

Integrating Carbon Improvements into Forest Management Decision Making

Presented to:
Washington Hardwood Commission
Annual Meeting
Chehalis, WA
June 6, 2024

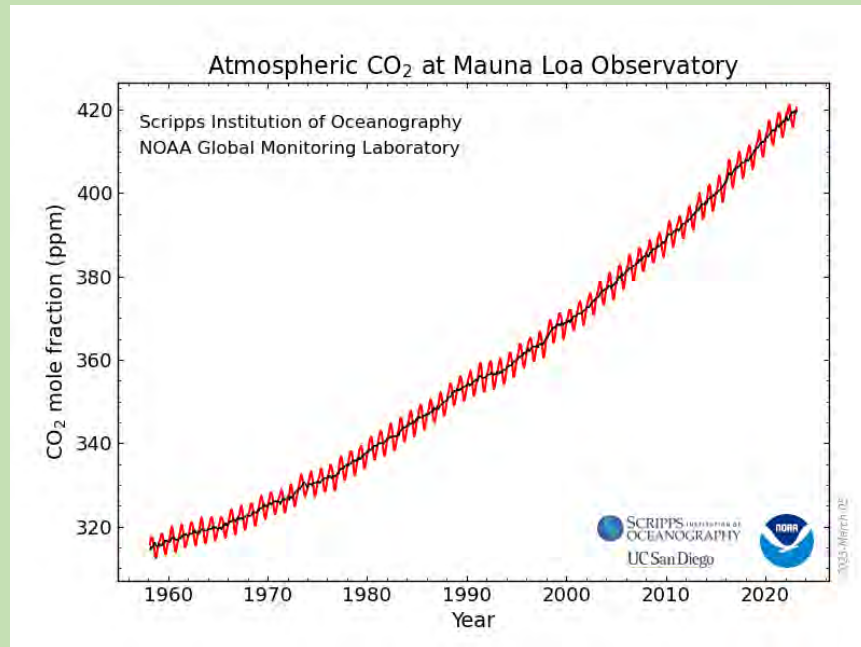
Elaine Oneil, PhD
Director of Science and Sustainability

Elaine Oneil, PhD
Executive Director

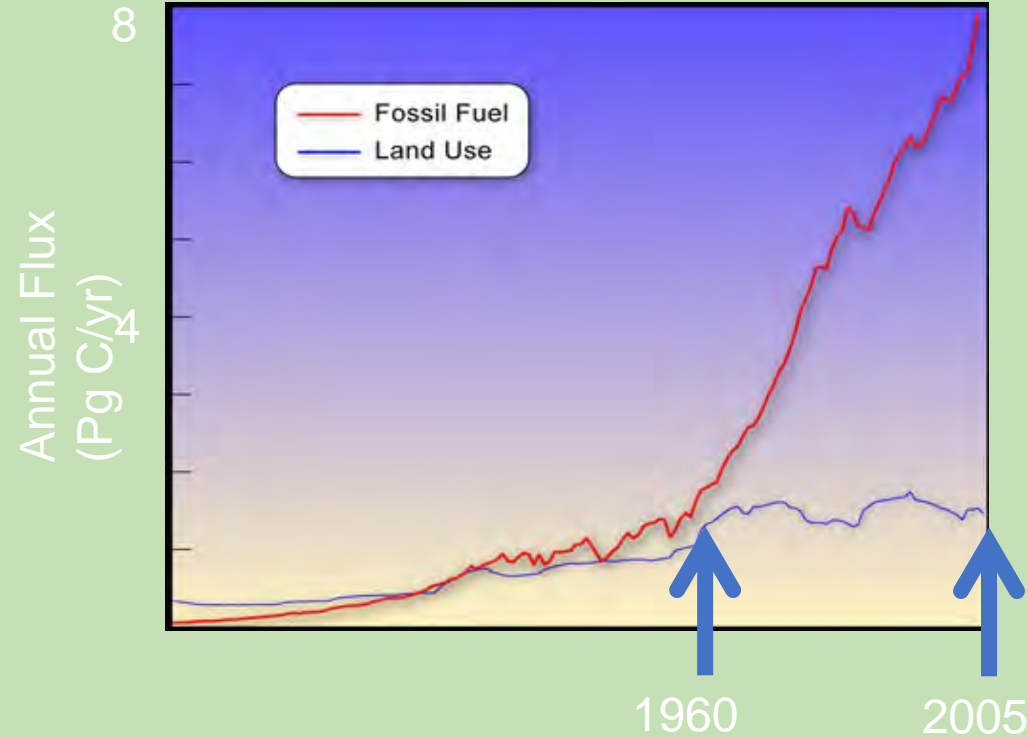


"Stewards of
the land...
for
generations
to come."

Carbon Dioxide Emission Sources



https://gml.noaa.gov/webdata/ccgg/trends/co2_data_mlo.png



Source:
adapted from Woods Hole Research Center

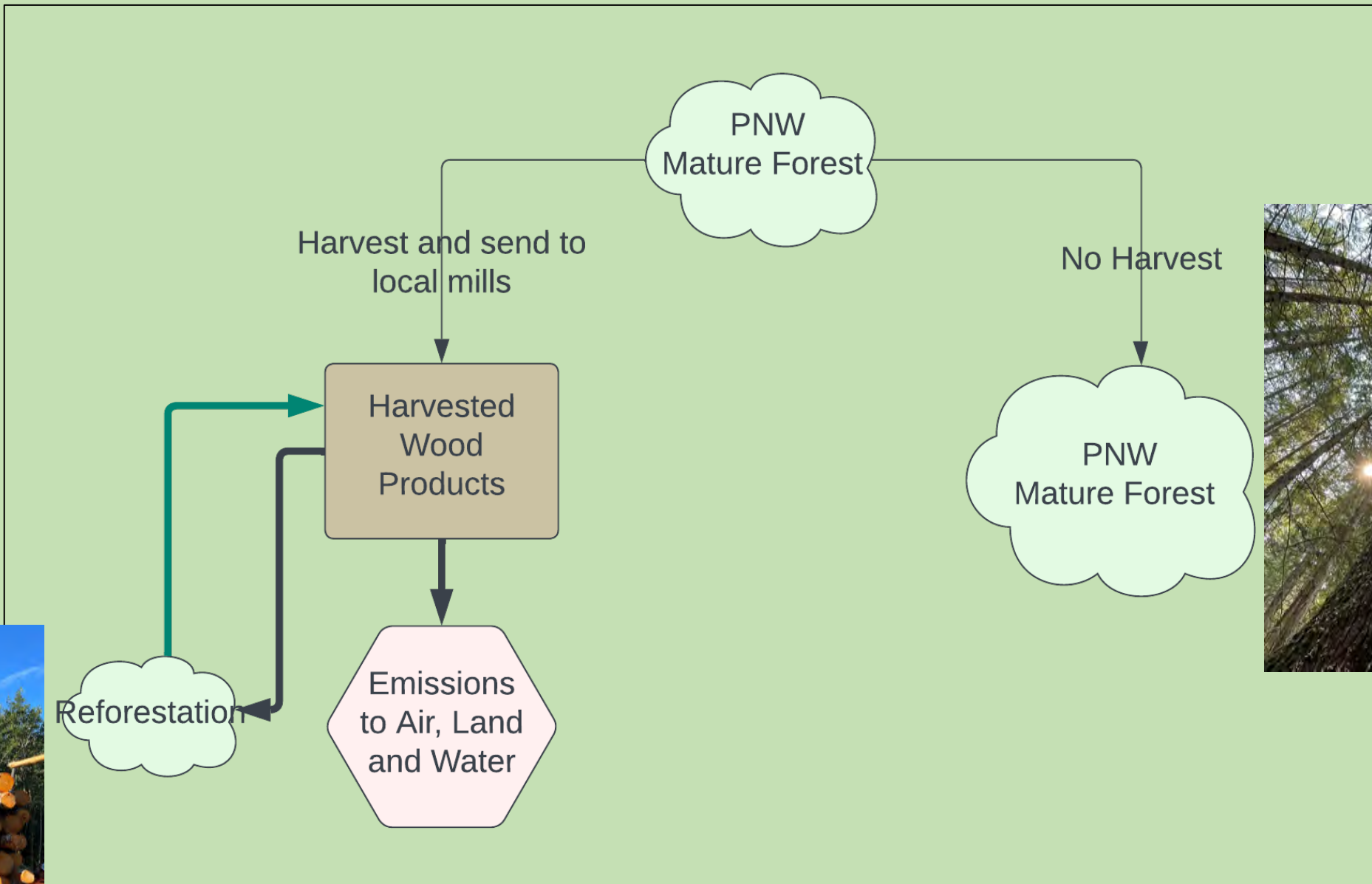
The closed loop of
FOREST CARBON
in the **ATMOSPHERE**

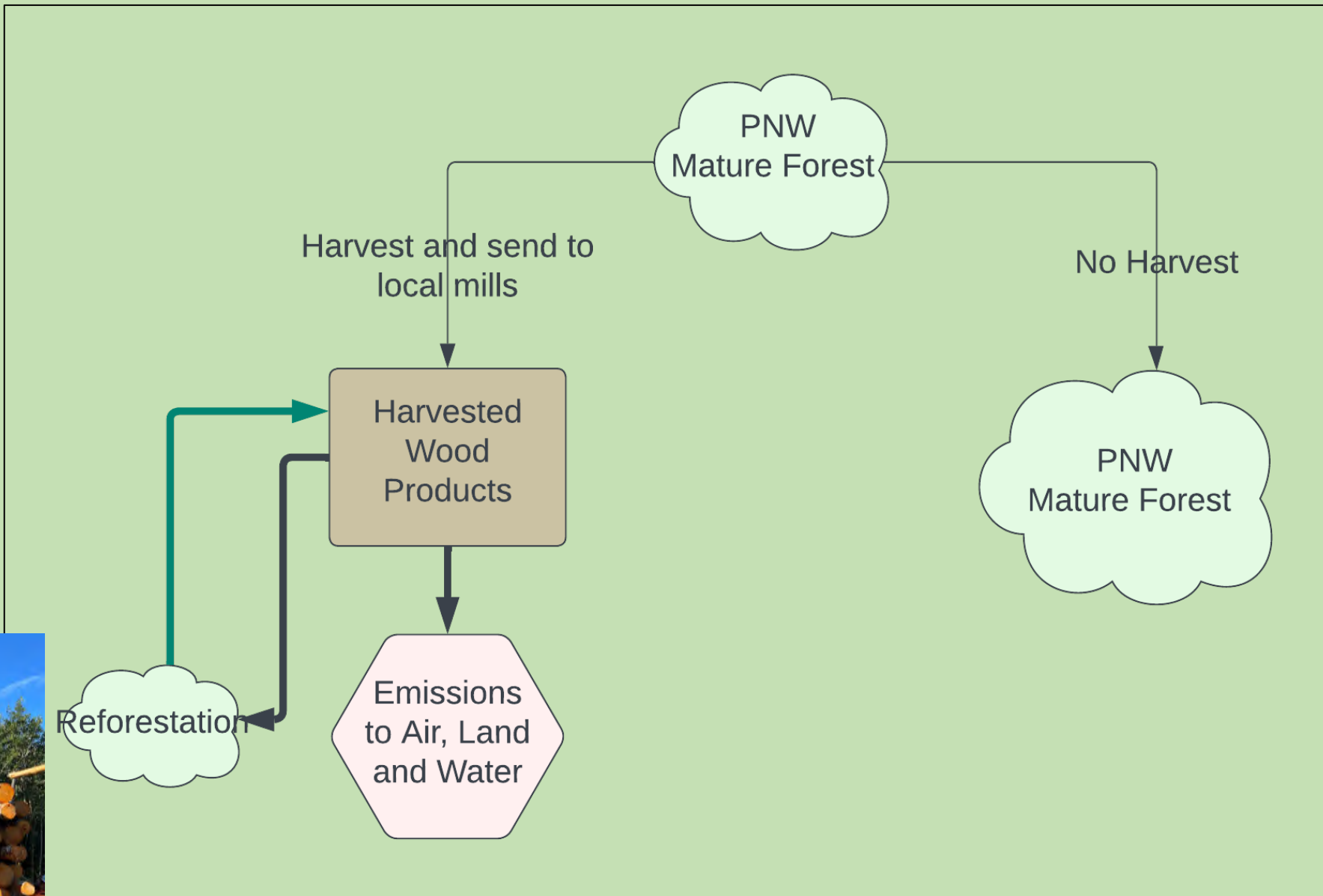
Carbon Cycle

Fossil fuel use is an
OPEN SYSTEM where
CO₂ remains in the
atmosphere.



Source: USFS Office of Sustainability and Climate: [Carbon | US Forest Service \(usda.gov\)](https://www.usda.gov/forestservice/carbon)





50+ years of neglect



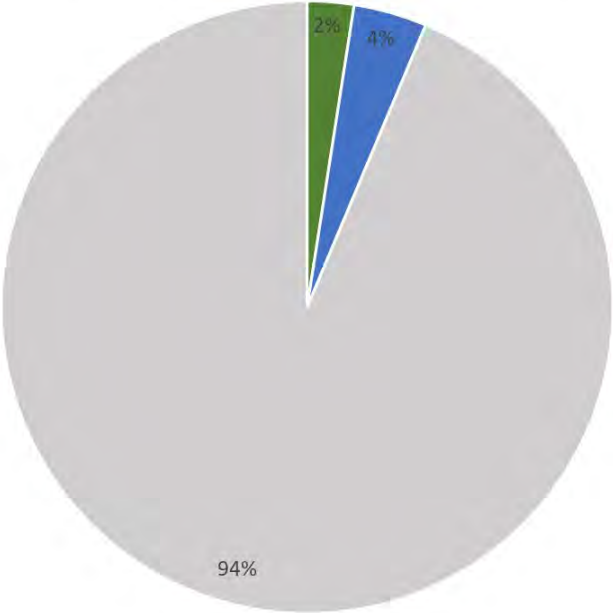
33 years of management



Our (current) place in the national/global context

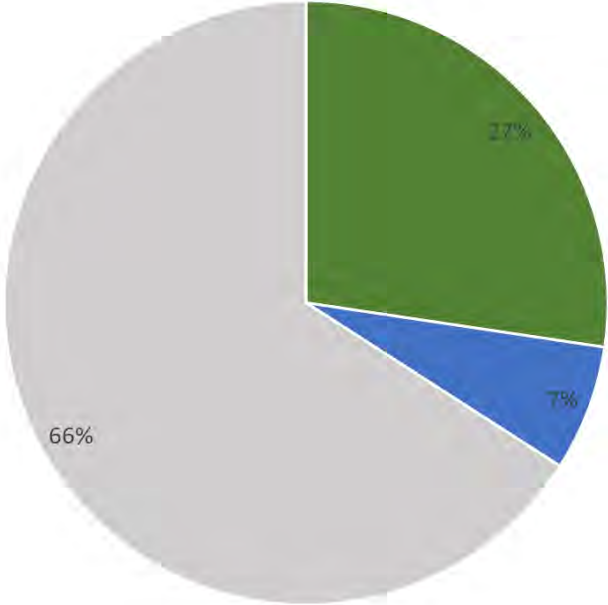
PNW share of US timberland by owner type

■ PNW Private ■ PNW Public ■ United States



Sawlog and Veneer Production by Region

■ PNW Private Forests ■ PNW Public Forests ■ Remainder of US Forests



United States as Global Provider of Wood Products



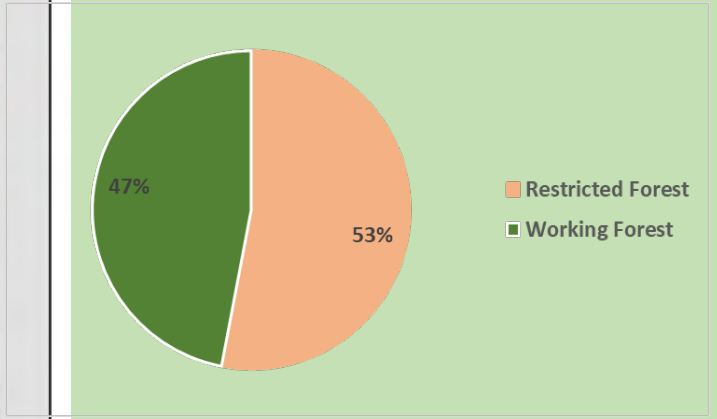
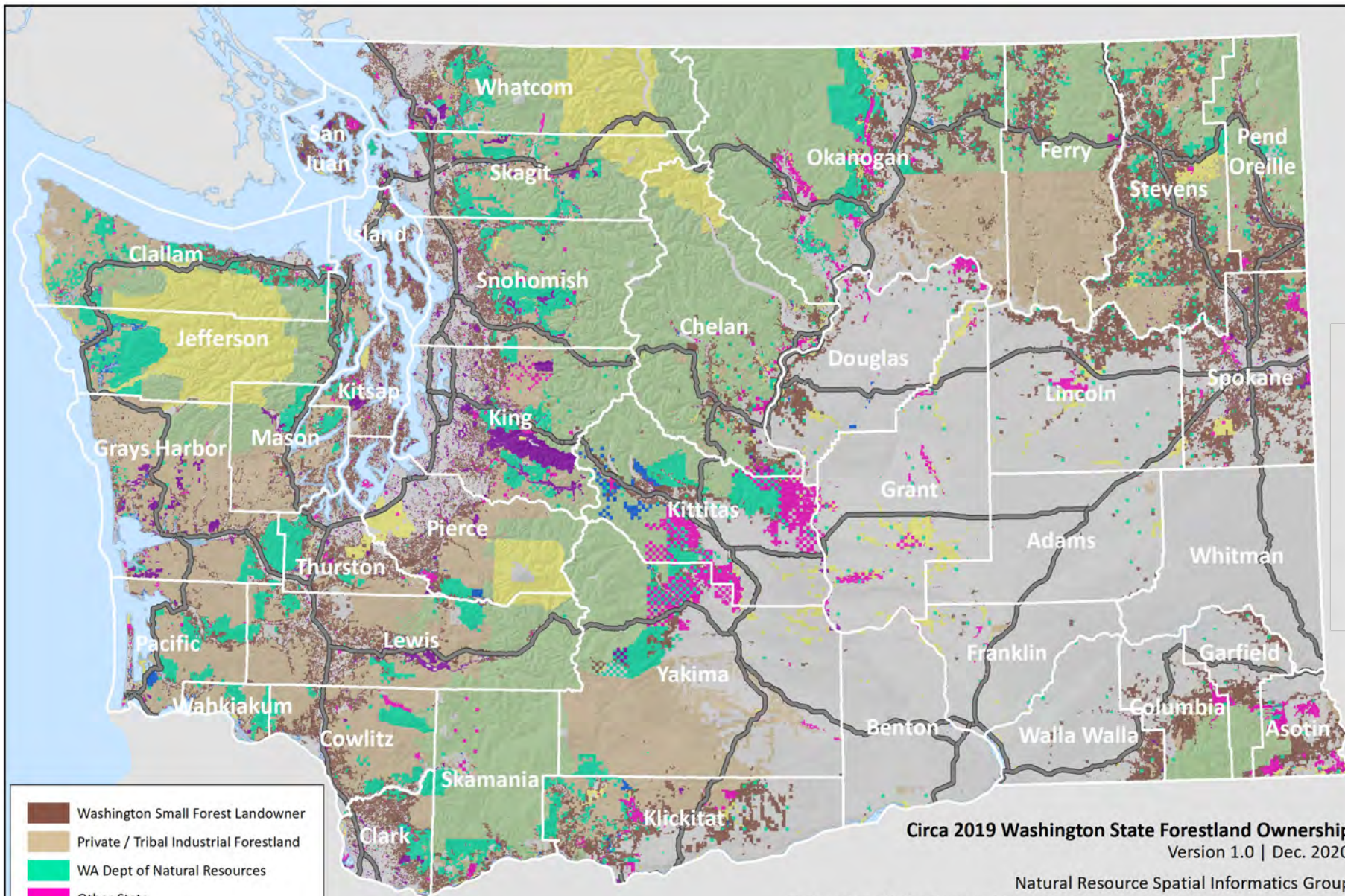
Population

Land Area

Forest Area

**Industrial
Roundwood
Production**

Global
leader



- Washington Small Forest Landowner
- Private / Tribal Industrial Forestland
- WA Dept of Natural Resources
- Other State
- US Forest Service
- Other Federal
- County, Local
- Conservation

Circa 2019 Washington State Forestland Ownership
Version 1.0 | Dec. 2020

Natural Resource Spatial Informatics Group
University of Washington | School of Environmental and Forest Sciences
Box 352100 | Seattle, WA 98195-2100 | <https://nrsig.org>

Citation: Cooke, Andrew G., J. M. Cornick, L. W. Rogers. 2020.
Circa 2019 Washington State Forestland Ownership.
Version 1.0. 2019 Washington State Forestland Database Series.
Scale 1:2,240,000. Seattle, Washington, University of Washington.

Forest Mortality drives carbon consequences on unmanaged forests

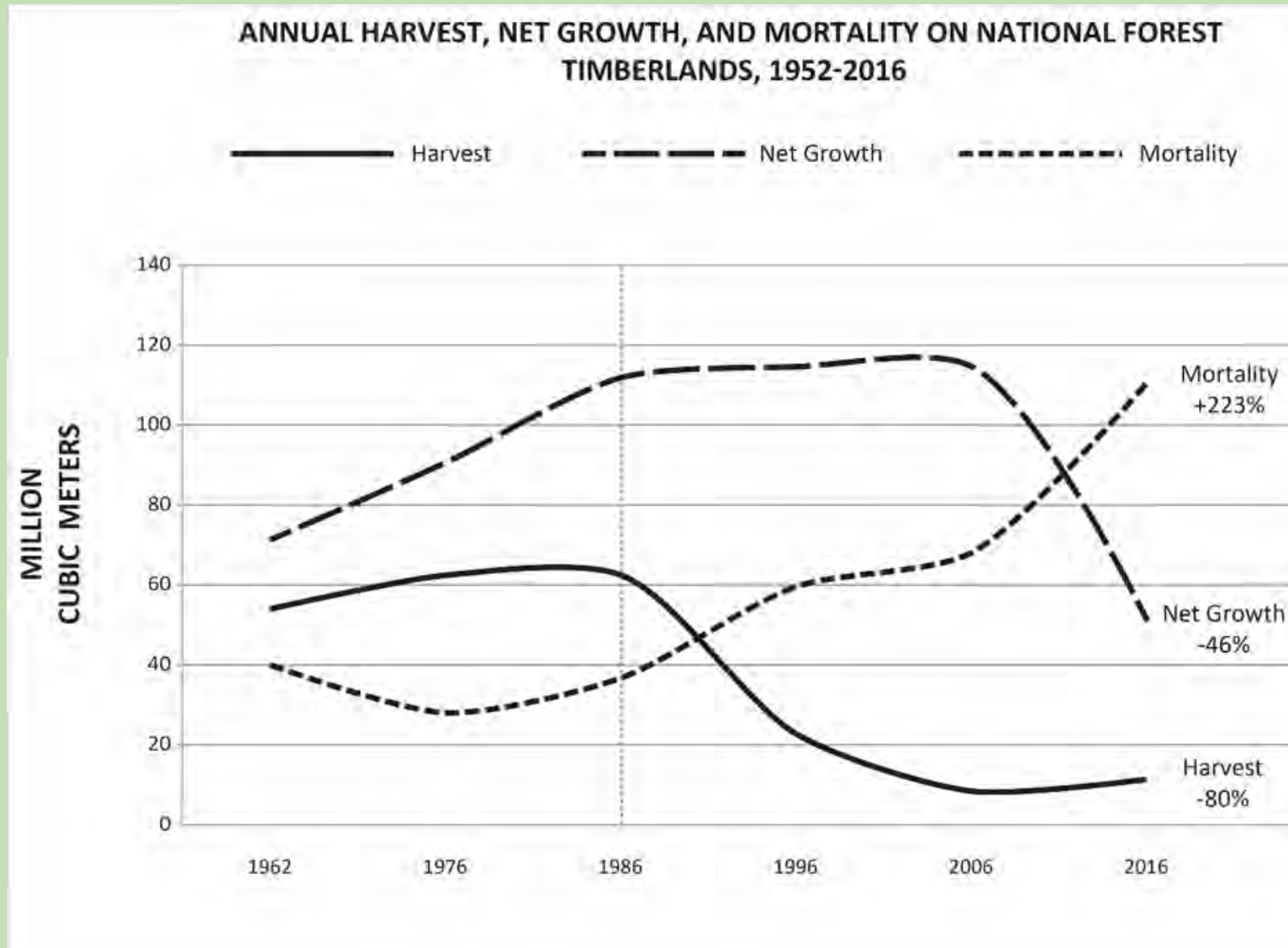
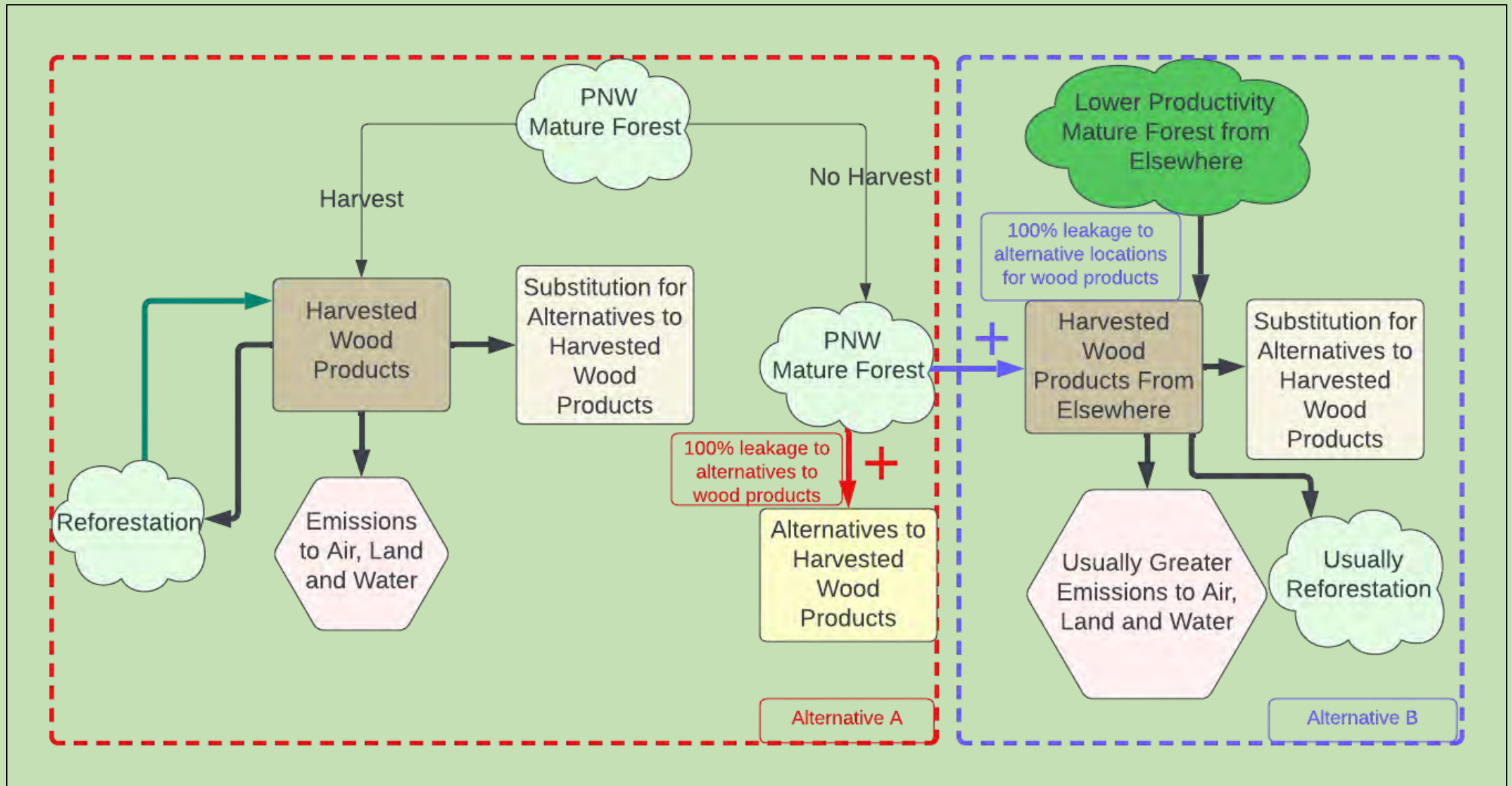


Figure 1 from Lippke et al, 2021, The Plant a Trillion Trees Campaign to Reduce Global Warming – Fleshing Out the Concept, Journal of Sustainable Forestry, Berlyn Reviews, <https://www.tandfonline.com/doi/full/10.1080/10549811.2021.1894951>

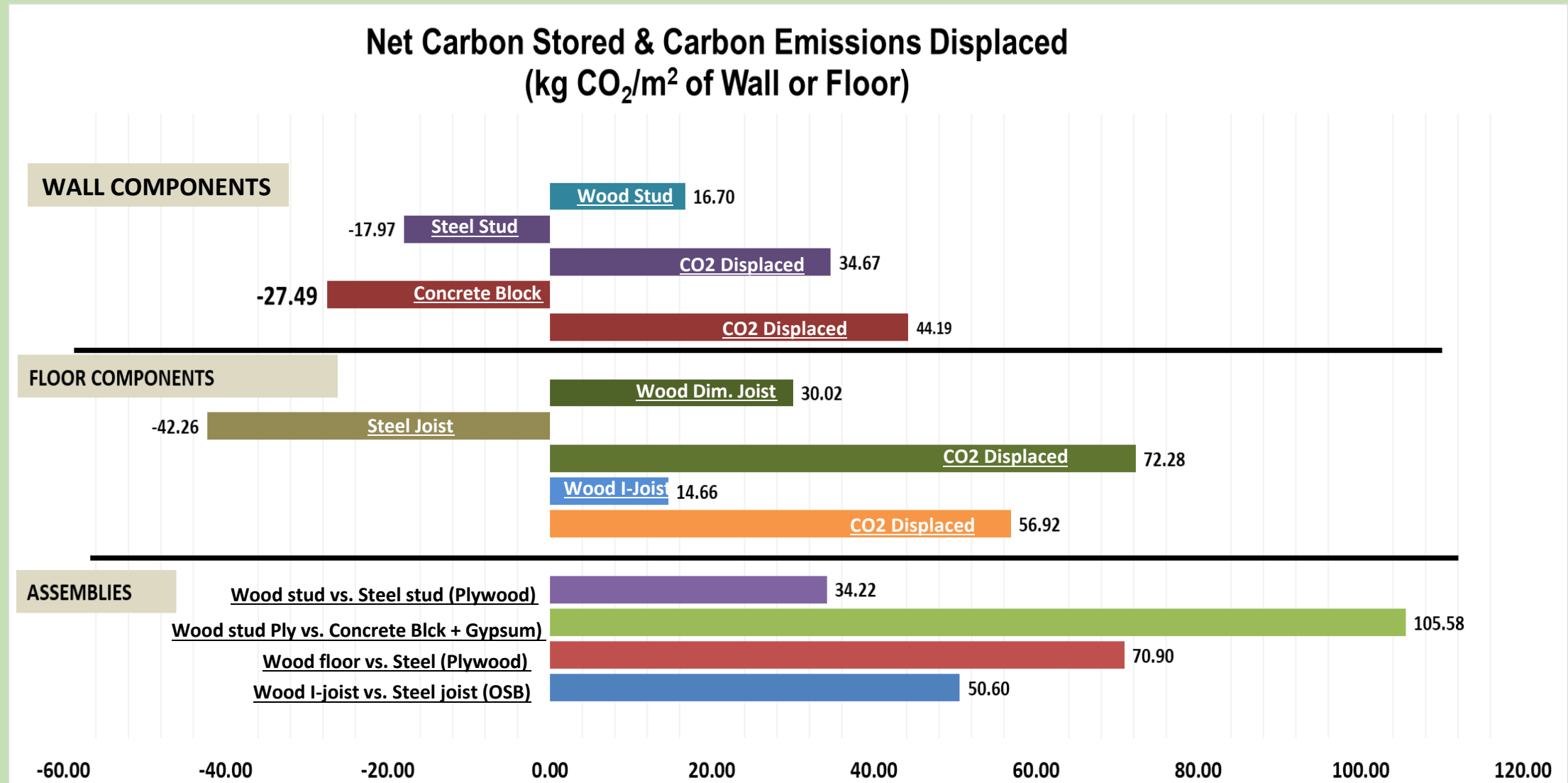
Forest and Harvested Wood Product Carbon Accounting Made Simple

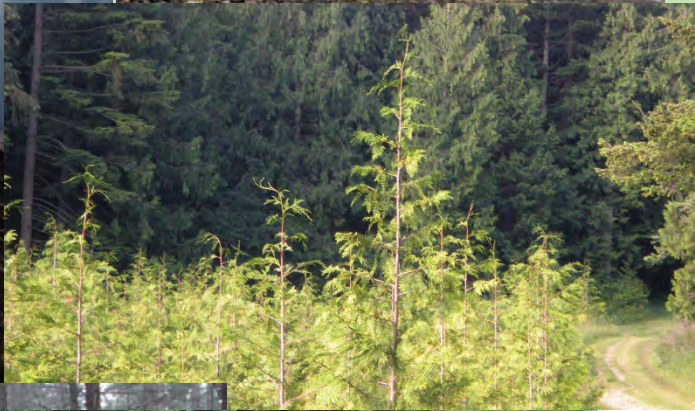
WA Owner Group	Gross Income (sequest./acre)	Expense (loss from mortality, decay, landfill, manufac. emissions)	Net Income (sequest - losses)	Profit (% for group)	Profit (% of gross average)	Profit (% of net average)	Inc. in Long-Term Asset (Standing Timber)	Product Inventory (HWP)
Industry	4.93	2.15	2.78	56%	76%	160%	0.34	2.44
DNR	4.09	2.26	1.83	45%	50%	106%	0.24	1.59
USFS	2.88	2.07	0.81	28%	22%	47%	0.72	0.09
SFLO	2.79	1.28	1.51	54%	41%	87%	0.93	0.58
Average	3.67	1.94	1.73	47%	47%	100%	0.56	1.18

70% mortality of annual growth

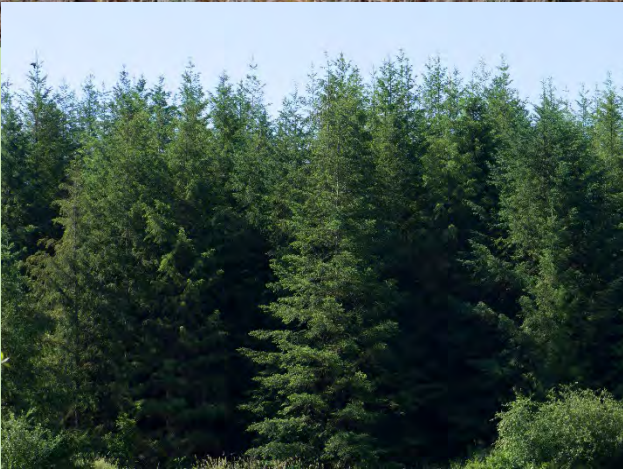


Example Displacement Values





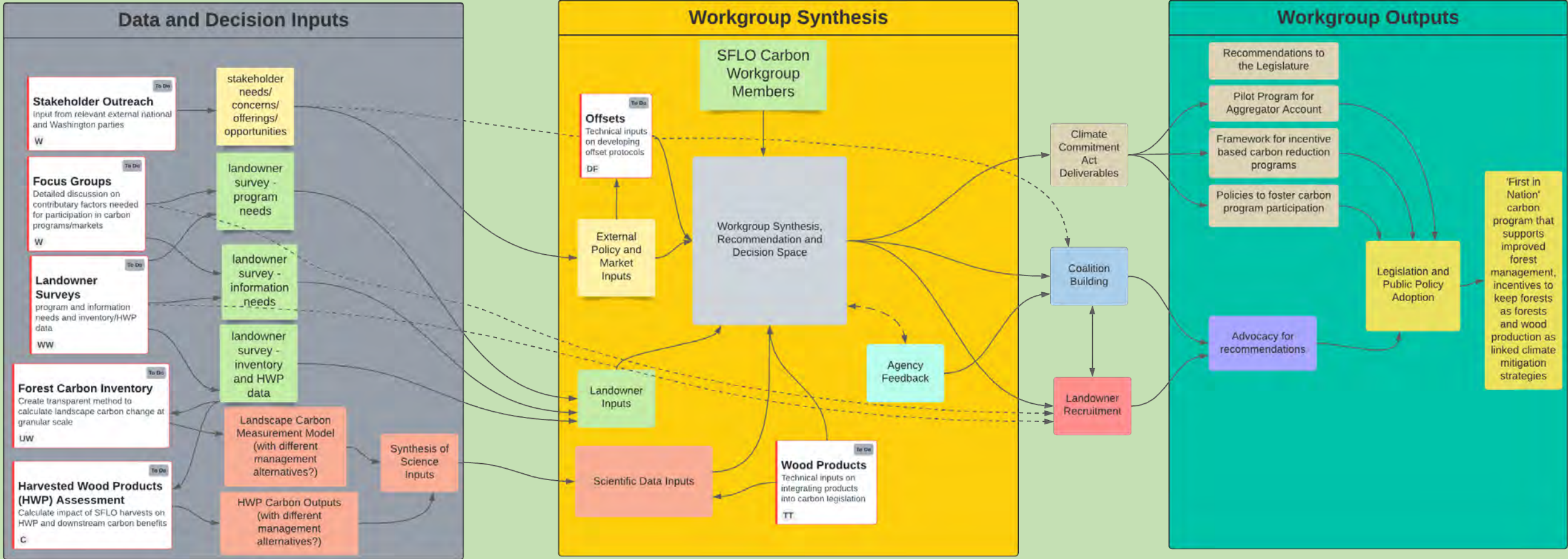
Co-creators with nature



SFLO Carbon Workgroup

- Established under [Section 21](#) of the Climate Commitment Act (SB 5126 (2021))
- Lead by the [Washington Farm Forestry Association](#)
- Questions the workgroup must answer
 - How should we set up and fund a pilot program to develop an aggregator account for carbon offset projects?
 - What kinds of policies are needed to support the incentive programs for participation in carbon markets?
 - What kinds of incentives are needed to increase carbon storage and sequestration in forests and wood products.
 - How do we work in requirements under prior law regarding the relationship between forest carbon projects and forest harvest – both of which provide carbon benefits?





Data and Decision Inputs

Stakeholder Outreach
 Input from relevant external national and Washington parties
 W

Focus Groups
 Detailed discussion on contributory factors needed for participation in carbon programs/markets
 W

Landowner Surveys
 program and information needs and inventory/HWP data
 WW

Forest Carbon Inventory
 Create transparent method to calculate landscape carbon change at granular scale
 UW

Harvested Wood Products (HWP) Assessment
 Calculate impact of SFLO harvests on HWP and downstream carbon benefits
 C

stakeholder needs/ concerns/ offerings/ opportunities

landowner survey - program needs

landowner survey - information needs

landowner survey - inventory and HWP data

Landscape Carbon Measurement Model (with different management alternatives?)

HWP Carbon Outputs (with different management alternatives?)

Synthesis of Science Inputs

Workgroup Synthesis

SFLO Carbon Workgroup Members

Offsets
 Technical inputs on developing offset protocols
 DF

External Policy and Market Inputs

Landowner Inputs

Scientific Data Inputs

Workgroup Synthesis, Recommendation and Decision Space

Wood Products
 Technical inputs on integrating products into carbon legislation
 TT

Agency Feedback

Climate Commitment Act Deliverables

Coalition Building

Landowner Recruitment

Workgroup Outputs

Recommendations to the Legislature

Pilot Program for Aggregator Account

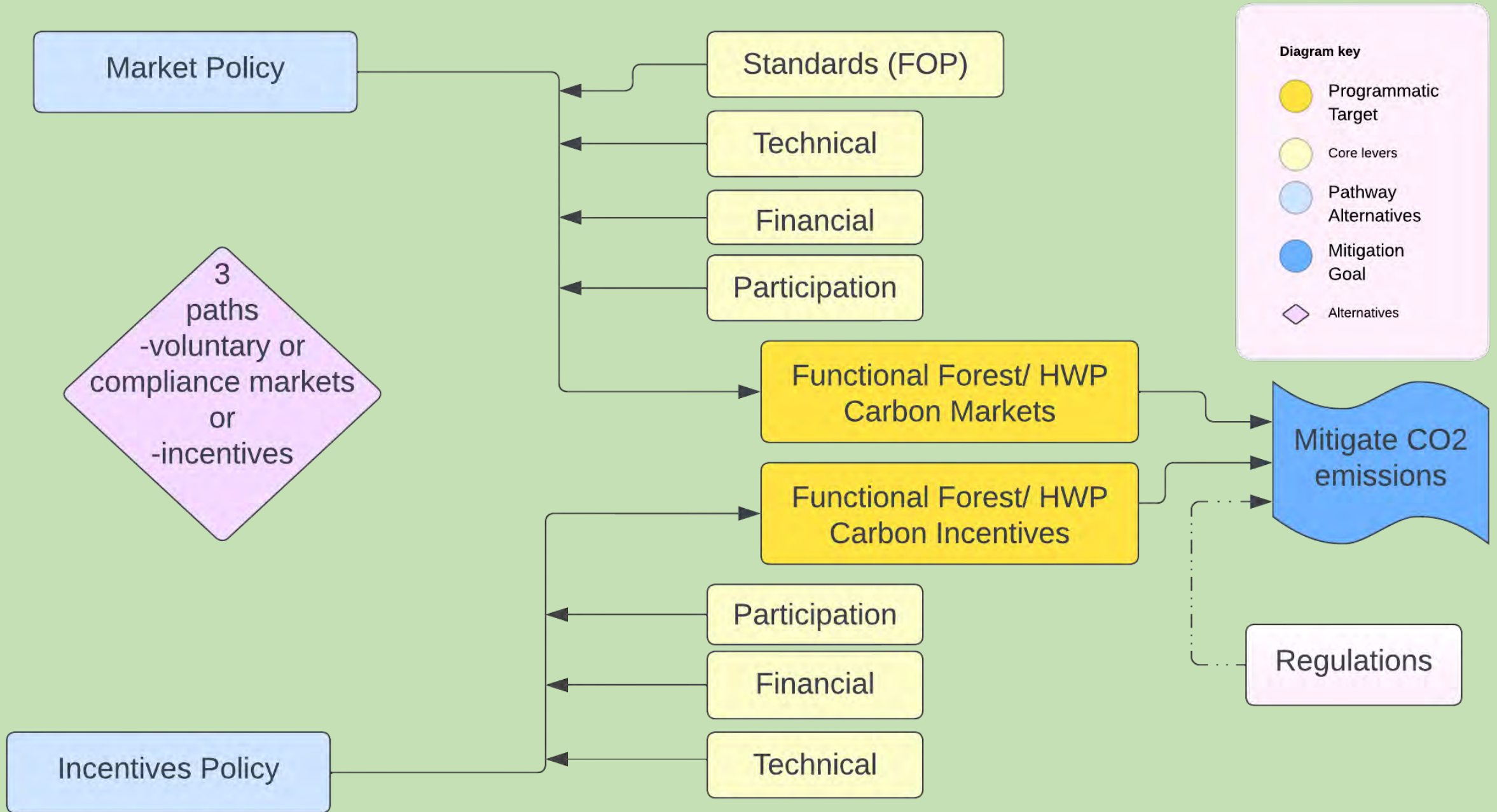
Framework for incentive based carbon reduction programs

Policies to foster carbon program participation

Legislation and Public Policy Adoption

Advocacy for recommendations

'First in Nation' carbon program that supports improved forest management, incentives to keep forests as forests and wood production as linked climate mitigation strategies



Who are Small Forest Landowners (SFLO) and what do they want?

We are important enough that we have our own statute (RCW 76.13) and state resources dedicated to understanding what SFLO need and want to keep their forests as forests

<https://nrsig.org/projects/small-forest-landowner-regulatory-impacts/files/Small-Forestland-Owners-ESSB-5330-Report-2021011.pdf>



Washington's Small Forest Landowners in 2020

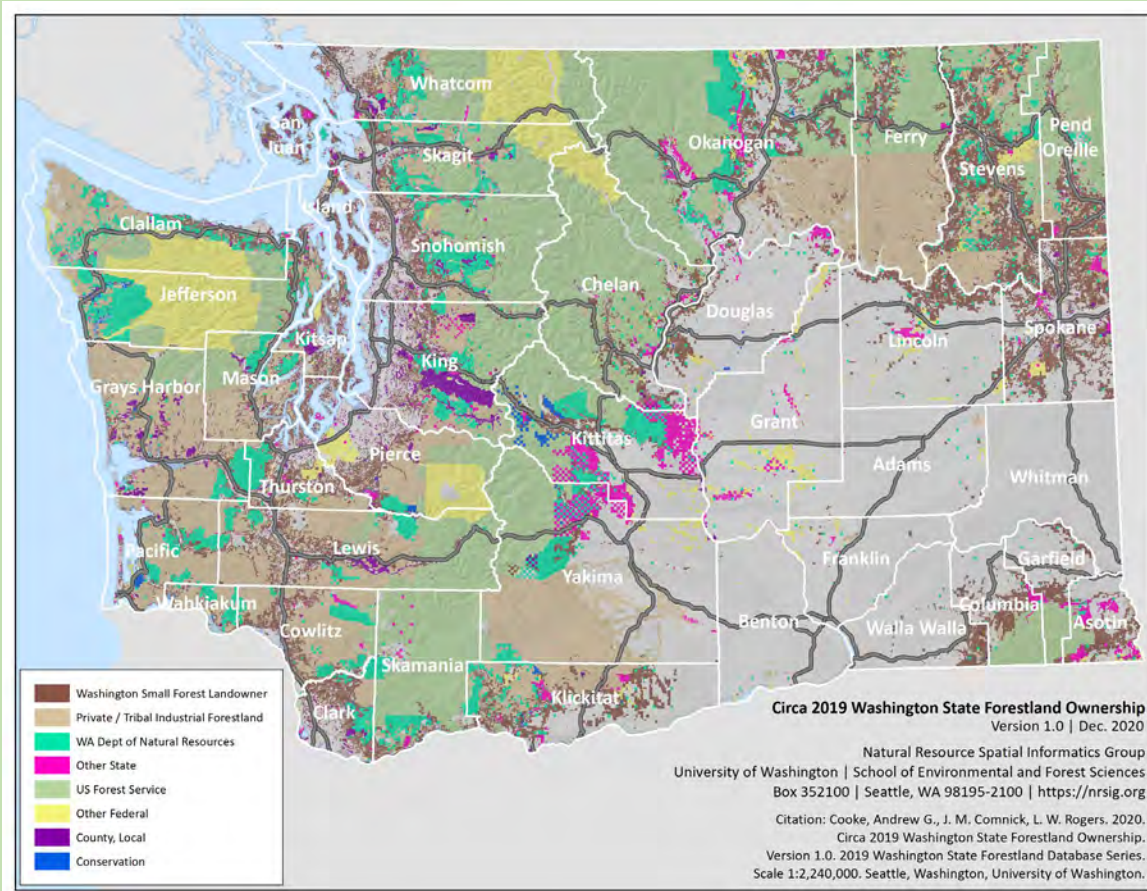
Status, trends and recommendations after 20 years of Forests & Fish

January 11, 2021



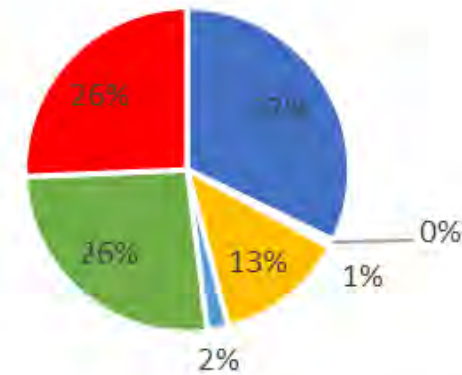
SCHOOL OF ENVIRONMENTAL AND FOREST SCIENCES
UNIVERSITY of WASHINGTON
College of the Environment

Forest and Timber Land Ownership Washington State



Private non-corporate own about one quarter of all timberland in Washington State (federal statistics)

Washington State Timberland

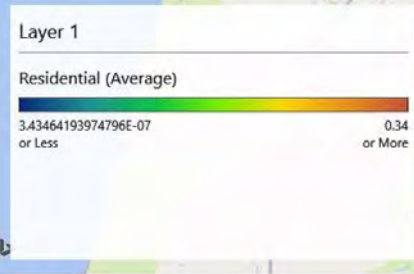
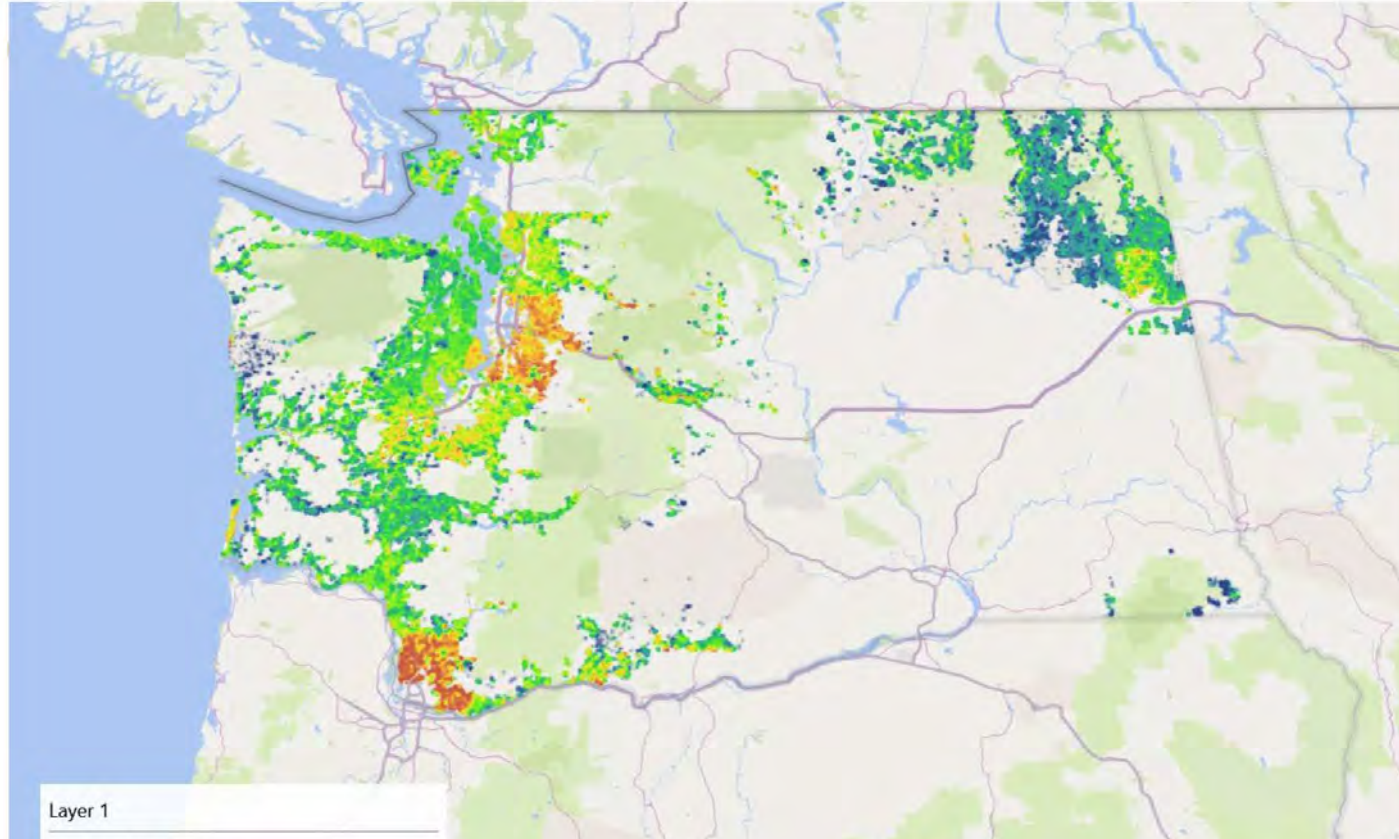


Family Forest Landowners own 15% of forested acres in Washington State (~2.9M acres)

- National forest
- Bureau of Land Management
- Other Federal
- State
- County and Municipal
- private corporate
- Conservation

Anticipated conversion to non-forest uses

> Residential development



Rabotyagov, et al, 2020, Washington's Small Forest Landowners in 2020 Status, trends and recommendations after 20 years of Forests & Fish, University of Washington, School of Environmental and Forest Sciences, 430 pp. <https://nrsig.sefs.uw.edu/projects/small-forest-landowner-regulatory-impacts>

Forest and Harvested Wood Product Carbon Accounting Made Simple

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Calculated from data in Ganguly et al, 2023, Global Warming Mitigating Role of Forests in Washington State, by Land Ownership Type, pp 58-67 of Washington Agribusiness Status and Outlook, Washington State University Impact Center Annual Report, http://ses.wsu.edu/impact-center/wp-content/uploads/sites/2/2023/01/WASO_2023_v5_wo-bleeds.pdf

SMALL FOREST LANDOWNER CARBON WORKGROUP REPORT

Luke Rogers
Andrew Cooke
Jeffrey Cornick

Natural Resources Spatial Informatics Group
Precision Forestry Cooperative
University of Washington

W NRSIG

June 4, 2024

Rogers et al, 2024, Small Forest Landowner Carbon Workgroup Report, University of Washington Natural Resources Spatial Informatics Group (NRSIG), 37 pp.

What did they do? Developed a next generation database that uses Machine Learning (AI) to predict forest stand conditions on a 66 m grid (1/10th acre) level of granularity.

What problem did it solve? Getting close(r) to solving the area estimation challenges for carbon markets (its intended use) BUT – the sky is the limit.

Predicted hardwood proportion on the Olympic Peninsula



Rogers et al, 2024, Small Forest Landowner Carbon Workgroup Report, University of Washington Natural Resources Spatial Informatics Group (NRSIG), 37 pp.

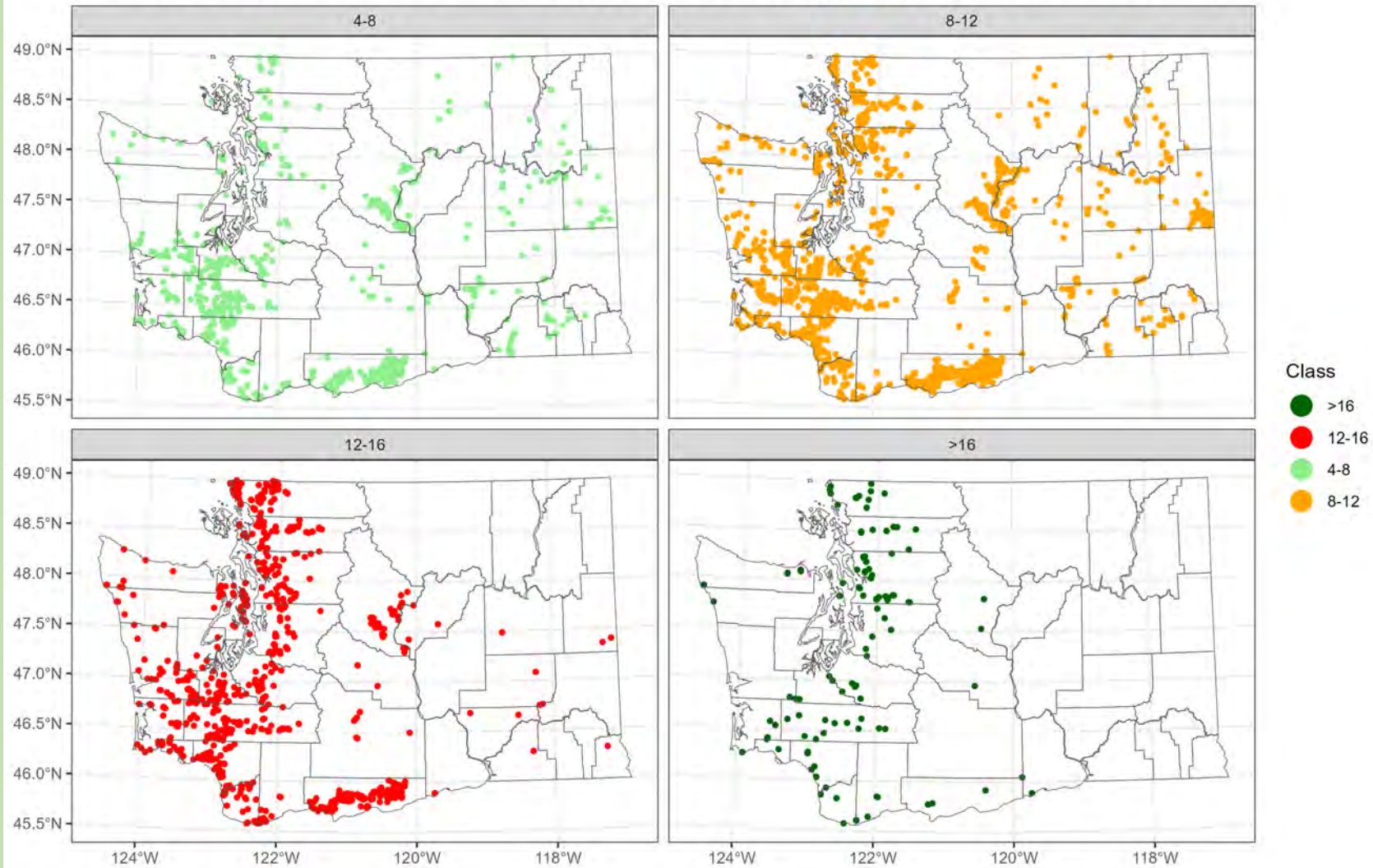
Small Forest Landowner Hardwood Acres

Summary of SFLO hardwood dominated (hardwood proportion $\geq .5$) forests by QMD size class using prediction rasters and the Forestland Database. (for those stands >20 acres)

Half State	QMD Size Class	Number Of Parcels	Forest Acres
West	4 to 8 in	61,577	89,307
	8 to 12 in	117,183	215,518
	12 to 16 in	130,280	242,769
	> 16 in	88,343	76,041
East	4 to 8 in	13,998	36,401
	8 to 12 in	18,647	86,315
	12 to 16 in	13,613	26,889
	> 16 in	6,841	5,627

Rogers et al, 2024, Small Forest Landowner Carbon Workgroup Report, University of Washington Natural Resources Spatial Informatics Group (NRSIG), 37 pp.

Small Forest Landowner Parcels with Hardwood Dominated Stands by QMD Size Class (minimum 20 acres)



UNIVERSITY of WASHINGTON

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School of Environmental and Forest Sciences



**WASHINGTON
HARDWOODS
COMMISSION**

&

**University of
Washington
Institute of
Forest Resources**

Luke Rogers
John Perez-Garcia
B. Bruce Bare

School of Environmental & Forest Sciences
College of the Environment
University of Washington

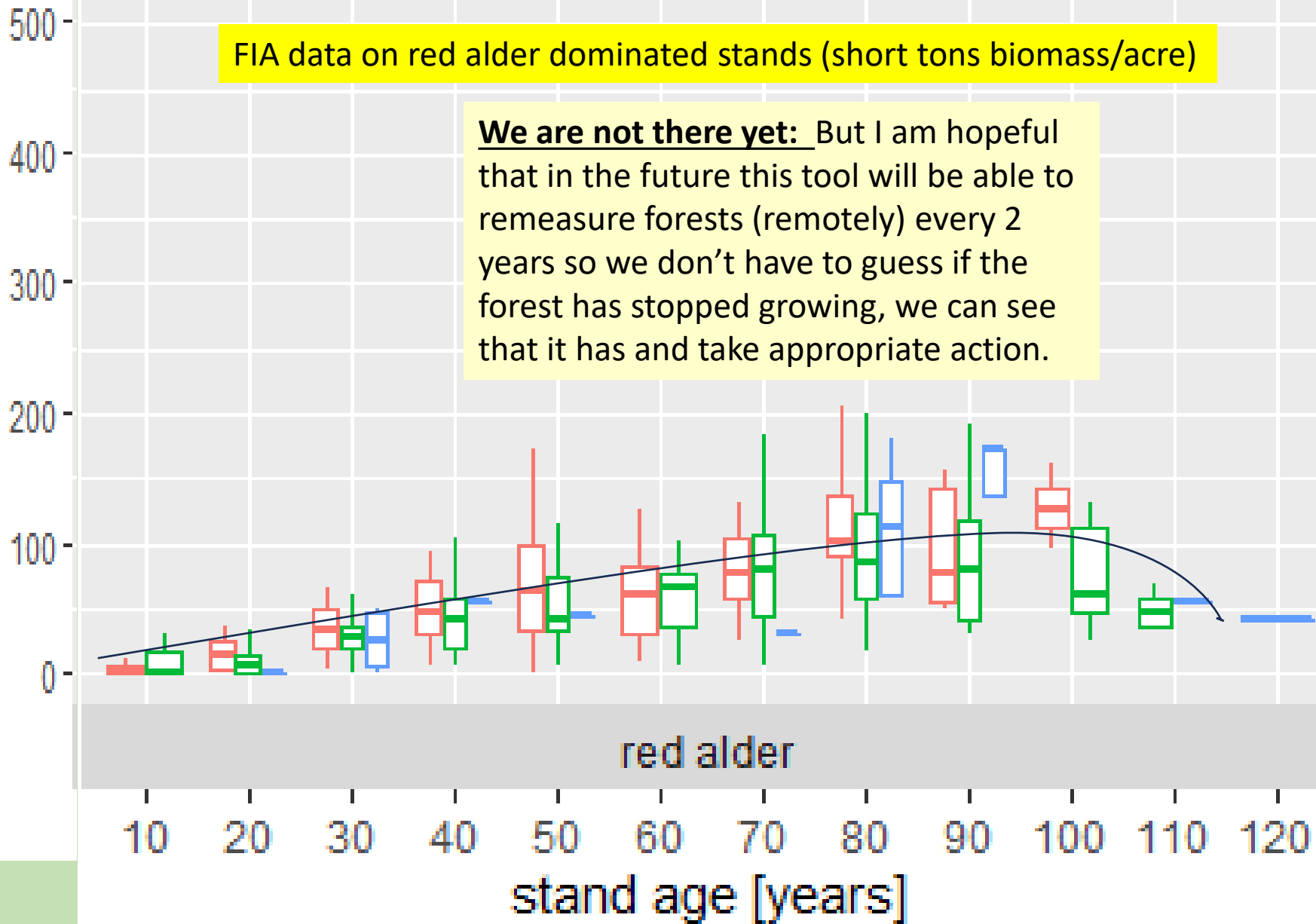
August 15, 2013

**2013 Western
Washington
Hardwood
Assessment**

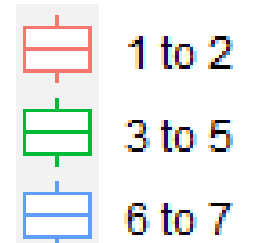
How does it compare to the WHC sponsored 2013 report?
It builds on it. And refines the estimates.

FIA data on red alder dominated stands (short tons biomass/acre)

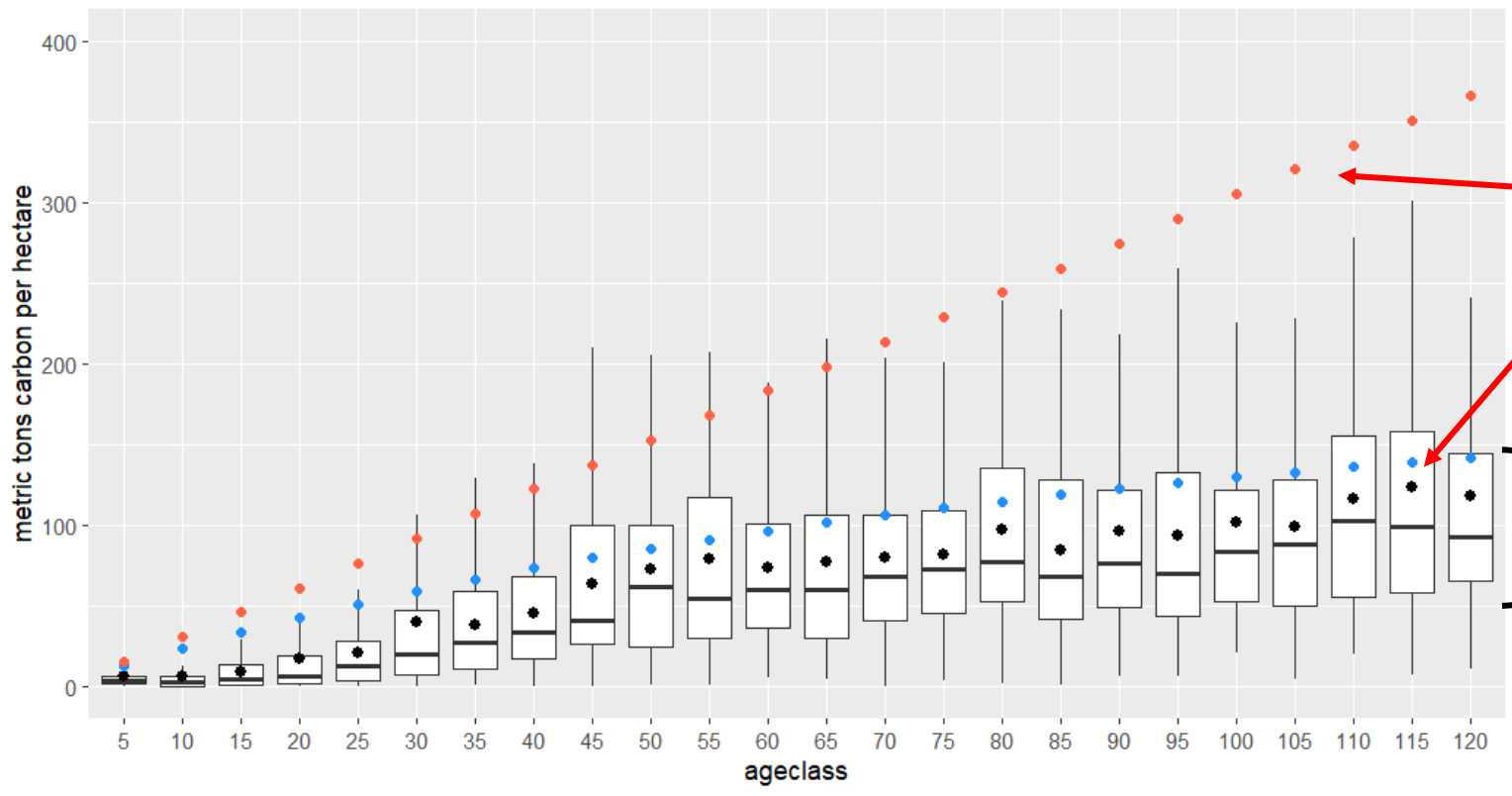
We are not there yet: But I am hopeful that in the future this tool will be able to remeasure forests (remotely) every 2 years so we don't have to guess if the forest has stopped growing, we can see that it has and take appropriate action.



siteclass



WASHINGTON aboveground metric tons carbon per hectare for site class 3, 4 and 5



Modeled growth in Peng et al 2023

Versus average measured FIA growth on sample plots of a given age

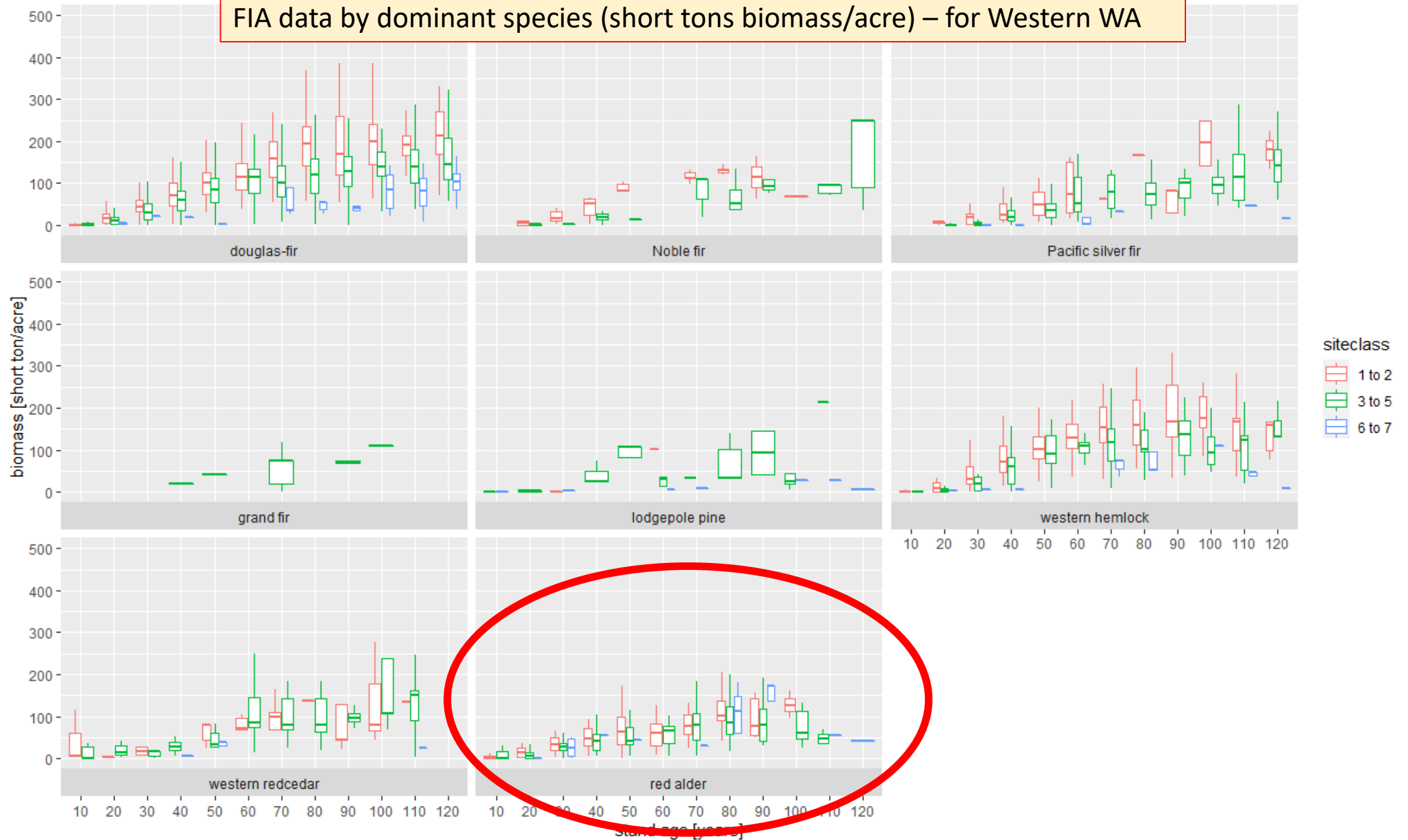
Analysis courtesy of Lieke Drooge, UW CINTRAFOR, 2024



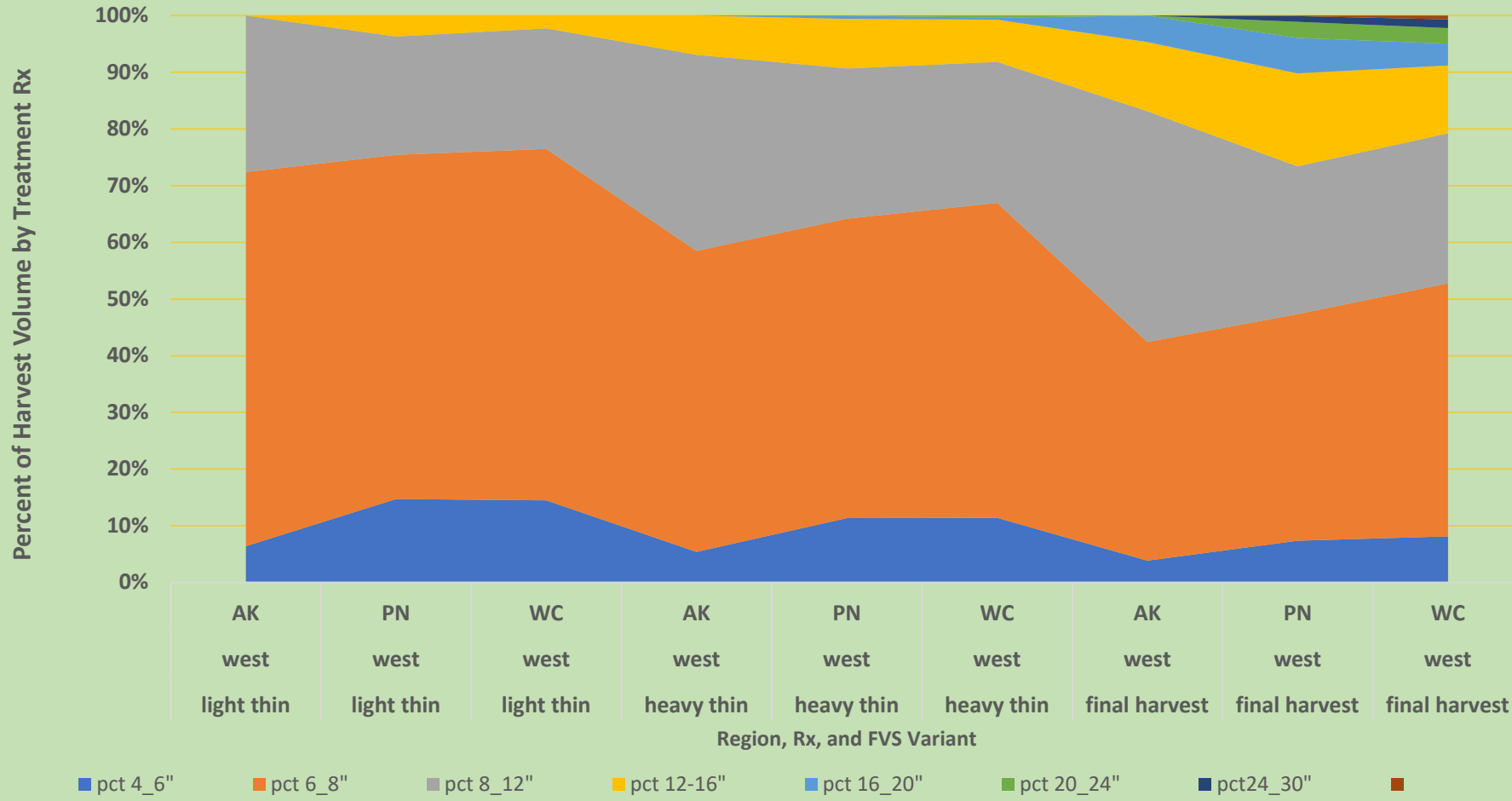
Thank You!

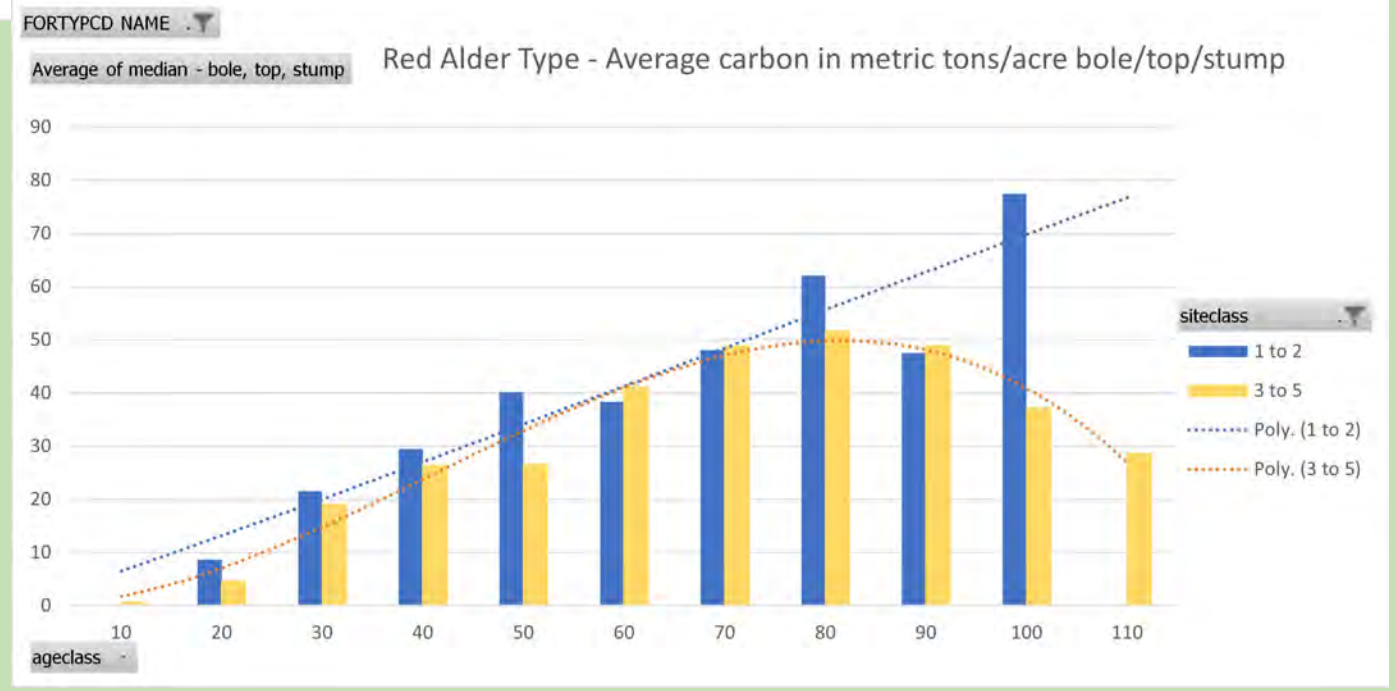
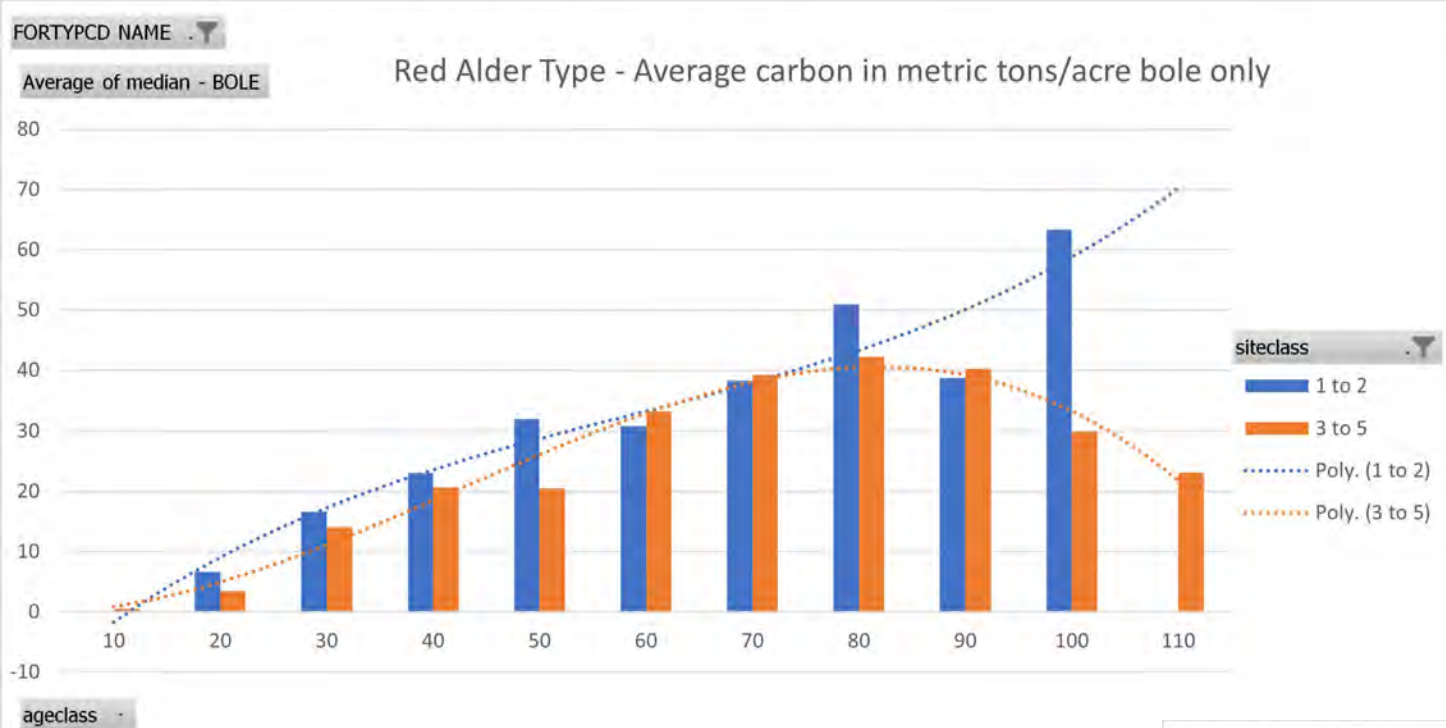
ownership = all

FIA data by dominant species (short tons biomass/acre) – for Western WA



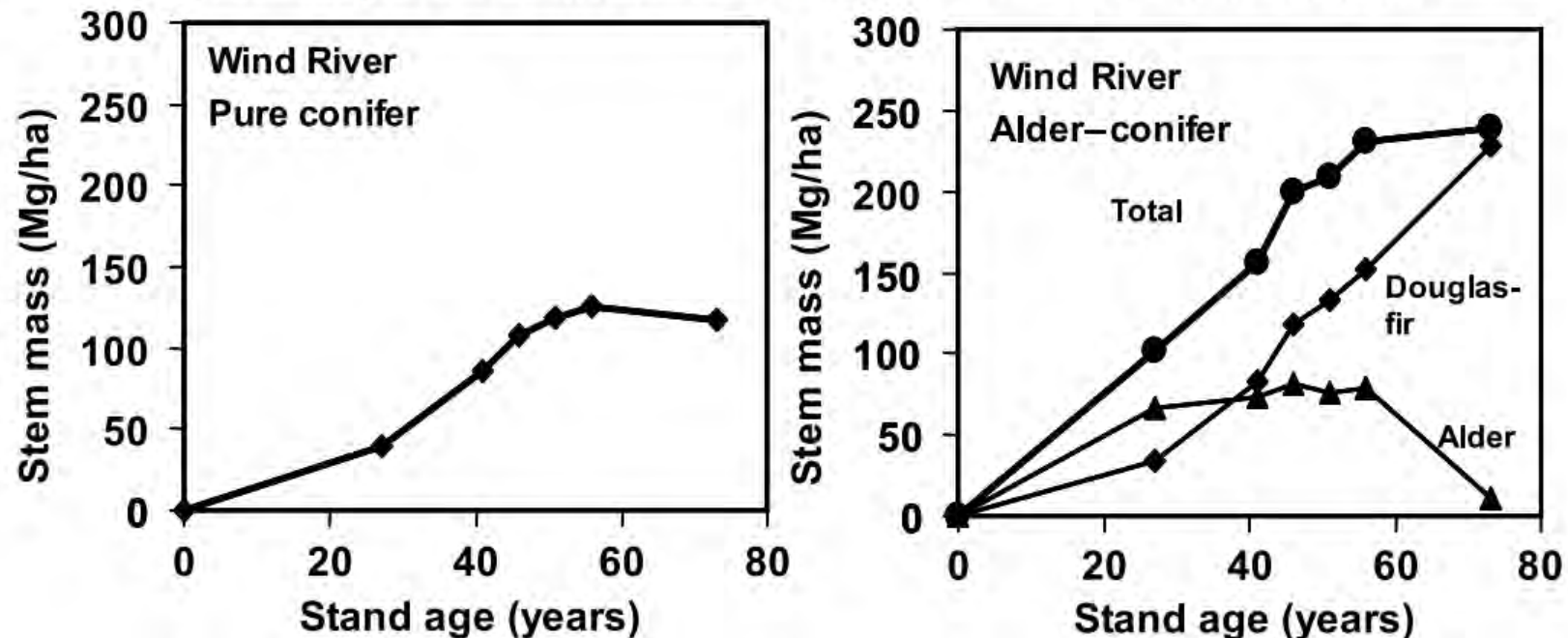
Westside Hardwood Harvest Scaling Diameter Distribution by Rx and Subregion





Alder to augment carbon sequestration on poor sites (70+ year retrospective study)

Fig. 1. Stem mass with stand age for the pure and mixed stands at the Wind River and Cascade Head sites.



~50% more C in 40 years (1/2 alder), still 50% more C in 80 years (no alder).

[Binkley 2003](#)

Unreserved timberland acres by ownership and management zone in western Washington

Owner Type / Mgt Zone	Uplands	Core Buffer	Inner Buffer	Outer Buffer	Wetland Buffer	Total (Acres)
Large Private	2,962,389	469,603	136,903	66,358	12,025	3,647,278
Small Private	1,185,371	106,319	68,237	32,537	16,712	1,409,175
State	810,656		466,743			1,277,398
Tribal	164,407	70,812				235,218
Federal	816,861	730,816				1,547,678
Other Public	144,896	17,407	6,610	3,346	615	172,875
Total (Acres)	6,084,580	1,394,957	678,492	102,241	29,352	8,289,622

2010 Hardwood volume available for harvest by owner type and management zone in western Washington (MBF)

MBF / Owner Type & Management Zone	Uplands	Inner Buffer	Outer Buffer	Wetland Buffer	Total (MBF)
Large Private	2,879,273	99,424	74,009	8,307	3,061,013
Small Private	3,305,262	50,714	59,292	10,127	3,425,394
State	1,070,272	142,747			1,213,019
Tribal	109,745				109,745
Federal	367,545				367,545
Other Public	94,015	3,289	2,849	236	100,388
Total (MBF)	7,826,112	296,173	136,149	18,669	8,277,104

Rogers et al., 2013

2010 Hardwood volume available for harvest by species and owner type in western Washington (MBF)

MBF / Owner Type & Species	Alder	Maple	Cottonwood	Birch	Other	Total (MBF)
Large Private	2,307,961	632,521	87,566	19,490	13,474	3,061,013
Small Private	1,838,697	1,270,194	155,767	146,426	14,310	3,425,394
State	880,610	286,844	31,780	8,878	4,907	1,213,019
Tribal	55,870	32,114	1,318	20,378	65	109,745
Federal	251,378	85,509	27,787	1,153	1,718	367,545
Other Public	72,552	19,217	7,778	292	549	100,388
Total (MBF)	5,407,069	2,326,399	311,996	196,616	35,024	8,277,104

2010 Hardwood volume available for harvest by diameter class and species in western Washington (MBF)

MBF / Diameter Class & Species	Alder	Maple	Cottonwood	Birch	Other	Total (MBF)
0"-5"						
5"-10"	1,270,335	299,397	11,906	42,061	14,582	1,638,281
10"-15"	1,974,862	561,343	23,060	123,025	10,561	2,692,851
15"-20"	1,363,066	757,254	34,640	31,530	9,880	2,196,371
20"-25"	643,521	587,360	102,911			1,333,792
25"-30"	155,286	100,550	131,268			387,104
30"-35"		18,844	8,211			27,054
35"-40"		1,651				1,651
Total (MBF)	5,407,069	2,326,399	311,996	196,616	35,024	8,277,104

Rogers et al., 2013