intensive development. Costs are addressed in the next section.

Costs of Timber Management/Production

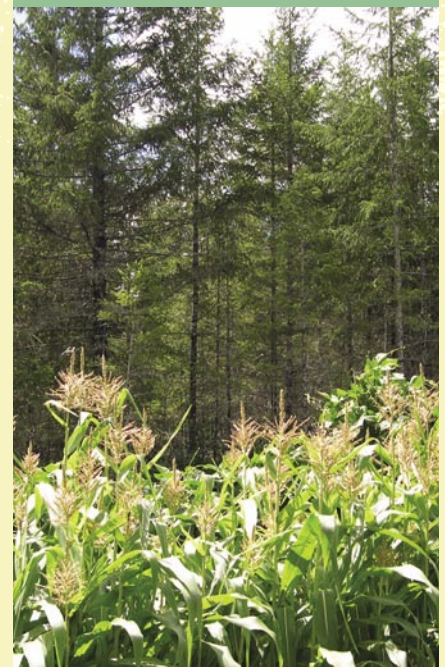
The costs landowners incur to own timberland, manage the forests growing on those lands, periodically harvest and market the timber, and replant the harvested areas are among the major influences on future timber supply. Besides the costs of capital, labor, and energy, these costs include taxes paid on land and timber, as well as the cost and foregone revenue from complying with environmental regulations.

Washington State has one of the highest tax obligations in the nation for owning timber land and harvesting timber. A study by the Washington Forest Protection Association for western Washington calculated the average forest tax at more than \$15 per acre. For private individuals harvesting timber, the effective tax rate can range from 21 percent to nearly 40 percent of total taxable income. The effective rate for corporations ranges from 32 to 49 percent. Washington timber owners pay both a land tax and a harvest tax, unlike other commodity products and most competing regions, resulting in a higher percentage tax relative to income.

The owners of sawmills and other processing facilities also incur a tax obligation as part of the cost of producing lumber and other products. Although a detailed treatment of this taxation is outside the scope of this report, in general, Washington ranks fourth in the U.S. for business taxes as a share of gross state product, at 5.1 percent, and ranks first in the U.S. in unemployment insurance taxes.

The cost of regulations is an increasingly significant issue for forest landowners large and small. On one hand, Washington's comparatively strict regulation of forest practices to protect the environment provides many benefits to Washington citizens and, being a relatively mature regulatory regime, is intended to provide a sense of stability for the forest industry. Washington's forest regulations could even provide a potential competitive edge if markets were to become sensitive

FURTHER LOSS OF FOREST LAND FOR TIMBER PRODUCTION IS LIKELY TO OCCUR AS A RESULT OF PRIVATE COMMERCIAL FOREST LAND CONVERTING TO LAND USES INCONSISTENT WITH COMMERCIAL TIMBER PRODUCTION, SUCH AS AGRICULTURE, RESIDENTIAL USE, OR MORE INTENSIVE DEVELOPMENT.





to the environmental results of producing the timber supply. On the other hand, the comparatively high cost of these regulations can erase a significant portion of the economic return to the landowner from investing in the practice of forestry, especially for owners of smaller forest parcels. Harvesting timber in areas near streams, in compliance with forest practices rules, can become especially prohibitively expensive. However, foregoing this harvest eliminates not only economic benefits to the landowner, but often some ecological benefits as well. Thinning can help overcrowded forests achieve an ecologically more desirable condition. This choice also increases the likelihood of conversion to more profitable non-forestry land uses, with potentially much greater environmental impacts. (See Focus Area: Over-Crowded Riparian Forests, page 49.)



Timber Prices

Demand for wood and paper products determines the residual price forest landowners receive for harvested trees. If the price is not high enough to cover the costs of production, the landowner may not harvest the timber, and if the timber is harvested, the landowner likely won't invest in growing the next cycle. If the timber is not harvested, it continues growing and could be harvested in the future if prices improve. If investments in future timber growth aren't made, the state's future supply will be reduced.



In general, the returns to forest landowners today are lower than in previous years, when export values were high and production efficiencies were rising. At present, global demand for wood products and wood fiber is growing at 0.6 percent to 1.0 percent per year, with demand for Washington products driven primarily by housing construction in California, the Midwest, and other western states. (For more information, see DNR's quarterly economic and revenue forecasts at www.dnr.wa.gov/htdocs/obe/rev-forecasts/sept06forecast/pdf.)



IF THE PRICE FOR HARVESTED TREES IS NOT HIGH ENOUGH TO COVER THE COSTS OF PRODUCTION, THE LANDOWNER MAY NOT HARVEST THE TIMBER AND THE STATE'S TIMBER SUPPLY WILL BE REDUCED.



REMOVING ALL TREES AND REPLANTING IS BECOMING MORE PREVALENT IN EASTERN WASHINGTON IN RESPONSE TO FOREST HEALTH PROBLEMS.

Forest Management Intensity

Landowners are required by state forest practices regulations to promptly reforest a harvested area by natural seeding or by planting seedlings. Site preparation by slash burning is increasingly uncommon due to cost and air-quality concerns. Various techniques are used to reduce seedling competition for sunlight from surrounding vegetation. Thinning forest stands at different growth stages can concentrate growth on fewer, larger trees, and provide revenue before final harvest. Where most trees are removed at harvest, management is described as “even-aged”. Leaving a significant number of trees is referred to as a “partial harvest,” or “uneven-aged” management. Uneven-aged management is mainly practiced in eastern Washington while even-aged management is more typical in western Washington. However, some western Washington landowners are experimenting with management practices resembling uneven-aged management. Meanwhile, removing all trees and replanting is becoming more prevalent in eastern Washington in response to forest health problems.

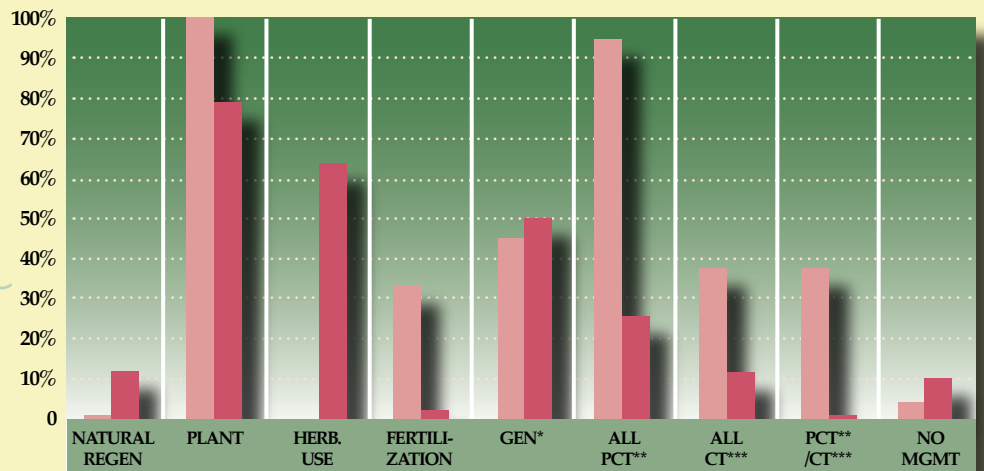
A recent survey of companies managing large commercial forest ownerships in western Washington shows substantial changes in management intentions compared to a similar survey in 1990. While the 1990 survey forecast substantial fertilization and thinning treatments and almost no vegetation management with chemical herbicides, the recent survey showed the reverse, with a higher level of chemical vegetation control and much less thinning. The recent survey also showed slightly more reliance on natural regeneration than previously forecast. As a consequence of the faster early growth that can be achieved with better control of competing vegetation, industrial forest landowners are also reducing the age at which trees are commercially harvested, to as young as 30-years old on the most productive sites, ranging up to a maximum of 60-years old on the least productive sites. Therefore, to the degree that early growth can be accelerated, the cost associated with thinning young stands can be reduced. Thinning can then become a more case-by-case decision for a private forest landowner, based on forest conditions and costs.

The recent survey also shows a significant increase in the area to be set aside for no management, primarily as a result of streamside buffer regulations. This effect varies significantly across timbersheds. A recent map-based analysis suggests the buffer zones vary from 3 to 15 percent of the acreage by county, with the average about 10.5 percent. This is very similar to the survey estimate of about 10 percent of acres that can no longer be managed, shown in Fig. 22.

Fig. 22
Western Washington Industrial Management Intensity Forecast Comparison of Various Management Practices

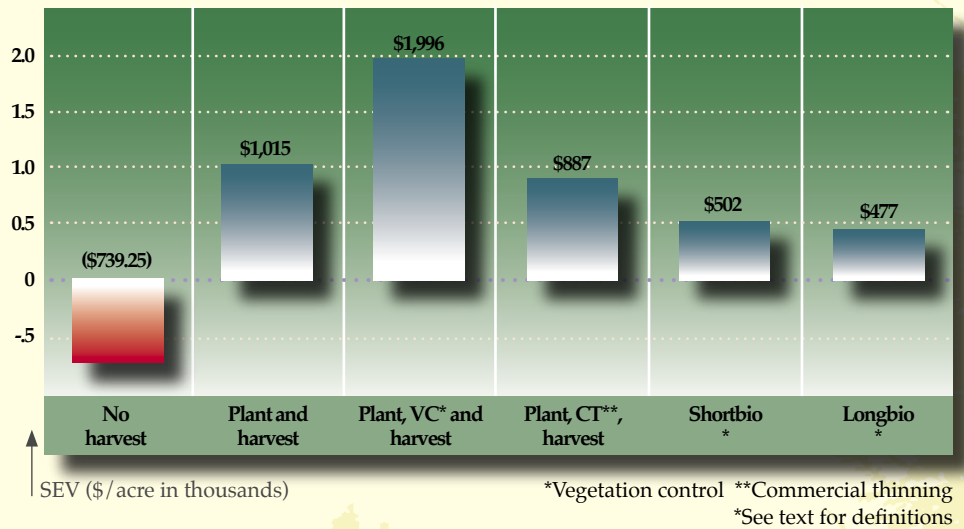
■ 1990 Forecast
■ 2006 Forecast

*Genetically improved seedlings
**Pre-commercial thinning
***Commercial thinning



REGULATORY CONSTRAINTS AND MANAGEMENT CHOICES AFFECT BOTH NEAR-TERM AND LONG-TERM TIMBER SUPPLY.

Fig. 23 - Soil Expectation Value by Management Scenario for Douglas Fir Moderate Site



These regulatory constraints and management choices affect both near-term and long-term timber supply. While increased thinning treatments tend to lower the total long-term volume of supply, they also accelerate the timing of some revenue availability to the landowner. Greater control of competing vegetation, along with younger harvest ages, can increase the timber supply as well as the timing of revenue availability. Lengthening the age of final harvest over fifty years, however, while increasing long-term volume, generally lowers revenue to the landowner, expressed as a net present value (NPV) because of the discounting of revenue received in the future (such as at 5 percent per year). Thinnings, especially later thinnings, also tend to reduce NPV, depending upon prices. The effects of lowering NPV are more pronounced the higher the discount rate used.

When comparing the performance of different management options over the life of the investment, a special type of NPV calculation known as soil expectation value (SEV) is useful. SEV calculates the discounted costs and revenues for perpetual forest growth cycles starting from bare land through final harvest. This removes the revenue of the current stand of trees from the calculation and so is used by forest economists to estimate the earning capability or bare land value of forestry land-use. In Fig. 25, SEV results are shown for a series of forest management scenarios. In Fig. 23, Soil Expectation Value by Management Scenario, "VC" means vegetation control, usually with herbicides. "CT" means commercial thinning. "Shortbio" and "Longbio" refer to special management scenarios using, respectively, two heavy thinnings and an older, 100-year old final harvest age, or three heavy thinnings, the last of which leaves 15 trees per acre beyond 100 years. These "biodiversity" scenarios are intended to produce more structural complexity in a managed forest to improve forest habitat and biodiversity. As can be seen, planting, vegetation control, and final harvest with no thinning has the highest SEV of \$1,996 per acre. While the emphasis on vegetation control is fairly new and a result of research on treatment alternatives, it tends to confirm the economic attractiveness of the change in industrial landowners' survey responses illustrated in Fig. 22.

In summary, the most important factors likely to influence timber supply in the future are: continued absence of federal timber supply; high mortality in eastern Washington forests; the cost of regulations and taxes, which may increase forest land conversions to non-forest development; the decisions by industrial landowners regarding the type of treatment practiced, such as thinning and age of final harvest; and policy decisions for both national forests and state trust lands regarding thinning treatments to reduce forest density and increase forest health.



Major Factors Affecting Future Market Demand for Washington Products

The vast majority of U.S. timber production, including that from Washington State, is consumed in North America, with the principal end use being housing construction and remodeling. Therefore, factors affecting the pace of housing construction can have a major influence on demand for Washington forest products. Housing responds primarily to fundamental demographic and economic forces, including interest rate fluctuations.

Demand for Washington's forest products is also influenced by international conditions because wood and paper products are traded at the global level. Canada

Fig. 24
National New Housing Starts

- West
- South
- Midwest
- Northeast

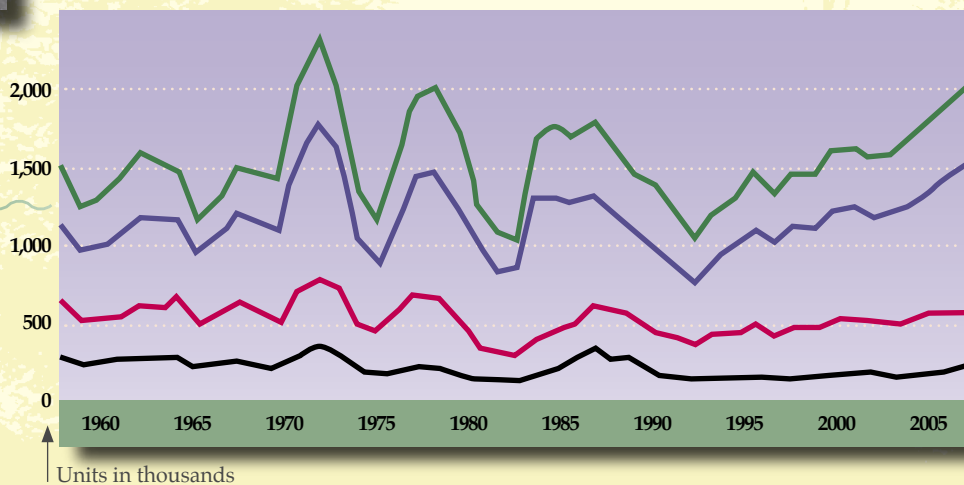
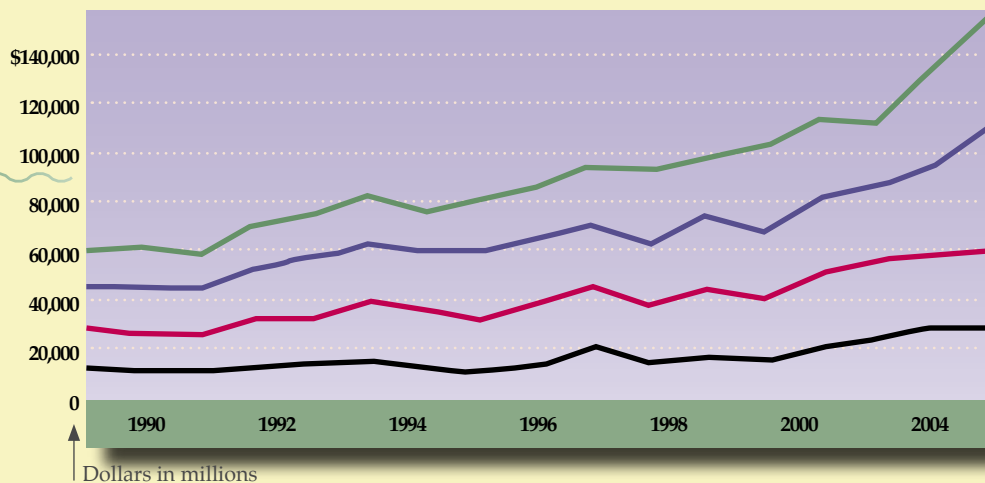


Fig. 25
National Owner-occupied Expenditures

- West
- South
- Midwest
- Northeast



MILL CLOSURES
HAVE GENERALLY
BEEN IN THE RURAL
AREAS, WHILE
LARGER, MODERN
MILLS ARE BEING
LOCATED CLOSER
TO MAJOR
TRANSPORTATION
ROUTES.



is the primary U.S. trading partner for forest products, and the U.S. consumes a major share of Canada's lumber production, including production from British Columbia. The Japanese market, formerly a major destination for logs and to a much lesser extent, lumber from the U.S. and Washington State, has experienced a multi-year economic decline in which log and lumber imports from the U.S. have dropped significantly. The Russian Federation is now Japan's major supplier of logs, although the U.S. remains an important source of valued Douglas fir logs. Japan is still the major destination for U.S. newsprint exports, especially from Washington, but that market's growth has declined as well. Forest plantation regions that are gaining international market share include South America, Australia and New Zealand. In addition, the Russian Federation has the world's largest softwood timber resource, and is emerging from a period of reduced production.

Major Factors Affecting Investments in Processing Facilities

Besides the macroeconomic factors discussed in the previous section, there are several major influences on private decisions to invest in sawmills and other processing facilities that constitute the immediate market for most harvested timber from Washington forests.

One important mill location factor is nearness to major transportation routes. There are significant regional disparities between where the timber is harvested and where most of the employment occurs. Mill closures have generally been in the rural areas, while larger, modern mills are being located closer to major transportation routes.

Business taxes and regulations affecting the business climate of Washington influence mill siting decisions. On the Milken "cost of doing business" index for 2005, Washington ranks 14th among U.S. states, reflecting the relatively high cost of taxes, wages, energy, and rent. Investors believe local regulatory permitting constraints to mill siting and expansion can also be barriers.

Timber supply is by far the dominant factor cited by mill owners as influencing processing facility investments. The factors dictating supply stability were discussed in a previous section. In Washington State, large reductions in land available for timber production have already occurred as a result of public land policy decisions. Future uncertainty relates primarily to land conversions and to the intentions and practices of large and small private landowners. Continuing declines in private harvest volumes which provide the majority of state raw material supplies to sawmills are a concern.

Supply from state trust lands is viewed by mill investors as a stable and important foundation to mills' financial viability. Although harvest from state trust lands dropped in 1997 after initial adoption of the Habitat Conservation Plan (HCP) for these lands, action in 2004 by the State Board of Natural Resources has established the sustainable harvest level from state trust lands, in compliance with the HCP, at about 700 million board feet per year, between 15 and 20 percent of total state harvest. Tribal lands also provide a small but important portion of the state supply, although probably not at the level of recent years. Recently, tribes in eastern Washington have been aggressively practicing forest health treatments which temporarily increased supply.

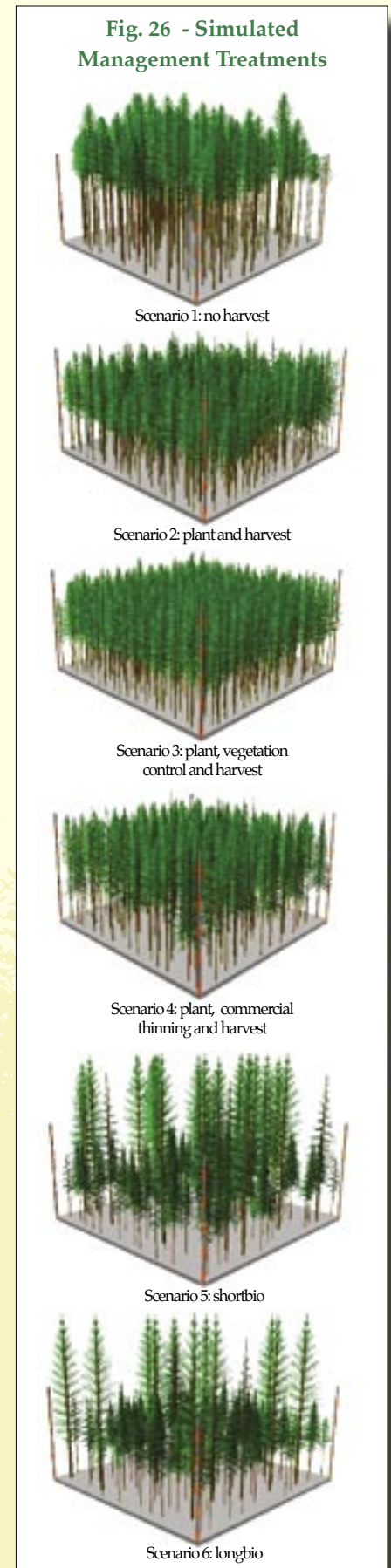
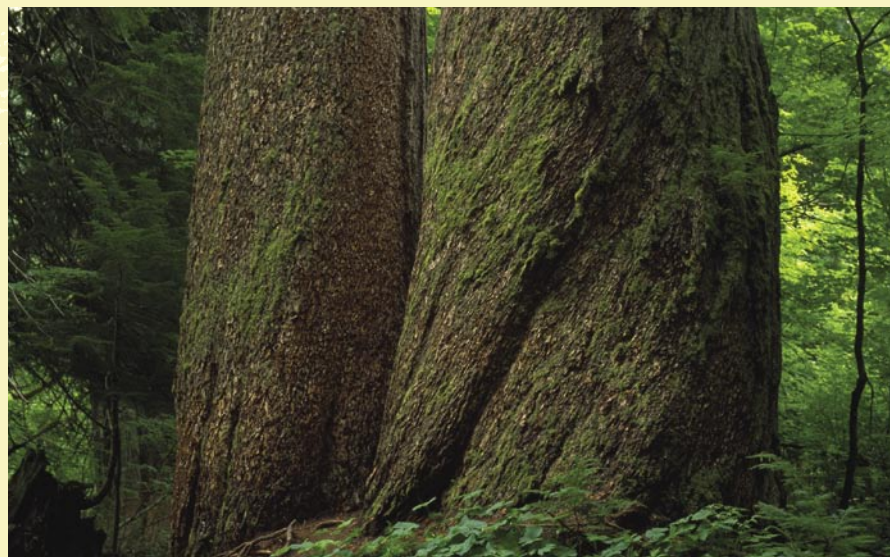
Effects of Supply on Forest Structure and Habitat

The role of forest structural complexity in providing habitat quality and biodiversity was discussed previously. Continuing protection of old growth forests on federal and state land will prevent further reductions from harvesting in these forests, but they will still be subject to natural disturbances. On previously harvested areas on all ownerships, second growth forests provide widely varying amounts and quality of habitat. Overcrowded second growth stands of any age reduce habitat quality, due to lower light penetration and lower structural complexity. Thinning these stands can increase habitat value. However, thinning has become less common on all ownership categories. On federal lands this has been due to policy and budget decisions. On large private land ownerships, thinning has declined because of poor performance relative to more aggressive vegetation control, and on small private land ownerships because of cost and regulatory complexity. The HCP for state trust lands does require thinnings and in particular some long rotations that may restore some old forest habitat. Reductions in thinning, including in streamside buffer areas, will have some negative impacts on habitat quality, a potential lost opportunity.

The College of Forest Resources performed computerized forest management simulations to illustrate these effects. Six simulations were used, all starting with bare ground with medium productivity in western Washington, and all starting with planting Douglas fir seedlings at 435 per acre. The six scenarios were:

1. No harvest, with no further treatment after planting.
2. Plant and harvest at 45 years.
3. Plant and control competing vegetation, then harvest at 40 years (This is similar to indications of current industrial landowners' typical intentions).
4. Plant, thin at age 30 down to 180 trees per acre, and harvest at 50 years.
5. Plant, thin at age 35 down to 150 trees per acre, thin again at age 50 down to 35 trees per acre, assume understory regeneration of a new layer of trees, and harvest at 100 years.
6. Plant, thin at age 35 down to 150 trees per acre, thin again at age 55 down to 60 trees per acre, assume understory regeneration, thin again at age 75 down to 15 trees per acre, and forgo a final harvest.

Fig. 26 shows computer-generated illustrations of the resulting forest stands, just prior to final harvest for those scenarios including final harvest, or otherwise at



OVERCROWDED SECOND GROWTH STANDS OF ANY AGE REDUCE HABITAT QUALITY, DUE TO LOWER LIGHT PENETRATION AND LOWER STRUCTURAL COMPLEXITY.



100 years. The “no harvest” scenario results in a 100 year-old dense stand with moderately large trees. The plant and harvest scenario and the plant, control vegetation, and harvest scenario both result in very dense stands of small trees, with the latter scenario producing slightly larger trees in a shorter time. The plant, thin, and harvest scenario results in a moderately dense stand of slightly taller trees than without thinning. The two scenarios with multiple thinnings, sometimes called “biodiversity” treatments, result in multi-layered stands with a low or very low-density overstory of large trees and a dense or moderately dense understory.

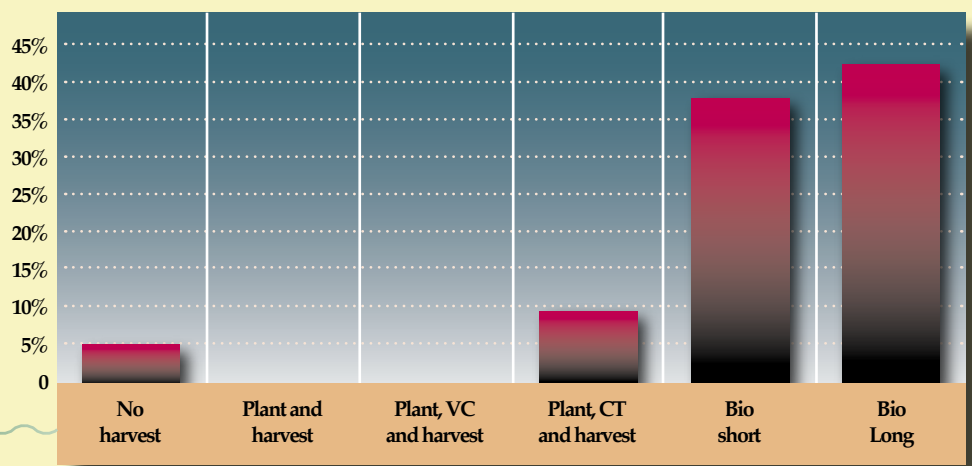
These simulated results were compared to criteria derived from recent scientific literature corresponding to the complex structural characteristics of older forests. Fig. 27 shows the percentage of time each of these scenarios spends in the “desired future condition” defined by those criteria. It can be seen that the “biodiversity” scenarios spend the most time, up to 43 percent, in the desired future condition, while the scenarios with no thinning and harvest at 50 years or younger spend no time in the desired future condition.

These results can be compared to Fig. 23, SEV by Management Scenarios on page 39, which showed the economic results for these same six scenarios, and showed superior economic performance for the scenarios without thinning.

There is an apparent divergence between the most economically advantageous scenarios and the scenarios with the most ecological value. Interestingly, the “no harvest” scenario in second growth stands shows poor performance both economically and ecologically. At least one thinning helps both economic and ecological performance to a moderate degree. Economic performance of thinning scenarios could be improved if there were sawmills available that were designed to process either the small diameter early thinnings or the large diameter logs resulting from older final cutting ages. Mills in the latter category have largely shut down in Washington. Global market and technological changes combined with lack of reliable supply do not support their re-emergence. In many areas on federal lands, the practical default to no management of dense second growth stands does not promise to create ecologically rich forests in those areas, and may in fact contribute to poor forest health and high fire risk.

Besides the commercial or ecological management programs of various categories of public and private forest landowners, habitat and biodiversity values are promoted by various public and private programs to acquire full or partial property

Fig. 27
Percent Time in
Desired Future Conditions



interests in forest lands for purposes of habitat conservation. This can occur, for example, through federal programs such as the Forest Legacy Program or Section 6 of the Endangered Species Act, state programs such as the Washington Wildlife and Recreation Program or the Salmon Recovery Funding Board, and programs by local governments or by private non-profit land trusts such as the Nature Conservancy, Trust for Public Land, and the Cascade Land Conservancy.



AN EVENTUAL
PRODUCT OF THE
FUTURE OF WASHINGTON
FORESTS PROJECT WILL BE
A SET OF FUTURE TIMBER
SUPPLY PROJECTIONS,
BROKEN DOWN BY
LANDOWNER CATEGORY
AND TIMBERSHED, AND
REFLECTING SEVERAL
ALTERNATIVE FOREST
MANAGEMENT
“SCENARIOS” MODELED
FOR VARIOUS
LANDOWNER CATEGORIES.

Modeling Future Timber Supply and Effects of Data Source Inadequacies

In keeping with legislative direction, an eventual product of the Future of Washington Forests project will be a set of future timber supply projections, broken down by landowner category and timbershed, and reflecting several alternative forest management “scenarios” modeled for various landowner categories. The supply projections will update projections from previous studies in 1992 for western Washington and 1995 for eastern Washington. This timber supply modeling exercise is primarily based on data from permanent plots established by the federal Forest Inventory Analysis (FIA) survey, supplemented by a variety of data from other sources. The FIA survey plots provide measurements of trees on the plot sites as well as other site information, on a grid of 1 plot per 6,000 acres across Washington forestlands.

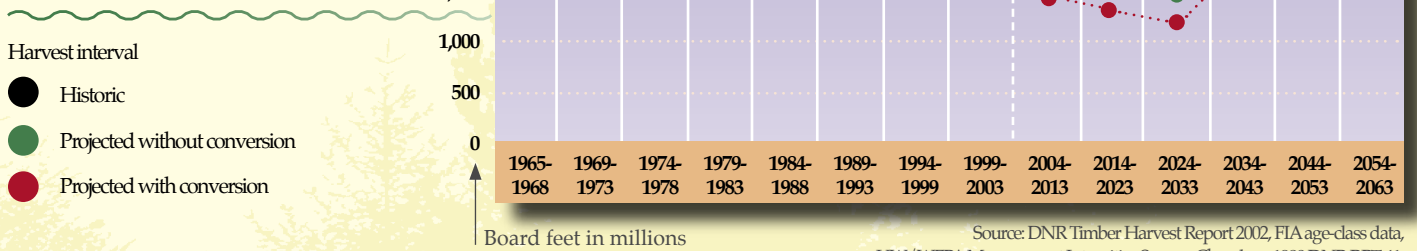
However, there are many limitations to the reliability of the current FIA data. A major problem is that the uniform sampling provides insufficient data on sensitive areas such as streams. In addition, the accuracy of current digital hydrologic information, while sufficient for large streams, is known to be unreliable for small streams, especially headwater streams. Both of these deficiencies could be alleviated by the analysis of LiDAR imagery (airplane acquired “Light Detection and Ranging”), if provided as an alternative to the FIA ground plots. In addition, because plot locations and plot-specific data are proprietary information for the various private landowners, certain privacy rules apply to the FIA data. The U.W. College of Forest Resources spent almost a year finalizing confidentiality agreements in order to access this data. As a result, the analysis and modeling necessary to produce the multiple timber supply projections have not been completed in time to be included in this report. This information is now estimated to be completed in spring of 2007 and included in the College of Forest Resources’ final study report prior to June 30, 2007.



Completion of the supply projections will also permit completion of the analysis of the economic contribution of that timber supply to the state and to local areas, as well as completion of the analysis of resulting forest structure.

Early work for this project, using previous U.S. Forest Service information, suggests that western Washington harvest level declines for all owners will stabilize at approximately 2.7 billion board feet per year in the coming two decades, before rebounding toward 3 billion board feet per year in succeeding decades. Meanwhile, current eastern Washington harvest levels have been about 0.9 billion board feet per year. Of those totals, the largest share comes from industry-owned lands. Preliminary analysis of FIA data allows a projection from industry-owned lands, and shows the potential impact of future land use conversions from commercial forestry. This projection confirms the leveling off of the future harvest levels on industry-owned land, at about 1.6 billion board feet per year, after the historical

Fig. 28
Average Annual Available Timber Volumes: Industry Forests Historic Harvest Volumes (5 year intervals) and Projected Inventory (10 year intervals)



Source: DNR Timber Harvest Report 2002, FIA age-class data, UW/WFPA Management Intensities Survey, Chambers 1980 DNR RPT 41.

declines, and, after two decades, a rebound to current and higher levels approaching 3 billion board feet per year as more of these lands return to harvestable age. In the scenario accounting for continuing land use conversions out of commercial forestry (via non-industrial private forest landowners as an intermediary), the decline continues for two decades and the subsequent rebound would be only to about 1.8 billion board feet per year.

For non-industrial private forest lands, harvests may remain near current levels of about 0.9 billion board feet per year, split about evenly between eastern and western Washington. This land base is likely to remain stable as lands leaving commercial production due to land use conversion are balanced by other commercial forest lands acquired from industrial landowners.

The future harvest from state-managed trust lands is projected to gradually increase to the recently adopted sustainable harvest level of approximately 0.6 billion board feet per year in western Washington, combined with up to 0.1 billion board feet per year in eastern Washington. Therefore, state-managed trust lands could remain a stable and increasingly important source of supply, as will tribal forest lands.

Future harvests from the federal national forests remain unknown. Recent harvest levels have been below 0.1 billion board feet, down from about 1.1 billion board feet in the 1980s. As explained elsewhere in this report, lack of stewardship of previously harvested forests in some areas is leading to over-crowded young forests vulnerable to insect and disease attacks and severe wildfire. Thinning treatments, critical to improve forest health, could also provide some timber supply, as well as raw material for biofuel processing, as explained below.

Predicting the forest condition that will result from these harvest levels requires also looking at the rates of growth and natural mortality discussed previously.

Future Forest Conditions

Overall, across all Washington's timberland in the 1980s and 1990s, forests gained in net volume at a rate of about 0.3 percent per year in the 1980s and climbing to almost 1 percent per year in the 1990s. This considers growth, minus natural mortality and timber harvest. The positive net volume gain was more than three times higher in western Washington than in eastern Washington in the 1990s, due largely to the increasing volume on federal acres as a consequence of the decline in federal harvests. In the 1990s, growth averaged 9.2 billion board feet per year across all ownerships, while harvest averaged 4.5 billion board feet per year, and natural mortality averaged 2.3 billion board feet per year, for a net increase of about 2.4 billion board feet per year.

The picture varies significantly when looking at different ownership categories. Generally, on industrial lands, annual harvest plus natural mortality slightly exceeded annual gross growth of 6.9 percent in the 1990s. However, using the most recent harvest figures since the 1990s and accounting for recent riparian harvest restrictions, net growth and removals have been about equal on industrial lands. On national forest lands, on the other hand, harvest is a much smaller percentage of total inventory, much less than 1 percent per year. But, because the older federal forests are growing much more slowly than the younger industrial forests, the net change on federal lands is still a fairly small annual gain.

The greatest net annual gain in forest volumes occurs on state-owned trust lands and on non-industrial private lands, where relatively high annual growth rates exceed the rates of annual harvest and natural mortality, leading to recent net volume increases of almost 2 percent per year on each of these ownership categories. For the most recent harvest rates, the net effect is almost 3 billion board feet of new net timber volume added each year across all owners. In many cases, this also reflects increased density in crowded second growth forests.



Interactions with Other Markets

Working forest lands contribute diverse products to a local-to-global forest products market while also providing environmental and social benefits. However, other new non-timber markets also exist, or are developing, which can attract forest materials away from timber markets, provide market payments for currently unmarketed forest products and services to supplement landowner income, or can attract forest land itself away from forest uses.

This section examines two of these other markets: carbon storage credits and bioenergy.

LACK OF STEWARDSHIP IN SOME AREAS IS LEADING TO OVER-CROWDED YOUNG FORESTS VULNERABLE TO INSECT AND DISEASE ATTACKS AND SEVERE WILDFIRE.

Carbon Storage

The concept of a market mechanism for carbon storage credits arises from recognition of the large amount of atmospheric carbon withdrawn from the atmosphere by respirating trees, the long term storage of that carbon in the forest and in wood products, and the resulting reduction in atmospheric greenhouse gases, primarily CO₂. At the global level, markets are developing to pay forest managers for voluntary contributions to increased carbon storage, which may help address climate change. In this case, the market payment to forest managers could originate from those emitting carbon, such as utilities, to offset those emissions by paying forest owners to increase carbon storage.

Development of functioning carbon “credit” trading market mechanisms has been sporadic, in the absence of an agreed-on global regime for limiting carbon emissions. However, carbon credit transactions do take place internationally, in Europe for example, and attempts have been made to establish some of the foundations of a market mechanism in the U.S. For example, the Chicago Climate Exchange allows participants to demonstrate agreed-to emission reductions or to purchase offsets. The U.S. Department of Energy has set up a prototype registry for recording voluntary carbon reductions, and several states have adopted in-state emissions caps and voluntary carbon registries. Washington State is considering following suit.



Major issues exist for establishing a workable carbon credit trading system that could bring financial benefits to forest land owners in Washington. These include:

- Establishing ownership rights to stored carbon which is to be traded.
- Determining the sources of real payments.
- Determining the baseline of storage, above which additional storage can be traded, especially in relation to widely differing forest practices regulations in different states.
- Appropriately crediting carbon storage in long-lived wood products.
- Dealing with negative leakage of other off-setting carbon emissions undermining the benefit of the carbon stored, as well as with positive displacement of more fossil-fuel-intensive building materials through use of wood.
- Ensuring security and longevity of market exchanges.

NON-TIMBER
PRODUCTS ARE ALSO
PRODUCED FROM
WORKING FORESTS SUCH
AS FLORAL GREENS,
MUSHROOMS, AND
SPECIALTY WOODS.

Bioenergy

The potential for transforming woody biomass from forests and mills into renewable electrical power, transportation fuel, or bio-products is gaining increased attention, due to national interest in reducing fossil fuel use and increasing the nation’s energy independence. This can be seen, for example, in the federal Clean Energy Initiative which contains incentives and tax credits for renewable energy development, and in similar initiatives at the state level. In Washington State, voter approval of Initiative 937 in 2006 has created the Washington Renewable Energy Standard, requiring public utilities to provide at least 15 percent of their energy supply from renewable sources other than hydroelectric power. While renewable sources can include wind, tidal, geothermal, and solar energy, by far the largest of these renewable sources is biomass, primarily forest material. In Washington, biomass is second only to hydroelectric power among renewable sources, while at the national level biomass has surpassed hydroelectricity.

Woody biomass can be burned to create heat to drive steam turbines to produce electricity, while also heating buildings. Woody biomass can also be transformed into diesel fuel and other products through pyrolysis in gasification plants, or converted to ethanol through hydrolysis and fermentation. Biomass can originate from mill residues and wood pulp, as well as from non-merchantable forest materials such as small trees from forest thinnings. Providing an economic market for these materials could provide landowners the incentive to undertake thinning critical to forest health, reducing fire risk and improving forest habitat.

Because use of woody biomass for bioenergy is already occurring in Washington, expansion of these technologies is feasible. For example, if the technology for hydrolysis and fermentation were compact enough to be mobile, in-forest processing into ethanol precursors could overcome the economic barrier of high transportation costs. As another example, existing pulp mills could theoretically be converted to wood ethanol production.

Currently, Washington State's focus for biofuel is on agricultural products and byproducts. However, local and national attention is expanding to woody biomass, which has efficiency advantages over agricultural crops. Nationally, the majority of the biomass used to supply almost half of the nation's renewable energy is from wood.

Major issues include the need for further technology development and demonstrations, and the need to show market competitiveness. The market depends heavily on the price of oil, the cost of processing and transportation for products derived from wood biomass, and the cost and availability of alternative biomass sources such as from agriculture. A particular challenge is how to incorporate the value of broad public benefits for energy, fire prevention, habitat, carbon storage and rural economic development into investment decisions for bioenergy facilities. Given evident market demand and a compatible policy environment, biofuel markets could be anticipated to develop in the not too distant future.



Conclusion

New markets for both carbon storage credits and bioenergy have the potential to provide additional payments to forest landowners, which could stimulate management actions not currently compensated, which have multiple social and environmental benefits. This could, in turn, contribute to keeping working forest land in forest uses, providing significant benefits compared to land conversion to non-forest uses or compared to failure to manage unhealthy forests.

Carbon storage is only one example of marketable ecosystem services from working forests. Other examples could include water quality, biodiversity, fire resistance, and other services of the forest. Bioenergy is an example of a new market for previously non-commercial timber products. Some non-timber products are also produced from working forests such as floral greens, mushrooms, and specialty woods for carving or musical instruments. None of these latter products were considered in the forest studies, although many have current but small markets.

Recreation is another service provided by forest lands, including working forests. Some private landowners provide fee-based recreation opportunities such as hunting. This is more common in other regions with less public land. State and federal lands, including working forest lands, have as part of their missions the provision of public recreation opportunities. By providing recreation opportunities at no cost or reduced cost to the public, commercial opportunities on public or private lands are reduced. For all landowners, control of legal liability and avoiding vandalism and other illegal activities are the main impediments to expanding recreation opportunities on working forest lands, and are responsible for the increasing closure of road access to the public on private forest lands.

The section on Forest Land Conversion will discuss markets for real estate development and for conservation. Lucrative real estate markets can attract landowners away from commercial forest uses, eventually reducing or eliminating forest cover and the ecological values of healthy forests. Conservation markets, in the form of full or partial property rights acquisition by private conservation organizations or by government, may either attract land away from commercial forest uses or secure the continuation of working forest uses through purchase or transfer of development rights, or acquisition of a conservation easement specifying forest management objectives to be met. The latter approach could compensate the forest landowner for enhanced biodiversity and related ecosystem services of working forests at a price set by the real estate market.