

Discussion Paper 1 (DP1): Growth, Mortality, Removals, and Conversion Loss Summary for WA Timberlands

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Introduction

The Forest Inventory and Analysis (FIA) Program of the U.S. Department of Agriculture (USDA) Forest Service reports on status and trends in forest area and location; in the species, size, and health of trees; in total tree growth, mortality, and removals by harvest; in wood production and utilization rates by various products; and in forest land ownership. FIA plot survey data collected each decade provides the most useful source of publicly available information for accessing trend changes in broad region and owner-specific growth, mortality, inventory and conversion losses. While the data results from a complex stratification of treatments across different owners with different objectives, it provides useful insights into changing forest conditions.

Conversion Loss: Westside Private

Based on the FIA survey of timberlands producing more than 20 cubic feet per acre per year, the net conversion losses from the Westside private timberland acreage increased from -0.45%/yr average over the 1980 to 1990 decade to -0.62% for the 1990 to 2000 decade. The net loss was primarily on industry lands with the conversion trend increasing from an average of -0.64% per year in the 1980's to -0.89% in the 1990's. While the gross acreage of non-industrial (NIPF) forests remained stable, it appears that ownership patterns among small owners are shifting as some lands are purchased from industry while other lands, especially those areas close to the urban interface and transportation corridors, are being sold for non-timber uses. Non-industrial private net conversion losses remained small changing from -0.08%/yr average in the 1980's to -0.06% in the 1990's. The 350,000 acre reduction in timberland over the last decade, almost all a

net loss from industry lands, seems likely to continue unabated or perhaps continue to increase since the industry loss rate increased by 39% from the 1980's to 1990's.

Conversion Loss: Eastside Private

The Eastside net conversion loss rate on private lands decreased from -0.66%/yr average in the 1980's to a +0.05%/yr average in the 1990's. The net loss from industry lands decreased from -0.95%/yr average in the 1980's to -0.52% for the 1990's. Non-industrial private net losses declined from -0.55%/yr average in the 1980's to an increase in acres of 0.27%/yr average in the 1990's buying more from industry than they were selling to non timber uses. However, the re-measured inventory plot data for the Eastside is based upon a small sample and the number of other owner classification changes is large, increasing the risk of error.

Conversion Loss: State & Federal

Conversion losses on State and Federal lands are more likely to reflect trades and reclassifications than direct conversion losses to other uses since very few of these lands directly border on urban growth areas.

Conversion Loss: Tribal Lands

Tribal forestry programs are a unique and increasingly contributor to forestry in Washington. In contrast to many other private forestland owners, tribes report aggressive acquisition programs with special emphasis on consolidation of reservation inholdings but also including purchases, when available, of adjacent commercial forestlands. Tribal forest statistics are included below in the analysis of FIA data as part of Private Forests.

Table DP1.1: Western Washington Acreage (thousands of acres in re-measured FIA plots)

	<u>Industry</u>	<u>Non-industrial</u>	<u>Private</u>	<u>State & Other</u>	<u>Federal(a)</u>	<u>Total</u>
1989	3,833	1,901	5,734	1,662	2,208	9,604
2001	3,389	1,885	5,274	1,763	2,320	9,357

(a) Federal Continuous Vegetation Survey (CVS) data was collected at different times and excludes reserve acres; acreage differences with other tables reflect the impact of different surveys.

Table DP1.2: Eastern Washington Acreage (thousands of acres in re-measured FIA plots)

	<u>Industry</u>	<u>Non-industrial</u>	<u>Private</u>	<u>State & Other</u>	<u>Federal(a)</u>	<u>Total</u>
1991	884	2,292	3,176	761	3,292	7,229
2002	829	2,367	3,196	731	3,292	7,219

(a) Federal Continuous Vegetation Survey (CVS) data was collected at different times and excludes reserved acres; acreage differences with other tables reflect the impact of different surveys.

Westside: Growth, Mortality and Harvest

Mortality on Westside private lands increased from 9.8% of gross growth during the 1980's to 16.2% in the 1990's. A partial explanation for this increase is the increased number of acres set aside which resulted in reduced harvest and increased mortality. Mortality on State & Other public lands was substantially higher than on private lands and increased from 12.5% during the 1980's to 27.9% during the 1990's. The higher state & other non-federal public mortality in the 80's relative to private may be explained by longer rotations and much higher inventories. The substantial increase in the 90's is likely the result of much reduced harvests under the Habitat Conservation Plan (HCP) covering state managed lands in Western Washington.

Harvest levels on private lands decreased from 3,498 million board feet per year (MMBF/YR) on average during the 1980's or 85.4% of gross growth to 2,889 MMBF/YR during the 1990's or 81.4% of gross growth. Harvest levels on Other Public lands decreased from 697 MMBF/YR on average during the 1980's or 43.4% of gross growth to 487 MMBF/YR or only 28.9% of gross growth during the 1990's. This

substantial difference between Other Public relative to Private reflects longer than Industry rotations in the 1980's and the substantial impact of the introduction of the HCP in the 1990's.

Federal inventory survey information was collected in the middle of the decade and the reserve acreage definitions may have changed but are still indicative of trends when lined up with the time intervals for removal rates. Mortality on Westside Federal lands was 26.3% of gross growth during the mid 1990's. Mortality on Federal lands is almost three times higher than Private and two times higher than Other Public. While it is likely that mortality on Federal lands will increase with the harvest reductions initiated the 1990's, the lack of periodic surveys makes comparisons problematic. The current Federal inventory survey compared to changing harvest rates shows that the Westside harvest decline from 789 MMBF/YR during the 1980's was 111% of gross growth compared to 133 MMBF/YR harvest during the 1990's or only 9% of gross growth.

Since harvest levels continue to decline across all ownerships, it is worthy of note that growth and mortality do not change nearly as rapidly as harvest levels. When current harvest rates (the last three-year average available; 2000 to 2002) are compared with the decadal average growth and mortality, the removal shares of gross growth for the Westside are 84% for Industry, 37% for Other Private, 27% Other Public, and 2% Federal.

Gross growth less mortality and removals shows the inventory change share of gross growth at 2% for Industry (although it had been negative in the prior two decades), 42% for Other Private, 45% for Other Public, and 78% for Federal. In effect, with the declining harvest levels, inventories are increasing as a share of growth for all owners in spite of shortened rotations on Industrial ownerships, which one might expect would draw down the inventory. The most recent annual inventory change as a share of total inventory was 0.1% for Industry, 1.9% for Other Private, 1.8 % for Other Public, and 1.4% for Federal, all with increasing inventory. Inventories will decrease as rotation ages decline but increase with either longer rotations or more acres restricted to other uses. The unanswered question is whether the low rate of removals on all but industry lands is effectively increasing non-timber market values such as habitat and other environmental objectives targeted by regulations or, conversely, contributing to increased forest health problems in the future.

Eastside: Growth, Mortality and Harvest

Mortality on Eastside private lands decreased from 35% of gross growth during the 1980's to 20% in the 1990's. Mortality on Other Public lands (State and other non-federal public) at 26% was higher than on Industry lands but lower than Other Private lands and increased to 54% in the 1990's, a substantial increase, with only a modest decline in harvest.

Harvest levels on private lands increased from 664 MMBF/YR on average during the 1980's or 105% of gross growth to 809 MMBF/YR during the 1990's or 74% of gross growth as the survey shows a substantial increase in gross growth. Harvest levels on Other Public lands decreased from 96 MMBF/YR during the 1980s or 33% of gross growth to 79 MMBF/YR or only 23% of gross growth during the 1990's. This substantial difference between Other Public relative to Private reflects both accelerated action by the Private sector to reduce densities to avoid forest health problems and a substitution of increases in private harvests for the declining State and Federal harvest volumes.

Growth and mortality information on Eastside Federal lands is obtained from different surveys reflecting different time intervals but still can provide some perspective on changing conditions. Unfortunately no field inventory survey information is available for the last 5 years, a period with a severe escalation in forest health problems; hence mortality is almost certainly understated on Federal acres and to a lesser degree for other owners.

Current harvest rates (last 3-year average available 2000 to 2002) measured as the removal share of gross growth for the Eastside are 123% for Industry, 54% for Other Private, 23% for Other Public and 7% for Federal. While Industrial harvests appear to be drawing down inventories, the increasing inventories for, Other Public, and Federal ownerships are contributing to overstocked conditions with consequent forest health impacts as noted in other sections of the report. Also worthy of note, but lost in the aggregated FIA data, has been the tribal response to insect infestations and fire hazard on Native American forestlands that has resulted in increased harvest activities to achieve needed density reductions. Consideration of tribal forest health programs in Eastern Washington as a model for other ownerships was recommended by the Northwest Environmental Forum in 2006.

A computation of the current inventory change (i.e. Gross Growth less mortality and removals) shows the inventory change share of gross growth at -38% for Industry, +25% for Other Private, +23% for Other Public and +44% Federal. The most recent inventory change/yr as a share of total inventory was -2% for Industry, +1% for Other Private, +0.7 % for Other Public and +1% for Federal. Increases in insect and fire associated mortality, not reflected in the last field survey but reported elsewhere in this report based on aerial forest health reports, will alter these rates significantly in the future.

Inventory and Productivity

The different management strategies employed by different owner groups and some differences in land productivity result in a wide range of standing inventory and growth per acre. Westside inventory per acre ranges from 10.3 MBF/acre for Industry lands, 13.5 MBF/acre for Other Private lands, 26.5 MBF/acre for Other Public lands and 29.8 MBF/acre for Federal lands. Net growth per year ranges from 571 BF/acre/yr on Industry lands, 472 BF/acre/yr on Other Private, 768 BF/acre/yr on Other Public, and 447 BF/acre/yr on Federal. Since extending rotations beyond the economic harvest age should increase average growth/acre/yr, low net growth for Federal forests reflects higher mortality and lower site class productivity. The comparatively high growth on Other Public forestlands is partially explained by a lower share of very young stands but may also be related to errors associated with the small sample of the most recent survey.

Comparing current harvest rates with net growth over each owner type total timberland provides a rough indicator of the sustainable timber harvest including the impact of recent management performance. The current Westside Industry harvest over net growth is 98%, Other Private 47%, Other Public 37% and Federal 2%. Harvest levels below 100% reflect the impact of managing for many other non-timber objectives.

Eastside average inventories by ownership range from 5.4 MBF/acre on Industry land, 9.2 MBF/acre on Other Private, 15.6 MBF/acre on Other Public, and 12 MBF/acre on Federal forestlands. Net annual growth ranges from 252 BF/acre for Industry, 280 BF/acre for Other Private, 218 BF/acre for Other Public, and 135 BF/acre for Federal.

Using the ratio of harvest to net growth as a timber harvest sustainability measure, the current Eastside Industry harvest over net growth is 145%, Other Private 68%, Other Public 50% and Federal 14%. Ratios of harvest to growth well below 100% may be contributing to increasing forest health problems as the forest density continues to increase above historic levels.

Westside and Eastside Issues

Declines in Westside harvest volumes have ended the period of inventory/acre reductions for Private lands, as the impact of the increase in acres reserved from management by regulatory constraints is more than offsetting any impact of shortening rotations. However, continuing losses of private forest acreages to land-use conversions suggest that harvest volumes will continue to decline and the regulatory objectives may be circumvented. The increase in inventory in both Other Private and Other Public is very large reflecting the substantial impact of the State HCP on Other Public lands and the varied management objectives compounded by regulatory issues, such as the longer rotations and fewer entries in riparian zones.

The high Eastside harvest levels are not sustainable on Industry lands although they have most likely contributed to a reduction of the forest health problems that plague public ownerships. The increase in harvest on Other Private appears to reflect a changing balance of mature stands and perhaps a response to forest health concerns.

The observation that Eastside removals as a percentage of gross growth has declined from 33% for Other Public and 43% on Federal to just 23% on other Public and 7% on Federal should be expected to worsen forest health problems associated with both insect and fire risk. Removals on the Westside have also fallen from 44% of gross growth to 27% for Other Public and from 111% to only 2% on Federal. While there is not a comparable forest health hazard on the Westside, excessive densities will contribute to increased mortality.

Table DP1.3: Westside Statistical Summary Tables for Growth, Mortality, Removals, and Inventory Change from 1990 to Current

Westside

Net volume sawtimber MMBF

1980 to 89	Industry	Other Priv.	Private	Other Pub.	Federal(a)
End Inventory (MMBF)	47,187	26,277	73,464	35,483	59,714
Gross Growth %	6.22%	5.35%	5.91%	4.66%	1.21%
Gross Growth (MMBF)	2,763	1,335	4,098	1,579	712
Mortality	259	142	401	197	187
% Mortality	9.37%	10.64%	9.79%	12.48%	26.26%
Removals (MMBF)	3036	462	3498	697	789
% Removals	109.88%	34.61%	85.36%	44.14%	110.81%
Inventory Ch. (MMBF)	-532	731	199	685	-264
% Inventory Ch. as % of Inventory	-19.25% -1.13%	54.76% 2.78%	4.86% 0.27%	43.38% 1.93%	-37.08% -0.44%
Acres (000s)	3,732	1,978	5,710	1,663	2,208
Inventory/acre (MBF/acre)	12.6	13.3	12.9	21.3	27.0
Gross Grth/acre (BF/acre/yr)	740	675	718	949	322
Net Grth/acre (BF/acre/yr)	671	603	647	831	238
1990 to 1999	Industry	Other Priv.	Private	Other Pub.	Federal(a)
End Inventory (MMBF)	37,319	25,943	63,262	42,025	69,172
Gross Growth %	6.9%	4.6%	5.9%	4.2%	1.9%
Gross Growth (MMBF)	2,399	1,148	3,547	1,687	1,303
Mortality	336	238	574	470	266
% Mortality	14.0%	20.7%	16.2%	27.9%	20.4%
Removals (MMBF)	2,303	586	2,889	487	133
% Removals	96.0%	51.0%	81.4%	28.9%	10.2%
Inventory Ch. (MMBF)	-240	324	84	730	904
% Inventory ch. as % of Inventory	-10.0% -0.64%	28.2% 1.25%	2.4% 0.13%	43.3% 1.74%	69.4% 1.31%
Current Removals (MMBF)	2,019	428	2,447	453	23
% Removals	84.2%	37.3%	69.0%	26.9%	1.8%
Inventory Ch. (MMBF)	44	482	526	764	1,014
% Inventory Ch. as % of Inventory	1.8% 0.1%	42.0% 1.9%	14.8% 0.8%	45.3% 1.8%	77.8% 1.5%
Acres (000s)	3,616	1,928	5,544	1,585	2,320
Inventory/acre (MBF/acre)	10.3	13.5	11.4	26.5	29.8
Gross Grth/acre (BF/acre/yr)	663	595	640	1,064	562
Net Grth/acre (BF/acre/yr)	571	472	536	768	447

(a) Federal Continuous Vegetation Survey (CVS) data was collected at different times and excludes reserved acres; acreage differences with other tables reflect the impact of different surveys.

Table DP1.4: Eastside Statistical Summary Tables for Growth, Mortality, Removals, and Inventory Change from 1990 to Current

Eastside

Net volume sawtimber mmbf

<u>1981 to 90</u>	<u>Industry</u>	<u>Other Priv.</u>	<u>Private</u>	<u>Other Pub.</u>	<u>Federal(a)</u>
End Inventory (MMBF)	8,535	20,298	28,833	9,504	38,616
Gross Growth %	3.6%	1.7%	2.2%	3.1%	2.3%
Gross Growth (MMBF)	299	332	631	287	866
Mortality	67	156	223	75	423
% Mortality	22.4%	47.0%	35.3%	26.1%	48.8%
Removals (MMBF)	370	294	664	96	358
% Removals	123.7%	88.6%	105.2%	33.4%	41.3%
Inventory Ch. (MMBF)	-138	-118	-256	116	85
% Inventory Ch.	-46.2%	-35.5%	-40.6%	40.4%	9.8%
as % of Inventory	-1.6%	-0.6%	-0.9%	1.2%	0.2%
Acres (000s)	878	2,366	3,244	764	3,292
Inventory/acre (MBF/acre)	9.7	8.6	8.9	12.4	11.7
Gross Grth/acre (BF/acre/yr)	341	140	195	376	263
Net Grth/acre (BF/acre/yr)	264	74	126	277	135
<u>1991 to 2000</u>	<u>Industry</u>	<u>Other Priv.</u>	<u>Private</u>	<u>Other Pub.</u>	<u>Federal(a)</u>
End Inventory (MMBF)	4,479	21,862	26,341	11,169	38,616
Gross Growth %	5.9%	4.0%	4.3%	3.1%	2.3%
Gross Growth (MMBF)	248	850	1,098	338	866
Mortality	39	181	220	182	423
% Mortality	15.7%	21.3%	20.0%	53.8%	48.8%
Removals (MMBF)	353	456	809	79	126
% Removals	142.3%	53.6%	73.7%	23.4%	14.5%
Inventory Ch. (MMBF)	-144	213	69	77	317
% Inventory ch.	-58.1%	25.1%	6.3%	22.8%	36.6%
as % of Inventory	-3.2%	1.0%	0.3%	0.7%	0.8%
Current Removals (MMBF)	304	457	761	78	63
% Removals	122.6%	53.8%	69.3%	23.1%	7.3%
Inventory Ch. (MMBF)	-95	212	117	78	380
% Inventory Ch.	-38.3%	24.9%	10.7%	23.1%	43.9%
as % of Inventory	-2.1%	1.0%	0.4%	0.7%	1.0%
Acres (000s)	830	2,388	3,218	714	3,292
Inventory/acre (MBF/acre)	5.4	9.2	8.2	15.6	11.7
Gross Grth/acre (BF/acre/yr)	299	356	341	473	263
Net Grth/acre (BF/acre/yr)	252	280	273	218	135

(a) Federal Continuous Vegetation Survey (CVS) data was collected at different times and excludes reserved acres; acreage differences with other tables reflect the impact of different surveys.

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