



**FOREST INDUSTRY  
RESEARCH PROGRAM**  
UNIVERSITY OF MONTANA

# **Timber Processing Capacity and Capability: North Central Washington Collaborative Forest Landscape Restoration Project**

**Prepared by:**

Ben Irely,  
Research Social Scientist

Thale Dillon,  
Forest Researcher

Todd A. Morgan,  
Director

Lauren Sampson,  
Research Associate

Clayton Dutton,  
Database Administrator

Forest Industry Research Program  
Bureau of Business and Economic Research  
University of Montana

**Submitted to:**

Lindsay Buchanan, USDA Forest Service  
Agreement No. 22-CS-11132400-472

**October 2025**

Irey et al.

## Introduction

The North Central Washington Collaborative Forest Landscape Restoration Project (CFLRP) covers 1.15 million acres dominated by dry mixed conifer forests (Okanogan-Wenatchee National Forest, 2020). The landscape is comprised primarily of Okanogan-Wenatchee National Forest lands.

According to the North Central Washington CFLRP proposal, the Okanogan-Wenatchee National Forest:

Is ready to implement high priority restoration treatments on more than 46,000 acres and expects to complete analysis and decisions on an additional 46,000 acres within the next 3 years. Our approach strategically prioritizes and places treatments in accessible terrain, creating effective opportunities to reduce wildfire risk for some of the most vulnerable communities in the Pacific Northwest and the ability to utilize unplanned fire ignitions to achieve restoration goals well beyond the treatment areas (Okanogan-Wenatchee National Forest, 2020).

Timber harvests are planned across 26,880 of the treatment acres for a total harvest volume of 393,849 hundred cubic feet (CCF) of timber over the ten-year span of the CFLRP.

The North Central Washington CFLRP contains portions of Okanogan and Chelan counties (figure 1). Those two Washington counties make up the “Study Area” in this report. The Study Area covers nearly 5.3 million acres. Analysis of timber flow indicates that timber harvested in the North Central Washington Study Area is processed by facilities located inside and outside its boundaries. All counties that contain one or more facility that processes timber harvested in the Study Area constitute the “Timber Processing Area” or TPA. The TPA for the North Central Washington CFLRP includes the two counties within the Study Area, as well as Lewis, Pierce, Skagit, Snohomish, Stevens, and Yakima counties in Washington; Umatilla and Union counties in Oregon; and Kootenai County in Idaho.

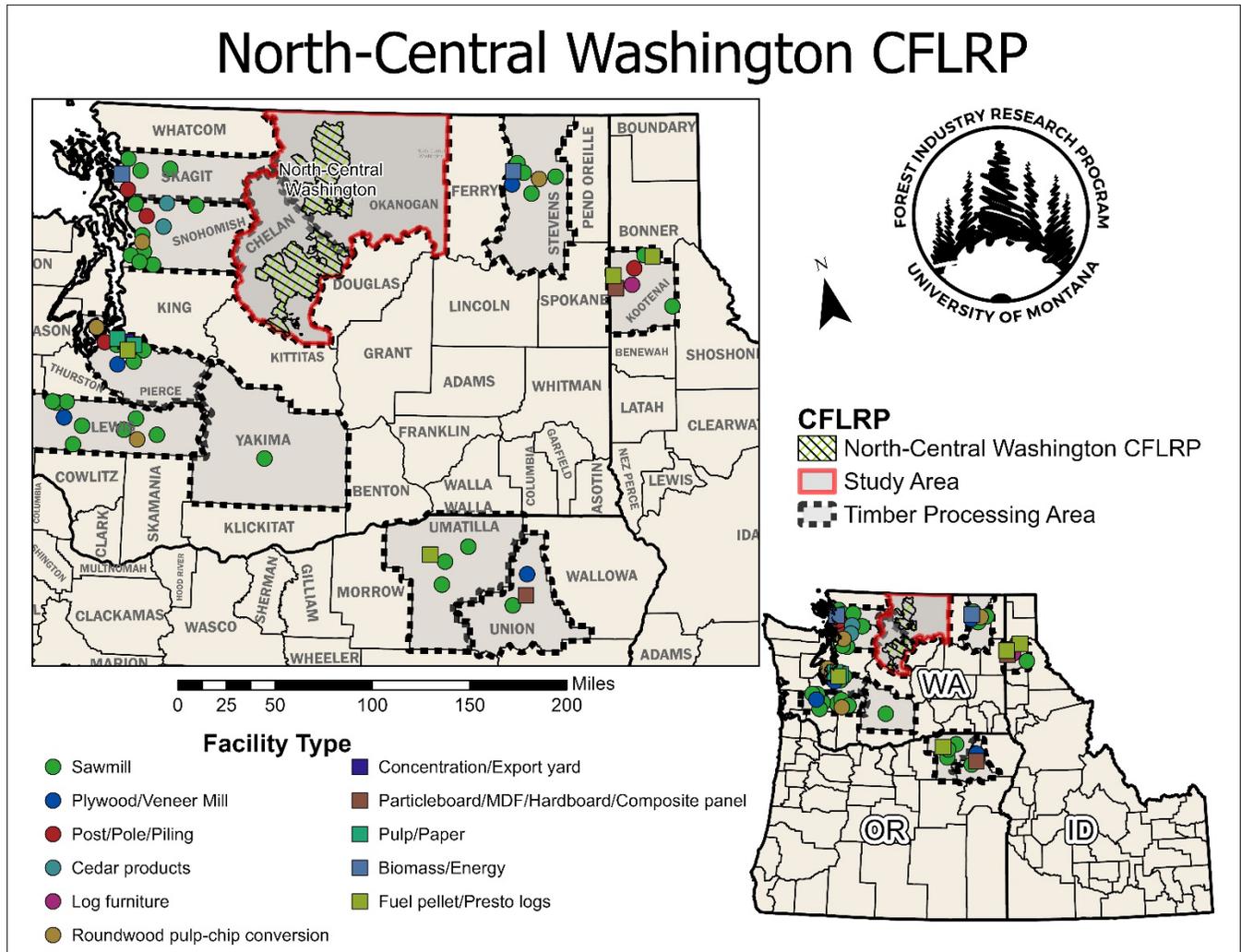
The data used to develop the information presented in this report were collected from timber-processing facilities by the University of Montana’s Forest Industry Research Program (FIRP) within the Bureau of Business and Economic Research. FIRP would like to thank the timber-processing facilities for their participation, without which, analyses such as this one would not be possible.

The 2020 data were collected and processed by FIRP under joint venture agreements with the USDA Forest Service’s Pacific Northwest Research Station as part of a periodic census of timber-processing facilities in Washington. Previous reports on Washington’s timber harvests and timber-processing industry were done by the Washington State Department of Natural Resources. The data in this report from 2018 was collected by Washington State Department of Natural Resources. In 2021 FIRP began conducting annual sampling of timber-processing facilities in Washington. Capacity and capability data for Oregon is from the 2022 periodic census and Idaho data is from the 2023 census.

FIRP makes every effort to identify and collect data from all commercial timber-processing facilities that buy logs and sell output products across the West. Hobbyists and timber processors that supply their own logs or saw for hire may not be included in FIRP’s database. If the reader identifies facilities in the TPA counties that are missing from this analysis, please let FIRP know.

Additional information from FIRP is available upon request; however, mill- or company-level data are confidential and will not be released.

Figure 1. The North Central Washington CFLRP, Study Area, Timber Processing Area, and facilities.



There are 59 timber processing facilities in the North Central Washington TPA, including 32 sawmills, 4 plywood/veneer mills, 4 roundwood pulp-chip conversion facilities, 4 post/pole/piling facilities, 4 fuel pellet/presto logs and briquette facilities, 2 biomass energy facilities, 2 particleboard/MDF/hardboard facilities, 2 pulp/paper facilities, 2 cedar products facilities, 1 log furniture facility, 1 tone wood facility, and 1 concentration/export yard (table 1).

**Table 1. North Central Washington TPA timber-processing facilities.**

Facility name	Facility type	State	County	Current Facility Status	Included in log-processing capacity analysis
Cascade Hardwood	Sawmill	WA	Lewis	Active	Yes
Alta Forest Product - Morton	Sawmill	WA	Lewis	Active	Yes
Hampton Lumber Mills - Morton	Sawmill	WA	Lewis	Active	Yes
Hampton Lumber Mills - Randle Division	Sawmill	WA	Lewis	Active	Yes
BUTTEVILLE LUMBER COMPANY	Sawmill	WA	Lewis	Active	Yes
NWH - Centralia	Sawmill	WA	Lewis	Active	Yes
Northwest Hardwood Mill - Centralia	Sawmill	WA	Lewis	Active	Yes
Reichert Shake & Fencing, Inc.	Sawmill	WA	Lewis	Inactive	Yes
SPI - Centralia	Sawmill	WA	Lewis	Active	Yes
Northwest Fiber	Roundwood pulp-chip conversion	WA	Lewis	Active	Yes
HardeI Mutual Plywood Co.	Plywood/veneer mill	WA	Lewis	Active	No
Manke Lumber Company - Sumner	Sawmill	WA	Pierce	Active	Yes
Manke Lumber Company - Tacoma	Sawmill	WA	Pierce	Active	Yes
Creative Inventory, LLC	Sawmill	WA	Pierce	Active	Yes
Edman Company	Roundwood pulp-chip conversion	WA	Pierce	Active	Yes
Sonoco Products Co.	Pulp/paper	WA	Pierce	Active	No
WestRock - Tacoma	Pulp/paper	WA	Pierce	Active	No
Stella-Jones - Tacoma	Post/pole/piling	WA	Pierce	Active	No
Rainier Veneer, Inc.	Plywood/veneer mill	WA	Pierce	Active	Yes
MLC - Wood Pellets Division	Fuel pellet/presto logs, briquettes	WA	Pierce	Active	No
Merrill and Ring Forest Products - Tacoma	Concentration/export yard	WA	Pierce	Active	No
Iron Mountain Sawmill	Sawmill	WA	Skagit	Active	No
SPI - Mt Vernon	Sawmill	WA	Skagit	Active	Yes
Bell Lumber & Pole - Longview	Post/pole/piling	WA	Skagit	Active	No
Pacific Rim Tonewoods	Other	WA	Skagit	New	No
SPI - Mount Vernon Cogen	Biomass/energy	WA	Skagit	Active	No
AJ's Custom Portable Saw Milling	Sawmill	WA	Snohomish	Active	No
Beck Mill Company	Sawmill	WA	Snohomish	Active	Yes
Buse Timber Sales	Sawmill	WA	Snohomish	Active	Yes
Canyon Lumber Company	Sawmill	WA	Snohomish	Active	Yes
Fritch Forest Products	Sawmill	WA	Snohomish	Active	Yes
Hampton Lumber Mills - Darrington Division	Sawmill	WA	Snohomish	Active	Yes
Smith Street Mill	Sawmill	WA	Snohomish	Active	Yes
Willis Enterprises - Everett	Roundwood pulp-chip conversion	WA	Snohomish	Active	Yes
Stella-Jones - Arlington	Post/pole/piling	WA	Snohomish	Active	Yes
Miller Shingle Co.	Cedar products	WA	Snohomish	Active	No
Deer Creek Cedar Products	Cedar products	WA	Snohomish	Active	Yes
Webley Lumber Company	Sawmill	WA	Stevens	Active	No
Boise Cascade - Kettle Falls lumber	Sawmill	WA	Stevens	Active	Yes
Boise Cascade - Arden Lumber Mill	Sawmill	WA	Stevens	Active	Yes
Vaagen Bros Lumber	Sawmill	WA	Stevens	Active	Yes
Vaagen Brothers Lumber - Colville Chipping	Roundwood pulp-chip conversion	WA	Stevens	Active	Yes
Boise Cascade - Kettle Falls Plywood	Plywood/veneer mill	WA	Stevens	Active	Yes
Kettle Falls Generating Station	Biomass/energy	WA	Stevens	Active	No
Yakama Forest Products	Sawmill	WA	Yakima	Active	Yes
Eastern Oregon Custom Milling	Sawmill	OR	Umatilla	Inactive	Yes
Woodgrain Millwork - Pilot Rock	Sawmill	OR	Umatilla	Active	Yes
Blue Mountain Lumber Products	Sawmill	OR	Umatilla	Active	Yes
Blue Mountain Lumber Products - Pellets	Fuel pellet/presto logs, briquettes	OR	Umatilla	Active	No
Woodgrain Millwork - La Grande	Sawmill	OR	Union	Active	Yes
Boise Cascade Elgin Plywood	Plywood/veneer mill	OR	Union	Active	Yes
Woodgrain - Particleboard	Particleboard/MDF/hardboard	OR	Union	Active	No
Idaho Forest Group - Chilco	Sawmill	ID	Kootenai	Active	Yes
Whiteman Lumber Company, Inc.	Sawmill	ID	Kootenai	Active	Yes
North Idaho Post and Pole	post/pole/piling	ID	Kootenai	Active	Yes
Plummer Forest Products	Particleboard/MDF/hardboard	ID	Kootenai	Active	No
North Idaho Log Furniture Co.	Log furniture	ID	Kootenai	Active	Yes
Lignetics, Inc.	Fuel pellet/presto logs, briquettes	ID	Kootenai	Active	No
North Idaho Energy Logs, Inc	Fuel pellet/presto logs, briquettes	ID	Kootenai	Active	No

## Timber harvest within the North Central Washington CFLRP Study Area

The total volume of timber harvested from the North Central Washington Study Area and processed into commercial products in 2020 was estimated at 129,750 CCF or 56,623 thousand board feet (MBF), Scribner with 81 percent of the harvest coming from Okanogan County. In 2018, 76 percent of the 102,290 CCF or 45,411 MBF, Scribner harvest was from Okanogan County.

**Table 2. Timber harvested in the North Central Washington Study Area, in thousand board feet, Scribner (MBF) and hundred cubic feet (CCF), 2018 and 2020.**

Study Area	2018			2020		
	MBF	CCF	Percent	MBF	CCF	Percent
Chelan	10,575	24,780	24%	10,945	25,199	19%
Okanogan	34,836	77,509	76%	45,678	104,551	81%
<b>Total</b>	<b>45,411</b>	<b>102,290</b>	<b>100%</b>	<b>56,623</b>	<b>129,750</b>	<b>100%</b>

The majority of timber harvested in the North Central Washington Study Area in 2018 and 2020 were saw logs, at 90 percent and 75 percent of the total harvest, respectively (table 3). Veneer logs made up 8 percent and 25 percent of the harvest, respectively. Pulpwood made up the remaining 2 percent of the harvest in 2018.

**Table 3. Timber harvested by timber product type in the North Central Washington Study Area, in thousand board feet, Scribner (MBF) and hundred cubic feet (CCF), 2018 and 2020.**

Product	2018			2020		
	MBF	CCF	Percent	MBF	CCF	Percent
Saw log	40,218	91,906	90%	42,039	97,082	75%
Veneer log	4,586	8,382	8%	14,584	32,668	25%
Pulpwood log	607	2,001	2%	-	-	0%
<b>Total</b>	<b>45,411</b>	<b>102,290</b>	<b>100%</b>	<b>56,623</b>	<b>129,750</b>	<b>100%</b>

Douglas-fir constituted the majority of timber harvested within the North Central Washington Study Area in 2020 at 61 percent, while ponderosa pine made up 18 percent of the harvest (table 4). In 2018, ponderosa pine made up the greatest portion of the harvest at 43 percent while Douglas-fir made up 29 percent. Western hemlock made up 17 percent of the harvest in 2020 and 26 percent in 2018.

**Table 4. Timber harvest by species in the North Central Washington Study Area, in thousand board feet, Scribner (MBF) and hundred cubic feet (CCF), 2018 and 2020.**

Species	2018			2020		
	MBF	CCF	Percent	MBF	CCF	Percent
White fir	-	-	0%	275	635	0%
Grand fir	-	-	0%	173	378	0%
Subalpine fir	-	-	0%	0	0	0%
Western larch	596	1,090	1%	1,944	4,359	3%
Engelmann spruce	-	-	0%	43	96	0%
Lodgepole pine	416	951	1%	81	184	0%
Western white pine	-	-	0%	0	0	0%
Ponderosa pine	19,009	43,525	43%	9,850	22,743	18%
Douglas-fir	13,839	30,102	29%	34,843	79,610	61%
Western redcedar	-	-	0%	0	0	0%
Western hemlock	11,550	26,622	26%	9,416	21,745	17%
<b>Total</b>	<b>45,411</b>	<b>102,290</b>	<b>100%</b>	<b>56,623</b>	<b>129,750</b>	<b>100%</b>

A large majority of the timber harvested in the North Central Washington Study Area in 2018 and 2020 was harvested on private and Tribal lands (table 5). Harvests on national forest lands made up 14 percent in 2018 and 25 percent in 2020.

**Table 5. Timber harvest by ownership in the North Central Washington Study Area, in thousand board feet, Scribner (MBF) and hundred cubic feet (CCF), 2018 and 2020.**

Ownership	2018			2020		
	MBF	CCF	Percent	MBF	CCF	Percent
Private and Tribal timberland	36,812	84,275	82%	41,548	95,212	73%
National forest	7,323	14,760	14%	14,133	32,362	25%
Other public	1,276	3,254	3%	942	2,176	2%
<b>Total</b>	<b>45,411</b>	<b>102,290</b>	<b>100%</b>	<b>56,623</b>	<b>129,750</b>	<b>100%</b>

Irey et al.

One hundred percent of timber harvested in the North Central Washington Study Area in 2018 was harvested live (table 6). In 2020, 9 percent of the saw timber was harvested dead.

**Table 6. Percentage of timber harvested live and dead in the North Central Washington Study Area, 2018 and 2020.**

Study Area	2018		2020	
	Live percent	Dead percent	Live percent	Dead percent
Sawlogs	100%	0%	91%	9%
Veneer log	100%	0%	100%	0%
Pulpwood log	100%	0%	0%	0%
<b>Volume-weighted average</b>	<b>100%</b>	<b>0%</b>	<b>93%</b>	<b>7%</b>

### Timber-processing within the North Central Washington Timber Processing Area

Of the total volume of timber processed by the facilities in the North Central Washington TPA in 2020, 53 percent was harvested within the TPA (table 7). Thirty-eight percent was harvested from other Washington counties.

**Table 7. Origin of timber processed within the North Central Washington TPA, in thousand board feet, Scribner (MBF) and hundred cubic feet (CCF); WA 2020, OR 2022, ID 2023.**

Origin of timber	Volume (MBF)	Volume (CCF)	Proportion of the total timber received
From TPA	764,564	1,831,452	53%
From other Washington counties	541,732	1,307,517	38%
From other states	135,959	310,738	9%
From British Columbia, CA	12,089	27,919	1%
<b>Total</b>	<b>1,454,343</b>	<b>3,477,626</b>	<b>100%</b>

#### *Timber-processing capacity and capability*

The purpose of this report is to provide the North Central Washington CFLRP and its stakeholders with information on 1) The current use of timber by primary wood-processing facilities in the vicinity of the North Central Washington CFLRP, and 2) The maximum amount of timber these facilities could economically use in their current configuration. This information is intended to help stakeholders understand the available milling capacity within the TPA.

The term “capacity” refers to the maximum total volume of timber that existing timber processors within the TPA could use annually, given firm market demand for products, sufficient raw material, and ordinary downtime for maintenance. Also known as “timber-processing capacity”, it is a measure of mills’ timber *input* capacity and is expressed in MBF, Scribner and CCF per year. Input capacity is a useful measure when attempting to express the capacity of multiple types of mills in a common unit of measure. It is estimated from production (output) capacity information provided by facilities. Estimates in this report include the capacity of active facilities as well as idle (inactive) facilities with equipment still in place. Facilities that are permanently closed are not included. This analysis focuses on facilities that exclusively use timber in round form, including sawmills and plywood mills, among others. Facilities that use a mix of roundwood and non-roundwood inputs, such as chips, sawdust, shavings, and bark (e.g., biomass facilities) are not included in this capacity analysis because the combination of

Irey et al.

roundwood and non-roundwood inputs can vary widely from year to year, potentially over- or under-estimating capacity and use of roundwood by substantial margins.

The term “capability” refers to the volume of trees of a certain size class (measured as diameter at breast height, or dbh) that existing timber processors can economically process annually. This report uses three dbh classes: <7”, 7 to 9.9”, and ≥10”. These size classes were chosen to focus analysis on the smallest log sizes that are merchantable in the western U.S. and that are often harvested in restoration treatments conducted on national forest lands. Some facilities are designed to operate using only trees of a given size class. Capability at these facilities is readily classified in just one of the size classes (e.g., plywood plants typically only use trees ≥10” dbh, and post manufacturers primarily use trees <10” dbh). Many facilities can and do use timber from a variety of size classes, especially sawmills, which often process logs that are larger than the smallest tree size they are capable of processing due to greater profitability. However, some mills that process larger logs are not capable of processing smaller-diameter timber due to the configuration of their equipment.

“Use” refers to the volume of timber, both in total and by tree dbh class, that facilities are currently processing.

#### *Annual processing capacity, capability, and utilization*

The estimated annual timber-processing capacity of facilities in the North Central Washington TPA was 4,619,969 CCF or 1,922,427 MBF, Scribner (table 8). Of this volume, 80 percent (3,678,296 CCF or 1,586,174 MBF, Scribner) was in the ≥10” dbh size class, 17 percent (796,319 CCF or 296,554 MBF, Scribner) was in the 7-9.9” dbh size class and 3 percent was in the <7” dbh size class. As such, a large majority of the North Central Washington TPA facilities timber-processing capacity is for larger logs and may not be able to process smaller ones, either due to their equipment or because such processing would have a profit margin too small to be economical.

**Table 8. Annual timber processing capacity and capability, by dbh size class, of facilities within the North Central Washington TPA, in thousand board feet, Scribner (MBF) and hundred cubic feet (CCF); WA 2020, OR 2022, ID 2023.**

<b>Tree dbh</b>	<b>Thousand board feet, Scribner (MBF)</b>	<b>Hundred cubic feet (CCF)</b>	<b>Percent</b>
<7 in.	39,699	145,354	3%
7 - 9.9 in.	296,554	796,319	17%
≥10 in.	1,586,174	3,678,296	80%
<b>Total capacity</b>	<b>1,922,427</b>	<b>4,619,969</b>	<b>100%</b>

Irey et al.

Timber-processing facilities in the North Central Washington TPA used 78 percent of their timber-processing capacity (table 9). The Lewis, Pierce, and Yakima county group has the largest annual capacity to process timber at 1,807,886 CCF or 758,010 MBF, Scribner. The Umatilla and Union county group has the least annual timber-processing capacity at 315,615 CCF or 138,271 MBF, Scribner.

**Table 9. Annual timber processing capacity and timber consumption by county group for facilities within the North Central Washington TPA, in thousand board feet, Scribner (MBF) and hundred cubic feet (CCF); WA 2020, OR 2022, ID 2023.**

<b>Timber Processing Area</b>	<b>-----Capacity to process timber-----</b>		<b>-----Actual timber consumption-----</b>		<b>Most recent utilization</b>
	<i>Thousand board feet, Scribner (MBF)</i>	<i>Hundred cubic feet (CCF)</i>	<i>Thousand board feet, Scribner (MBF)</i>	<i>Hundred cubic feet (CCF)</i>	
Lewis, Pierce, and Yakima counties, WA	758,010	1,807,886	660,397	1,568,735	87%
Kootenai County, ID and Stevens County, WA	510,399	1,267,419	419,056	997,484	79%
Skagit and Snohomish counties, WA	515,747	1,229,049	318,404	763,393	62%
Umatilla and Union counties, OR	138,271	315,615	115,625	263,895	84%
<b>North-Central Washington total</b>	<b>1,922,426</b>	<b>4,619,968</b>	<b>1,513,482</b>	<b>3,593,507</b>	<b>78%</b>

The Kootenai and Stevens county group is the only one in the North Central Washington TPA to have overused their reported capacity to process timber  $\geq 10''$  dbh, at 65,875 CCF (table 10). This is likely due to facilities substituting larger logs for smaller whenever they are available as larger logs are more economical to process. The Skagit and Snohomish county group has the largest unused capacity for timber  $\geq 10''$  dbh at 381,322 CCF.

**Table 10. Annual timber processing capability and unused capability by county group for facilities within the North Central Washington TPA, in hundred cubic feet (CCF); WA 2020, OR 2022, ID 2023.**

Timber Processing Area	Capability to process timber by dbh size class (CCF)			Unused capability to process timber by dbh size class (CCF)		
	<7" dbh	7-9.9" dbh	$\geq 10''$ dbh	<7" dbh	7-9.9" dbh	$\geq 10''$ dbh
Lewis, Pierce, and Yakima counties, WA	32,287	183,031	1,592,568	14,869	9,454	214,827
Kootenai County, ID and Stevens County, WA	93,375	428,420	745,623	72,325	263,484	(65,875)
Skagit and Snohomish counties, WA	19,686	141,564	1,067,800	9,185	75,150	381,322
Umatilla and Union counties, OR	6	43,304	272,305	6	28,384	23,331
<b>North-Central Washington total</b>	<b>145,354</b>	<b>796,319</b>	<b>3,678,296</b>	<b>96,384</b>	<b>376,472</b>	<b>553,604</b>

Timber use by facilities in the North Central Washington TPA in the  $\geq 10''$  dbh size class was at a rate 7.5 times greater than the rate of use of the 7-9.9" dbh size class (table 11). The facilities in the TPA used timber in the 7-9.9" dbh size class at a rate 8.5 times greater than the <7" dbh size class.

**Table 11. Timber use, by dbh size class, for facilities within the North Central Washington TPA, in thousand board feet, Scribner (MBF) and hundred cubic feet (CCF); WA 2020, OR 2022, ID 2023.**

Tree dbh	Thousand board feet, Scribner (MBF)	Hundred cubic feet (CCF)	Percent
<7 in.	11,067	48,970	1%
7 - 9.9 in.	147,548	419,848	12%
$\geq 10$ in.	1,354,867	3,124,690	87%
<b>Total timber use</b>	<b>1,513,482</b>	<b>3,593,507</b>	<b>100%</b>

There was 1,026,460 (408,944 MBF, Scribner) of unused timber processing capacity in the North Central Washington TPA, 54 percent of which was for trees  $\geq 10''$  dbh (table 12). The unused timber processing capacity in the 7-9.9" and <7" dbh size classes was 37 percent and 9 percent, respectively.

**Table 12. Unused timber processing capacity, by dbh size class, for facilities within the North Central Washington TPA, in thousand board feet, Scribner (MBF) and hundred cubic feet (CCF); WA 2020, OR 2022, ID 2023.**

Tree dbh	Thousand board feet, Scribner (MBF)	Hundred cubic feet (CCF)	Percent
<7 in.	28,632	96,384	9%
7 - 9.9 in.	149,006	376,472	37%
$\geq 10$ in.	231,307	553,604	54%
<b>Total unused timber-processing capacity</b>	<b>408,944</b>	<b>1,026,460</b>	<b>100%</b>

## Discussion

The capacity utilization levels presented in this report indicate that the forest products industry in the North Central Washington TPA has capacity available to process an increased yield of timber resulting from mechanized

Irey et al.

fuels reduction (table 12). However, the size and quality of timber available, as well as prevailing market prices and the availability of qualified labor, also affect the level of capacity at which primary processors are able to operate and in what size class(es) capability is concentrated. Fuels reduction treatments frequently involve the harvesting of smaller-diameter timber, the profitability of which diminishes as tree diameter decreases (Stewart et al. 2004). Harvesting salvage (standing dead) timber can become similarly unprofitable, especially if logs are less than 10" dbh, due to the lower grade recovery for these logs (Fahey et al. 1986).

While some operators have configurations capable of accommodating the processing of large and small logs, not all processors are able to do so. Processing a greater volume of logs from smaller trees, that typically yield lower recovery, could reduce profit margins to the point of a mill becoming unprofitable, especially in a weak lumber market.

Irey et al.

## Sources

Fahey, Thomas D.; Snellgrove, Thomas A.; Plank, Marlin E. 1986. "Changes in Product Recovery Between Live and Dead Lodgepole Pine: A Compendium." Research Paper PNW-RP-353. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Rangeland Experiment Station. 32p.

Okanogan-Wenatchee National Forest. 2020. North Central Washington CFLRP: Reducing risk and increasing resilience in Washington's East Cascades.

Stewart, Hayden G.; Blatner, Keith A.; Wagner, Francis G.; Keegan, Charles E. 2004. "Risk and feasibility of processing small-diameter material in the U.S. West, Part I: Structural lumber." *Forest Products Journal* 54(12): 97-103.