



**FOREST INDUSTRY
RESEARCH PROGRAM**
UNIVERSITY OF MONTANA

Timber Use, Processing Capacity and Capability of Mills to Utilize Timber by Diameter Size Class Within the Helena-Lewis & Clark National Forest Timber-Processing Area

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Introduction

The state of Montana and the U.S. Forest Service have increased investments in forest health, hazardous fuels mitigation and safety protection on private and public lands through former Governor Bullock’s Forests in Focus investments and more recently through the Shared Stewardship Initiative launched by the USDA Forest Service. These treatments, designed to restore ecological condition and function and reduce fire hazard, often require the removal of a mix of timber valuable enough to offset some of the costs along with smaller trees with limited value and markets (Wagner et al. 2000).

The loss of milling infrastructure throughout the West during the 1990s and 2000s, combined with changing management objectives on federal lands, has raised questions about the industry’s ability to purchase and use timber of varying sizes and quality at a rate adequate for forest management goals and economically sustainable for the industry (Keegan et al. 2005; Keegan et al. 2006). Recent investments by Congress to treat millions of acres in the western United States to reduce wildfire risk to communities has made accurate information on timber milling capacity and the capability of mills to handle timber of various sizes an important consideration for managers (USDA Forest Service, 2022).

Goals and Objectives

This report was prepared by the Forest Industry Research Program at the University of Montana’s Bureau of Business and Economic Research (BBER) as a forest planning and project-level support document for the Helena-Lewis & Clark National Forest (hereinafter Helena-Lewis & Clark NF) and seeks to:

1. examine the harvest of timber from the counties containing Helena-Lewis & Clark NF timberland – the “study area”;
2. analyze the timber flow and identify the Helena-Lewis & Clark NF “timber-processing area” – the counties containing facilities that received timber harvested from the study area; and

3. describe the number and types of facilities and quantify their total capacity to process timber, their capability to use timber of various sizes, and their capacity utilization rates. The study focuses on facilities that exclusively use timber in round form (i.e., logs). Facilities that use only mill residuals (e.g., sawdust or chips) are not included.

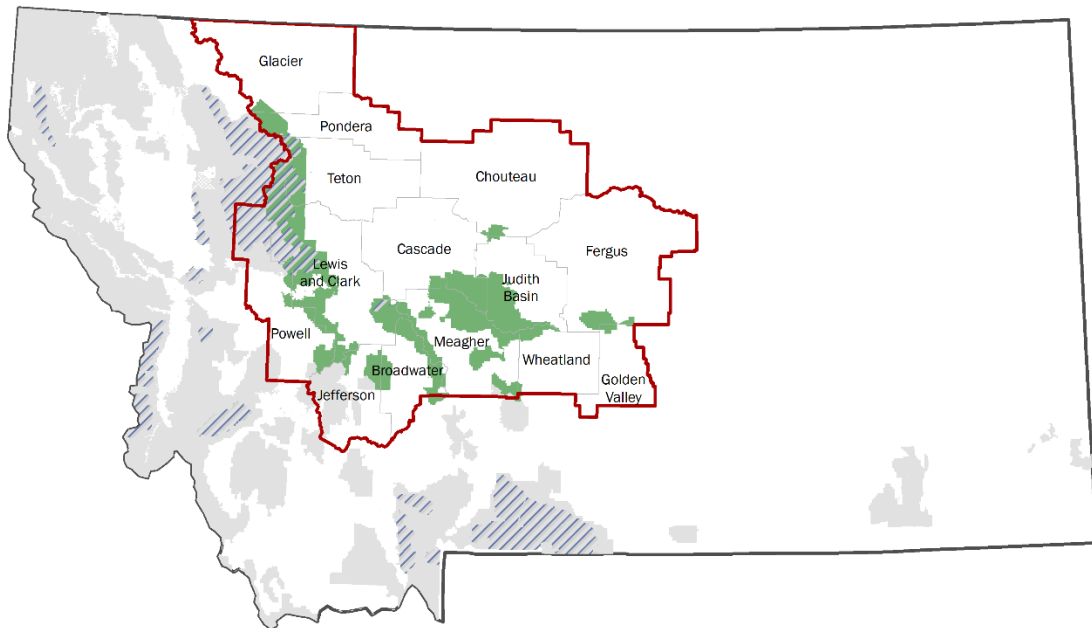


Figure 1 – Helena-Lewis & Clark National Forest and study area.

Helena-Lewis & Clark National Forest Study Area

The Helena-Lewis & Clark NF study area is situated in the northcentral region of Montana, spreading over fourteen counties: Broadwater, Cascade, Chouteau, Fergus, Glacier, Golden Valley, Jefferson, Judith Basin, Lewis and Clark, Meagher, Pondera, Powell, Teton and Wheatland (figure 1). The resulting study area contains approximately 4.4 million acres of timberland (USDA 2021), of which 58 percent (2.6 million acres) is managed by the USDA Forest Service (table 1).

Table 1 – Acres of timberland¹ by county and ownership in the Helena-Lewis & Clark NF Study Area.

County	National Forest	Private	Bureau of Land Management	State	County or Municipal	Total
Broadwater	136,260	44,543	13,036	-	-	193,839
Cascade	168,482	110,989	19,270	13,840	-	312,581
Choteau	16,024	32,271	10,197	1,457	-	59,949
Fergus	78,837	217,676	86,264	12,197	-	394,974
Glacier	29,465	77,262	-	-	-	106,727
Golden Valley	21,886	29,182	5,836	-	-	56,904
Jefferson	380,095	137,133	43,755	6,316	-	567,299
Judith Basin	211,716	17,612	-	-	-	229,328
Lewis and Clark	466,910	277,420	68,046	33,984	3,266	849,626
Meagher	431,621	161,774	6,756	4,664	-	604,815
Pondera	116,584	14,419	-	-	-	131,003
Powell	374,730	178,363	80,624	60,042	-	693,759
Teton	92,991	10,614	13,044	-	-	116,649
Wheatland	37,058	21,617	-	7,720	-	66,395
Grand Total	2,562,659	1,330,875	346,828	140,220	3,266	4,383,848

¹Timberland: Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. (Note: Areas qualifying as timberland are capable of producing at least 20 cubic feet per acre per year of industrial wood in natural stands. Currently inaccessible and inoperable areas are included.)

Source: USDA Forest Service, Forest Inventory and Analysis Program, Tue Jan 29 20:47:43 GMT 2019. Forest Inventory EVALIDator web-application Version 1.8.0.00. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Research Station. [Available only on internet: <http://fsxopsx1056.fdc.fs.usda.gov:9001/EvalIdator/evalIdator.jsp>].

The total volume of timber harvested and utilized from all ownerships in the study area was estimated at 168,204 CCF (57,374 MBF) in 2018 (table 2). National forests contributed 43 percent (72,475 CCF) of the timber harvested in the study area's fourteen counties. Of the other ownerships contributing to the study area's timber harvest, private and tribal timberlands accounted for 46 percent (76,837 CCF), the Bureau of Land Management and other public sources accounted for 5 percent (8,508 CCF) and state lands contributed 6 percent (10,384 CCF). Timber from the Helena-Lewis & Clark NF accounted for 19 percent of the National Forest timber harvested from the study area, with moderate volumes from surrounding national forests making up the balance (Hayes et al. 2021). The species composition of the timber harvested in the study area was heavily weighted to Douglas-fir (46 percent), followed by lodgepole pine (22 percent), ponderosa pine (10 percent), Engelmann spruce (9 percent), Grand fir (7 percent), western larch (4 percent), and smaller volumes of white fir and western hemlock (Hayes et al., 2021).

Table 2 – Timber harvest by county and ownership in the Helena-Lewis & Clark NF study area, 2018^a.

County	National Forest	Private & Tribal	State	BLM and Other Public	Grand Total
----- <i>Hundred cubic feet (CCF)</i> -----					
Broadwater	313	285	383	-	981
Cascade	501	238	-	-	739
Fergus	-	15,131	13	-	15,144
Glacier	-	13	-	-	13
Jefferson	7,823	2,784	-	-	10,607
Judith Basin	1,253	2,461	-	-	3,714
Lewis and Clark	14,754	10,043	1,113	1,945	27,855
Meagher	9,767	31,753	-	2,927	44,447
Powell	38,064	14,129	8,875	3,636	64,704
Grand Total	72,475	76,837	10,384	8,508	168,204

Source: Hayes et al. 2021

^aOnly counties reporting harvest volume included in table.

Helena-Lewis & Clark National Forest Timber-Processing Area

Timber Flow Trends – Into Study Area

Facilities in the study area received 136,561 CCF (54,236 MBF), making the area a net exporter of timber. Of the timber received and processed by mills, 54 percent (74,089 CCF) came from national forest timberlands in Montana and neighboring states, with the Helena-Lewis & Clark NF providing 19,422 CCF (14 percent of total receipts). Private (industrial and non-industrial) and tribal timberlands provided 36 percent (48,482 CCF) and state timberlands supplied 1 percent (1,629 CCF). The Bureau of Land Management provided 9 percent (12,361 CCF) of timber received by mills in the study area.

Timber Flow Trends – Out of Study Area

Of the 168,204 CCF (64,979 MBF) of timber harvested in the Helena-Lewis & Clark NF study area in 2018, approximately 9 percent (15,063 CCF) was processed in the county of harvest, and 34 percent (57,227 CCF) was processed elsewhere within the study area (table 3, figure 2). The remaining 57 percent of the harvest was processed elsewhere in Montana.

Table 3 - Timber flow from the Helena-Lewis & Clark NF Study Area, 2018^a.

County of harvest	Processed within the county of harvest	Processed elsewhere within study area	Processed outside study area
	<i>----- percentage of harvest by county -----</i>		
Broadwater	26	47	27
Cascade	0	45	55
Fergus	1	18	81
Glacier	0	0	100
Jefferson	4	71	25
Judith Basin	0	50	50
Lewis and Clark	2	57	41
Meagher	0	62	38
Powell	21	1	78
Grand Total	9	34	57

Source: Hayes et al. 2021

^aOnly counties reporting harvest volume included in table.

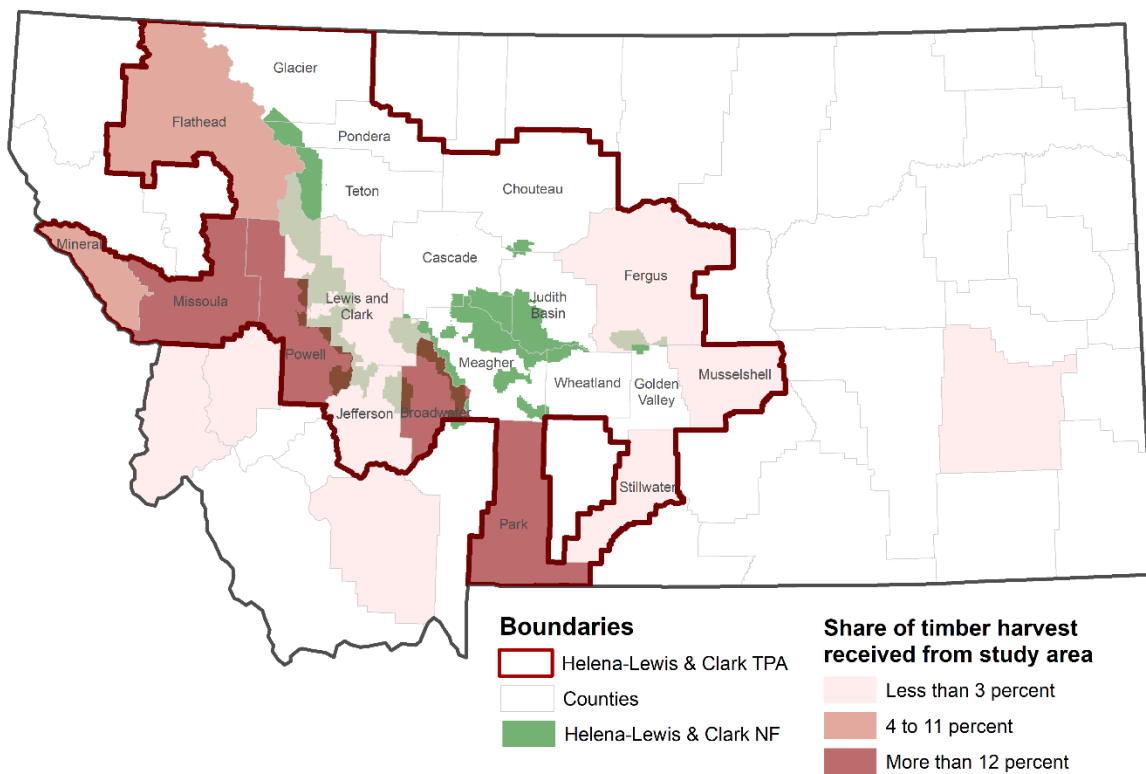


Figure 2 – Counties receiving timber from the Helena-Lewis & Clark National Forest study area and resulting Timber-Processing Area.

Based on analysis of the above timber flow trends, 19 counties were identified as encompassing the Helena-Lewis & Clark NF TPA. In addition to the fourteen Montana counties in the study area, five other counties in Montana contained mills that received a sufficient volume of timber from the study area to be included in the TPA (figure 2). A total of 37 primary wood products facilities operate within the TPA, of which 19 received timber from the Helena-Lewis & Clark study area and 17 were active as of 2021 (table 4). A list of all mills located within the TPA regardless of whether they received and processed timber from the Helena-Lewis & Clark NF study area is included in Appendix B.

Table 4 – Active timber-processing facilities in the Helena-Lewis and Clark NF timber-processing area, 2022

Type	2022
Sawmill and plywood	12
Post or pole	2
Log home/house log	1
Log furniture	1
Roundwood chipping	1
Total	17

Hayes et al. 2021

Timber-Processing Capacity, Capability, and Utilization

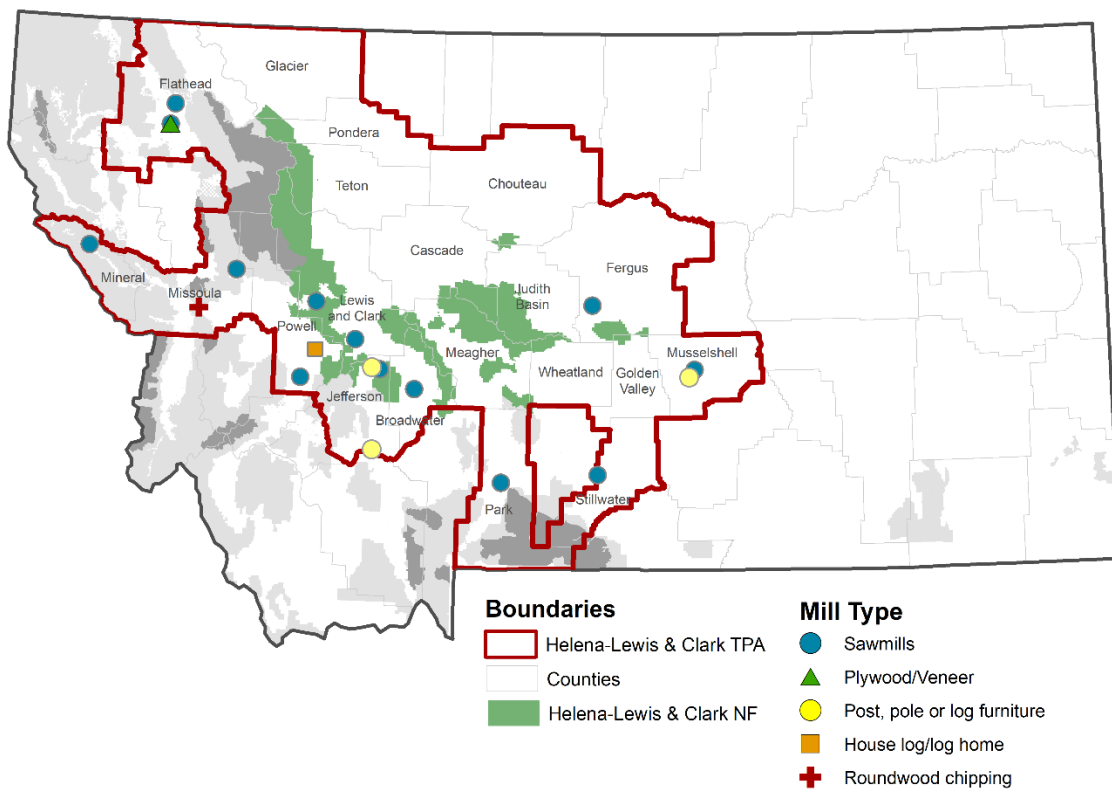


Figure 3 – Location and type of timber-processing facilities receiving timber from the Helena-Lewis & Clark NF study area in 2018.

Capacity to process timber in the Helena-Lewis & Clark NF TPA during 2021 was estimated at 1,145,206 CCF (453,799 MBF) and includes the capacity of two mills that have

ceased operations since 2018: R-Y Timber sawmill in Townsend, MT and the Idaho Forest Group mill in St. Regis (table 5; figures 3 and 4). Timber-processing capacity within the study area represented 20 percent of the total capacity in the TPA. More than 57 percent (653,163 CCF or 272,996 MBF) of timber-processing capacity in the Helena-Lewis & Clark NF TPA is not capable of efficiently utilizing trees less than 10 inches dbh. Capability to efficiently utilize trees 7 to 9.9 inches dbh accounted for 32 percent of total timber-processing capacity, while slightly more than 11 percent of capacity in the TPA could efficiently utilize trees less than 7 inches dbh.

Table 5 – Annual capacity and capability of mills to process trees by size class in the Helena-Lewis and Clark NF TPA, 2021^a

<i>Hundred cubic feet (CCF)</i>		<i>Thousand board feet, Scribner (MBF)</i>	
Tree dbh	Capability	Tree dbh	Capability
< 7 in.	129,793	< 7 in.	29,899
7 - 9.9 in.	362,250	7 - 9.9 in.	150,904
≥ 10 in.	653,163	≥ 10 in.	272,996
Total capacity	1,145,206	Total capacity	453,799

Source: Hayes et al. 2021

^aIncludes capacity of mills closed since 2018

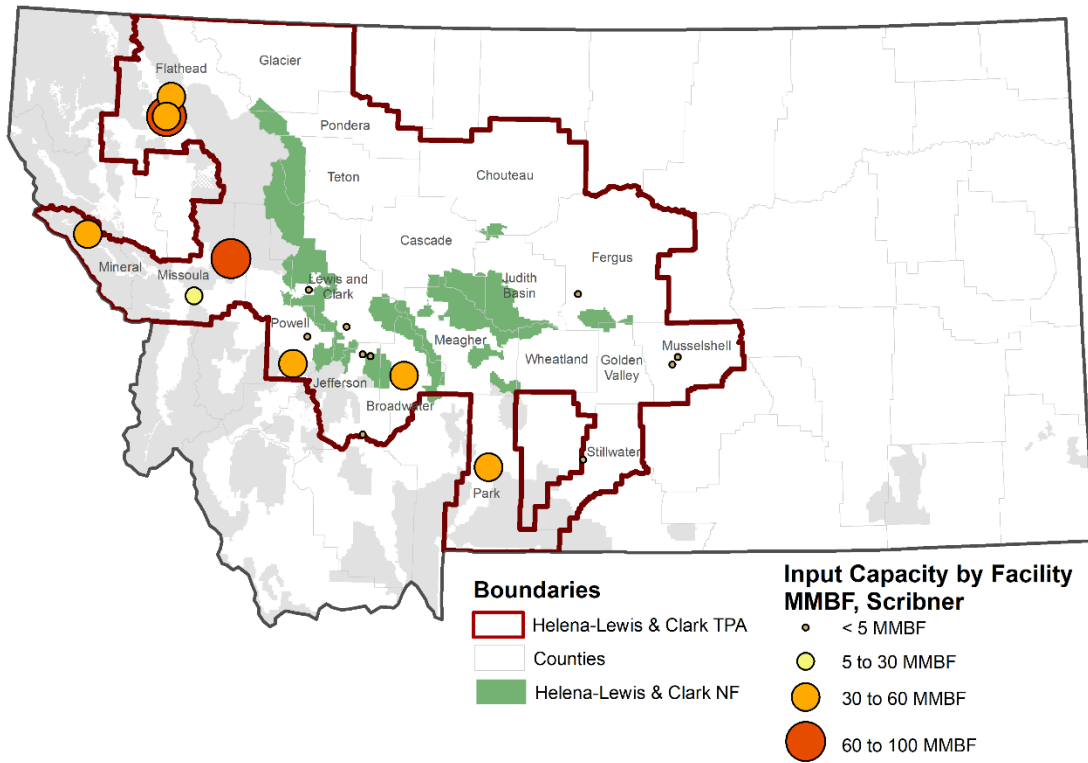


Figure 4 – Capacity of mills receiving timber from the Helena-Lewis & Clark NF study area (includes inactive mills).

Mills in the TPA processed 567,849 CCF (224,866 MBF) of timber in 2018 – the last year that a full census was conducted. After accounting for mill closures, mills in the TPA were estimated to use approximately 50 percent of total 2021 capacity (on a cubic foot basis). Trees with a dbh 10 inches or greater comprised 59 percent of the estimated annual volume processed in the TPA, while 38 percent came from trees 7-9.9 dbh, and three percent was made up of trees less than 7 inches dbh (table 6). Comparing 2018 utilization trends to 2021 capacity, unused capability was concentrated in the smallest size class (<7 inches dbh) on a percentage basis. A moderate proportion of total capability was utilized in the 7 to 9.9 inch dbh and greater

than 10 inch size classes (59 and 51 percent, respectively). However, on a volume basis, unutilized capacity was concentrated in the largest size class (318,290 CCF).

Table 6 – Annual volume of timber processed by tree size class for the Helena-Lewis and Clark NF TPA, 2021a.

<i>Hundred cubic feet (CCF)</i>		<i>Thousand board feet, Scribner (MBF)</i>	
Tree dbh	Volume used	Tree dbh	Volume used
< 7 in.	17,603	< 7 in.	4,560
7 - 9.9 in.	215,373	7 - 9.9 in.	83,176
≥ 10 in.	334,873	≥ 10 in.	137,130
Total processed	567,849	Total processed	224,866

Source: Hayes et al. 2021

^aAdjusted to reflect mill closures since 2018

Discussion

The capacity and capability information used in this report represent mills that received timber from the study area’s fourteen counties and characterizes market dynamics in 2018 with some updates to industry capacity changes through 2021. The steep rise and decline in finished wood product prices that took place in 2020 and 2021 combined with the focus on post-fire salvage harvest in 2018 and 2019 may have changed the ability of some mills to draw timber from more distant locations, potentially impacting the size and overall capacity of the Helena-Lewis & Clark TPA. The authors estimate that in 2018, 27,200 CCF of additional timber-processing capacity existed among mills in the TPA counties that did not receive timber from the study area in 2018. Most of these mills were small sawmills, post and small pole, log furniture and log home manufacturers that either do not consume large quantities of timber or rely upon timber with specific size and species characteristics. Nearly all of the TPA mills that did not receive timber from the study area were located outside the study area. A list of all mills located in the TPA regardless of whether they received and processed timber from the Helena-Lewis & Clark NF study area is included in Appendix B.

Spatial distribution of capacity

As demonstrated in Figure 5, the spatial distribution of capacity varied significantly by size class. Capability is closely tied to characteristics of specific products and the configuration of sawmills. Capability to process trees in the smallest size class was concentrated in counties

with roundwood chipping, log furniture and post and small pole facilities. Capability in the 7 to 10-inch dbh category was distributed across multiple counties containing sawmills producing stud-sized lumber for commodity markets. Remaining capability not able to process trees <10 inches dbh was largely concentrated in house log facilities, plywood manufacturers and random length sawmills. It is worth reiterating that capability estimates represent the maximum volume of timber in the smallest size class that a facility can process economically, and does not necessarily preclude utilization of larger trees.

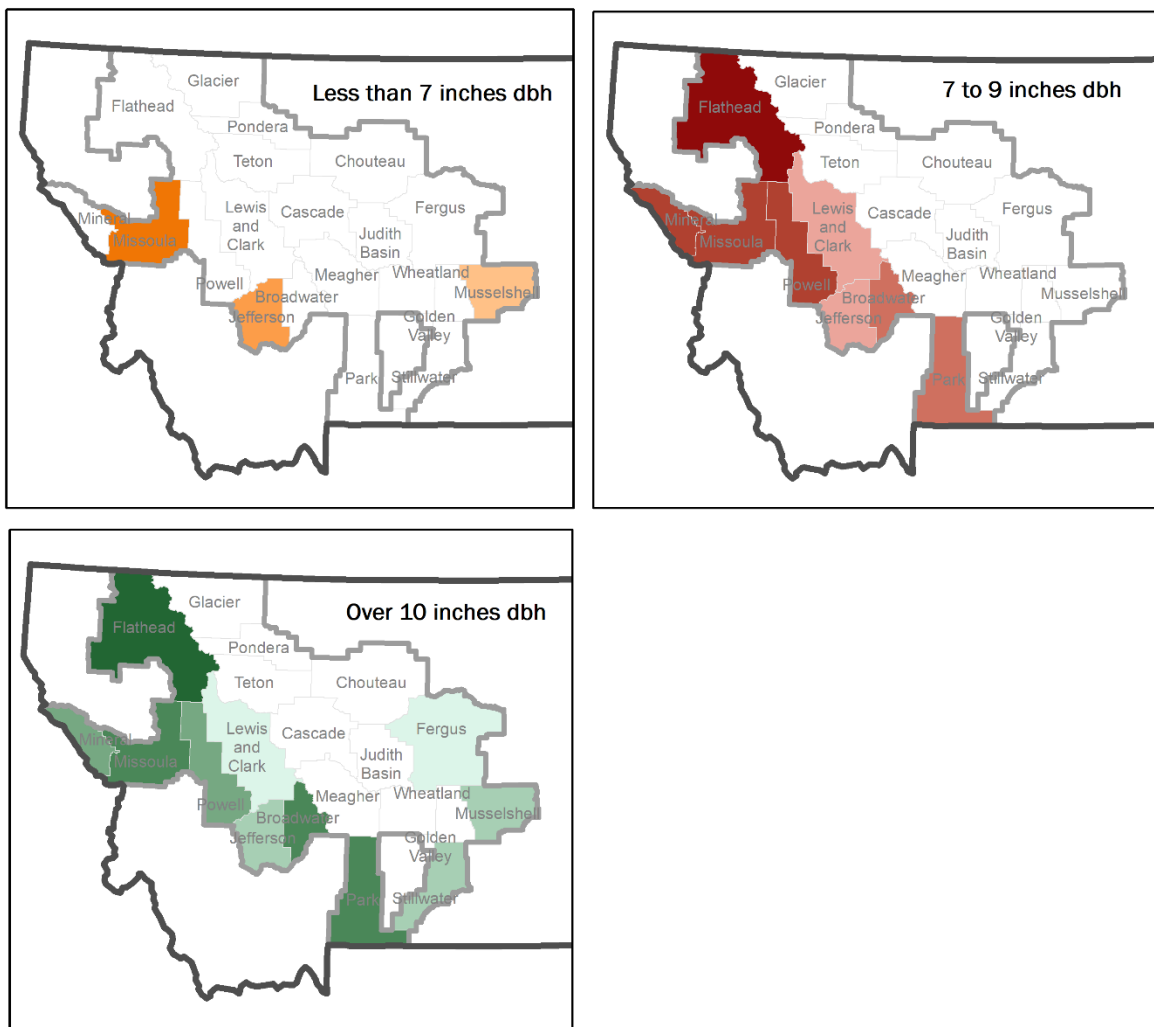


Figure 5 – Capability to process logs by size class among mills receiving timber from the Helena-Lewis & Clark NF study area (darker colors = greater capacity).

A moderate amount of the capability to use smaller diameter trees was being used to process larger trees or going unused. Slightly more than 3 percent of capability in the less than 7-inch dbh category was utilized to process trees less than 7-inch dbh, while nearly 38 percent of capability in the 7 to 9.9-inch dbh category was being used to process trees 7 to 9.9-inch dbh. Overall, mills receiving timber from the study area exhibited unused capability in all three size classes during 2018 (figure 6). However, there was also evidence that some mills took in more timber in a size class than was *economical* for them to process. For example, mills in Park and Musselshell Counties took in more than 400 CCF in timber in the 7 to 10-inch dbh class than they were estimated to efficiently and economically process. Jefferson and Lewis and Clark counties substituted larger (>10 inch) timber for timber in smaller size classes, perhaps owing to the higher than average volume of salvage harvest occurring in the region during 2018.

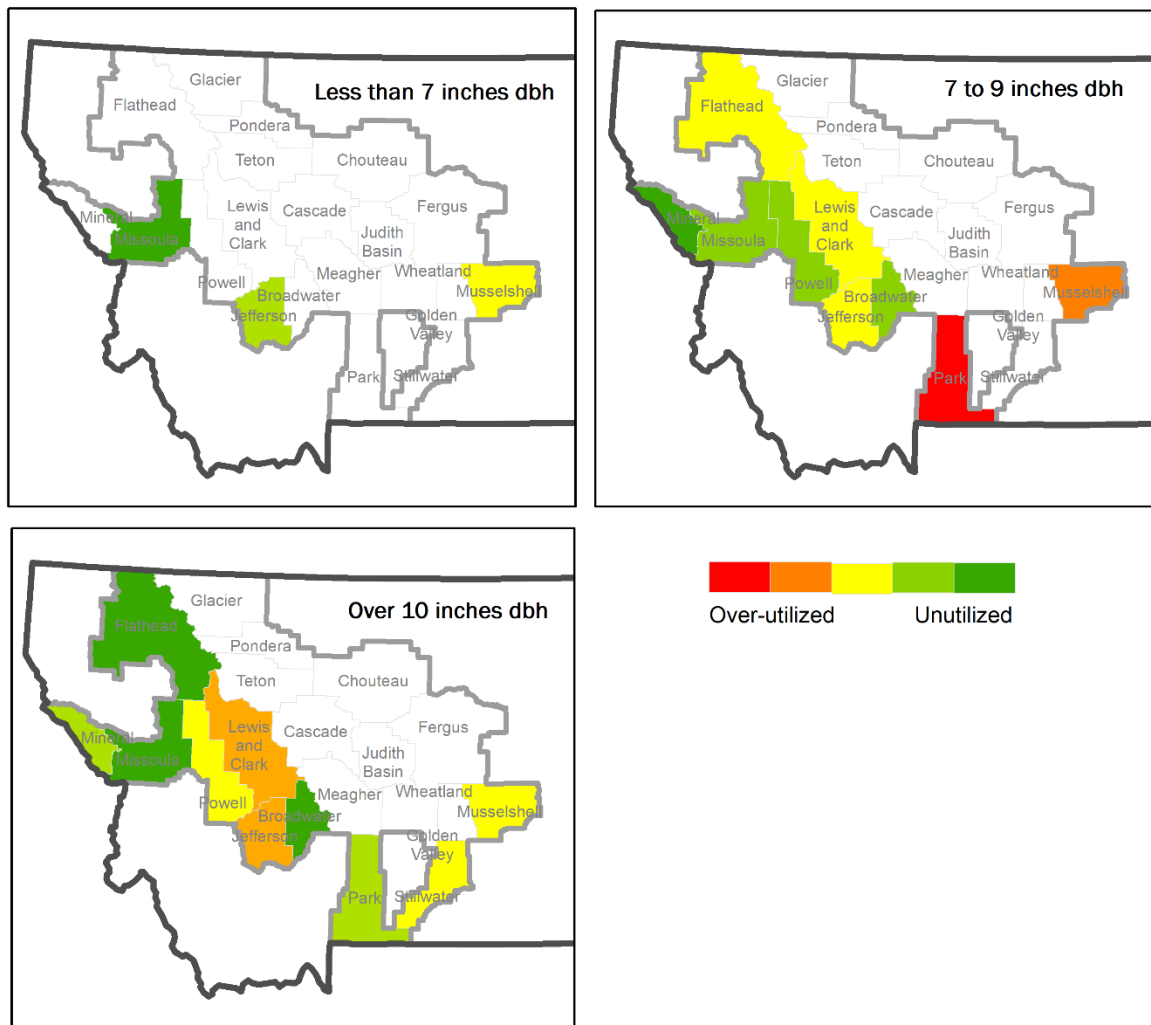


Figure 6—Unused capacity among active mills receiving timber from the study area by size class and county.

Capability to process trees less than 7 inches dbh tends to be concentrated among facilities that produce pulp chips, studs, posts and small poles. Generally, it is less capital intensive (i.e. less expensive) to increase chipping or post and pole capacity than to re-fit a larger sawmill to process smaller diameter logs into lumber. However, demand for roundwood pulpwood tends to move counter-cyclically with demand for lumber since roundwood chips are a substitute for mill residues as a raw material input for pulp and paper mills. Thus, when demand for lumber is strong, increased lumber production at sawmills leads to increased

availability of mill residue; while roundwood chipping facilities may increase production when lumber demand is weak because less sawmill residue is being generated.

Finally, many of the facilities throughout the Northern Region are included in the timber processing areas of more than one National Forest. Therefore, the sum of the capacity and capability of all the individual National Forests is greater than the total for the region. The region-wide report (forthcoming) provides information on total capacity and capability for the entire region. We encourage coordination at the Regional, Forest, and even the district level among timber planning staff to share information about prospective projects and potential buyers to prevent offering more timber, particularly in the smaller size classes, than can be processed.

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APPENDIX A - Data Sources, Definitions and Methods

Data Sources

Information in this report is primarily generated through a statewide periodic census of manufacturers of primary forest products. The census is conducted through a cooperative agreement between the BBER and the USDA Forest Service, Interior West Forest Inventory and Analysis (FIA) program. This analysis is based primarily on 2018 mill survey data for Montana with supporting data from the 2019 Idaho mill survey (FIDACS; Hayes et al. 2021; Simmons et al. in prep). When 2018 data for a mill were not available, prior 2014 or 2010 data were used as a baseline and adjusted to reflect 2018 harvest and market conditions. Mill survey data from Hayes et al. (2021), Simmons et al. (in prep), USFS Cut and Sold reports (USFS 2018), annual timber product output (TPO) data (2019, 2020) collected by BBER on behalf of FIA, and conversations with mill owners were used to characterize timber harvest and timber capacity and consumption by mills. These sources were supplemented by literature from peer-reviewed journals when appropriate.

Study Area

The study area for a national forest is defined as all counties that contain timberland within that national forest. Timberland is defined by FIA as producing or capable of producing at least 20 cubic feet per acre per year (USDA Forest Service). Reserved lands are excluded from calculation of the study area because they are statutorily exempt from timber harvesting activity. Non-forested lands are also excluded from this calculation because they also do not have the capability to produce timber. Once defined, the study area is analyzed to understand harvest and utilization trends for timber originating from all ownerships in order to understand national forest harvest trends in context and to characterize the broader market for timber in the area.

Timber-processing Area

A national forest's timber-processing area (TPA), or area of influence, establishes the geographic region and wood product manufacturers that *potentially* influence and are

influenced by timber harvested from that forest by analyzing the flow of timber from all ownerships within the study area. Counties containing mills that received and processed timber from the study area during 2018 were identified from mill surveys and included in the timber-processing area, unless the volume received are very small. Mills receiving timber from the study area during 2019 or 2020 were also included if they were located in an adjacent county.

The list of mills receiving timber from the study area that are located within the TPA are identified and compiled in order to characterize the capacity and capability of manufacturers in the TPA to process timber in total, and by tree size class. Only mills receiving timber from the study area were included in this analysis in order to best represent 2018/2019 market conditions and supply chain differences between sectors. A mill's procurement distance is determined by multiple factors including finished good market demand, competition, the value-added nature of a product and the total volume of timber consumed annually. For example, log homes are a high-value product that require high quality raw material of a certain size, enabling manufacturers to procure timber from longer distances, including Canada. Log furniture manufacturers produce medium to high value products but use a very small volume of timber and therefore are less likely to draw timber from long distances. In many cases, these differences will explain why some mills are not included in a national forest's TPA even though they reside within a TPA county.

Timber-processing capacity

In this report, "capacity" refers to the total volume of timber (a.k.a., roundwood or logs) that timber processors could utilize annually. Also known as "timber-processing capacity", it is a measure of input capacity and is expressed in board feet Scribner or cubic feet. Input capacity is a useful measure when attempting to express the capacity of multiple types of mills in a common unit of measure. Since finished products (mill outputs and output capacity) are measured in a variety of units: board feet lumber tally for lumber, lineal feet for house logs, and pieces for posts, small poles, and log furniture, input capacity provides for direct comparisons between mill types. Input or timber-processing capacity is a measure of the volume of logs that a facility can process in a given year given firm market demand, sufficient raw material, and usual downtime for maintenance. Estimates in this report include the capacity of facilities that

use timber in round form; this includes sawmills and facilities processing timber into plywood or veneer, house logs, log homes, posts, poles, log furniture, firewood, clean/pulp chips, and biomass energy.

Timber-processing capability

In contrast to timber-processing capacity, “capability” refers to the volume of trees of a certain size class (measured as tree diameter at breast height – dbh) that timber processors can efficiently process annually. Most facilities are designed to operate using trees of a given size class. For example, log home manufacturers typically use trees ≥ 10 inches dbh, and post manufacturers primarily use trees < 8 inches dbh. Capability at these facilities is readily classified in a single size class. This is true for some sawmills, but sawmills can vary greatly in equipment, configuration, product output, and ability to process timber of various sizes (Wagner et al. 1998, 2000; Keegan et al. 2005, 2006; Stewart et al. 2004).

Sawmills often process trees that are larger than the smallest tree sizes they are capable of processing. In other words, most mills capable of processing trees 7 to 9.9-inches dbh are also capable of, and prefer, processing trees greater than 10-inches dbh, thus these mills tend to process substantially more of the larger trees. However, some mills that process larger trees are not capable of processing smaller-diameter trees. For this reason, this report presents capability to process trees greater than 10-inches dbh as the proportion of total capacity *not* capable of efficiently using trees less than 10-inches dbh. Whereas, capability to process trees less than 7-inches dbh and 7 to 9.9-inches dbh are presented as maximum volumes of trees of these size classes that can be processed efficiently.

Assigning capacity and capability at the mill level

For each mill in the TPA that received timber from the study area, an estimate of the mill’s capability to process timber of a given size was made based on literature (Wagner et al. 1998, 2000; Keegan et al. 2005, 2006; Stewart et al. 2004), conversations with mill owners and the most recent BBER mill census data, which aim to take into consideration the financial feasibility and physical characteristics of the mill. For this report, three tree size classes were used: less than 7-inches dbh, 7 to 9.9-inches dbh, and 10 inches dbh or greater. BBER

researchers first assigned capability to efficiently process timber in the less than 7-inch and 7 to 9.9-inch dbh classes. Capability to process trees 10 inches dbh or greater was then calculated as the remaining proportion of total capacity *not* capable of efficiently using trees less than 10 inches dbh. Total timber-processing capacity and capability by dbh class are presented in both hundred cubic feet (CCF) and thousand board feet Scribner (MBF) to facilitate discussion among national forest managers, timber purchasers, and wood products facility operators.

APPENDIX B – Wood Products Facilities

Table B1. Wood products facilities located within the Helena-Lewis & Clark National Forest TPA counties (includes facilities that did not receive timber from the study area).

Mill Name	Mill Type	County	State
B&J Sawmill	Sawmill	Stillwater	MT
Bad Goat	Sawmill	Missoula	MT
Big Sky Forest Products	Post or pole	Mineral	MT
Cascade Log Homes of Montana	House log/log home	Cascade	MT
Conkle's Custom Cuts	Sawmill	Flathead	MT
Evergreen Wood Products	Sawmill	Fergus	MT
F H Stoltze Land & Lumber Co	Sawmill	Flathead	MT
Frontier Log Furniture	Log furniture	Flathead	MT
Gebhardt Post & Lumber--Post/Pole	Post or pole	Musselshell	MT
Gebhardt Post & Lumber--Sawmill	Sawmill	Musselshell	MT
Glacier Log Mill / Lazarus Log Homes (House log)	House log/log home	Flathead	MT
Glacier Log Mill / Lazarus Log Homes (Post/pole)	Post or pole	Flathead	MT
Hideaway Log Homes	House log/log home	Flathead	MT
Huckaba Custom Designs	Log furniture	Jefferson	MT
Idaho Forest Group, LLC. - ST Regis Mill	Sawmill	Mineral	MT
Kalispell Montana Log Homes, Inc.	House log/log home	Flathead	MT
L & L Custom Sawing	Sawmill	Lewis and Clark	MT
Log Homes Handcrafted	House log/log home	Missoula	MT
Marks Lumber	Sawmill	Jefferson	MT
Marks-Miller Post & Pole Inc	Post or pole	Jefferson	MT
Montana Timberline Firewood Co.	Firewood	Flathead	MT
Mountain View Log Homes--Condon	House log/log home	Missoula	MT
Myrstol Post and Pole	Post or pole	Park	MT
Nordique Systems Log Homes	House log/log home	Missoula	MT
North Country Log Works	House log/log home	Flathead	MT
Old Style Log Works	House log/log home	Flathead	MT
Pyramid Mountain Lumber, Inc.	Sawmill	Missoula	MT
RBM Logging & Lumber	Sawmill	Flathead	MT
Roundwood West Corporation	Post or pole	Missoula	MT
R-Y Timber, Inc. - Livingston	Sawmill	Park	MT
R-Y Timber, Inc. - Townsend	Sawmill	Broadwater	MT
Simonson's Log Furniture	Log furniture	Flathead	MT
Sun Mountain Lumber	Sawmill	Powell	MT
The Rustics Of Montana	House log/log home	Missoula	MT
Trout Creek Log Homes	House log/log home	Powell	MT
Weyerhaeuser - Evergreen Plywood	Veneer/plywood	Flathead	MT
Weyerhaeuser - Evergreen Sawmill	Sawmill	Flathead	MT
Wild Montana Wood	Sawmill	Flathead	MT
Willis Entrprises, Inc.-Bonner Chip Plant	Roundwood chipping	Missoula	MT
Woody's Lumber & Sawmill	Sawmill	Lewis and Clark	MT