FOREST INDUSTRY
RESEARCH PROGRAM
UNIVERSITY OF MONTANA

# Timber Use, Processing Capacity and Capability of Mills to Utilize Timber by Diameter Size Class Within the Custer-Gallatin 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 Custer-Gallatin National Forest (hereinafter Custer-Gallatin NF) and seeks to:

1. examine the harvest of timber from the counties containing Custer-Gallatin NF timberland – the "study area";
2. analyze the timber flow and identify the Custer-Gallatin 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.

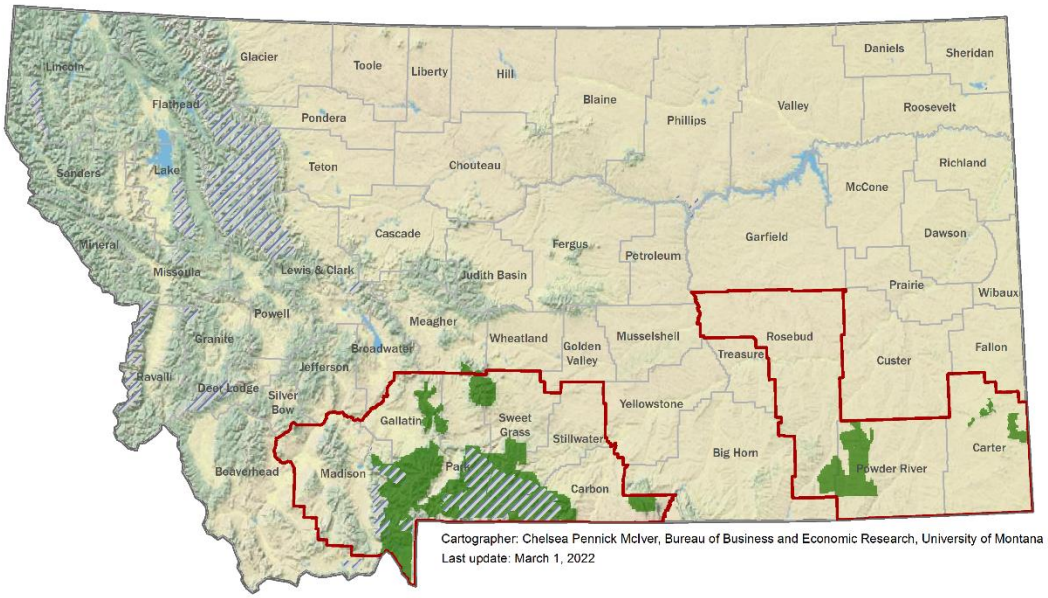


**Figure 1** – Custer-Gallatin National Forest (excluding grasslands) and study area.

## Custer-Gallatin National Forest Study Area

The Custer-Gallatin NF study area is situated in the eastern region of Montana, spreading over nine counties: Carbon, Carter, Gallatin, Madison, Park, Powder River, Rosebud,

Stillwater, and Sweet Grass (figure 1). The resulting study area contains approximately 3.0 million acres of timberland (USDA 2021), of which 62 percent (1.8 million acres) is managed by the USDA Forest Service (table 1).

**Table 1** – Acres of timberland[1] by county and ownership in the Custer-Gallatin NF Study Area.

| County | National Forest | Private | Bureau of Land Management | State | County or Municipal | Total |
|---|---|---|---|---|---|---|
| Carbon | 66,179 | 17,481 | 12,690 | 6,345 | - | 102,695 |
| Carter | 62,752 | 31,031 | - | - | - | 93,783 |
| Gallatin | 525,209 | 168,268 | - | 15,295 | - | 708,772 |
| Madison | 458,379 | 97,570 | 86,689 | - | - | 642,638 |
| Park | 269,278 | 133,670 | - | 14,400 | - | 417,348 |
| Powder River | 198,120 | 92,429 | 23,829 | 8,921 | - | 323,299 |
| Rosebud | 46,756 | 207,615 | 5,099 | 18,219 | - | 277,689 |
| Stillwater | 50,463 | 91,527 | 5,293 | 5,293 | - | 152,576 |
| Sweet Grass | 172,432 | 81,011 | 8,402 | 3,726 | - | 265,571 |
| Grand Total | 1,849,568 | 920,602 | 142,002 | 72,199 | 0 | 2,984,371 |

[1] Timberland: 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 43,572 CCF (17,552 MBF) in 2018 (table 2). National forests contributed 64 percent (27,704 CCF) of the timber harvested in the study area's nine counties. Of the other ownerships contributing to the study area's timber harvest, private and tribal timberlands accounted for 33 percent (14,336 CCF), and state lands contributed 4 percent (1,531 CCF). Timber from the Custer-Gallatin NF accounted for 46 percent of the National Forest timber harvested from the study area, with small 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 lodgepole pine (39 percent), followed by Douglas-fir (27 percent), Engelmann spruce (22 percent), ponderosa pine (7 percent), white spruce (3 percent), subalpine fir (2 percent), and smaller volumes of western larch and grand fir (Hayes et al., 2021).

**Table 2 –** Timber harvest by county and ownership in the Custer-Gallatin NF study area, 2018.

| County | National Forest | Private & Tribal | State | Grand Total |
|---|---|---|---|---|
| | ---------- *Hundred cubic feet (CCF)*---------- | | | |
| Carbon | 1,651 | - | - | 1,651 |
| Carter | 752 | 2,273 | 1,107 | 4,132 |
| Gallatin | 14,579 | 2,983 | - | 17,562 |
| Madison | 7,662 | 4,254 | 424 | 12,340 |
| Park | 679 | 3,130 | - | 3,809 |
| Powder River | 2,381 | - | - | 2,381 |
| Rosebud | - | - | - | - |
| Stillwater | - | 38 | - | 38 |
| Sweet Grass | - | 1,658 | - | 1,658 |
| Grand Total | 27,704 | 14,336 | 1,531 | 43,571 |

Source: Hayes et al. 2021

## Custer-Gallatin National Forest Timber-Processing Area

### Timber Flow Trends – Into Study Area

Facilities in the study area received 57,750 CCF (23,330 MBF), making the area a net importer of timber. Of the timber received and processed by mills, 17 percent (9,728 CCF) came from the Custer-Gallatin National Forest and 50 percent (28,935 CCF) came from national forest timberlands in Montana and neighboring states. Private (industrial and non-industrial) timberlands provided 45 percent (25,745 CCF) and state timberlands supplied 1 percent (784 CCF). The Bureau of Land Management provided 4 percent (2,228 CCF) of timber received by mills in the study area, and Canadian sources provided less than 1 percent (58 CCF).

### Timber Flow Trends – Out of Study Area

Of the 43,571 CCF (17,552 MBF) of timber harvested in the Custer-Gallatin NF study area in 2018, approximately 9 percent (6,975 CCF) was processed in the county of harvest, and 27 percent (14,108 CCF) was processed elsewhere within the study area (table 3, figure 2). Eight percent (3,644 CCF) of the harvest from the study area was processed in South Dakota.

**Table 3** - Timber flow from the Custer-Gallatin NF Study Area, 2018[a].

| County of harvest | Processed within the county of harvest | Processed elsewhere within study area | Processed outside study area |
|---|---|---|---|
| | *percentage of harvest by county* | | |
| Carbon | 0 | 48 | 52 |
| Carter | 0 | 9 | 91 |
| Gallatin | 14 | 45 | 41 |
| Madison | 0 | 32 | 68 |
| Park | 37 | 0 | 63 |
| Powder River | 0 | 20 | 80 |
| Stillwater | 0 | 18 | 82 |
| Sweet Grass | 0 | 35 | 65 |
| Grand Total | 9 | 27 | 64 |

Source: Hayes et al. 2021

[a]Only counties reporting harvest volume included in table.

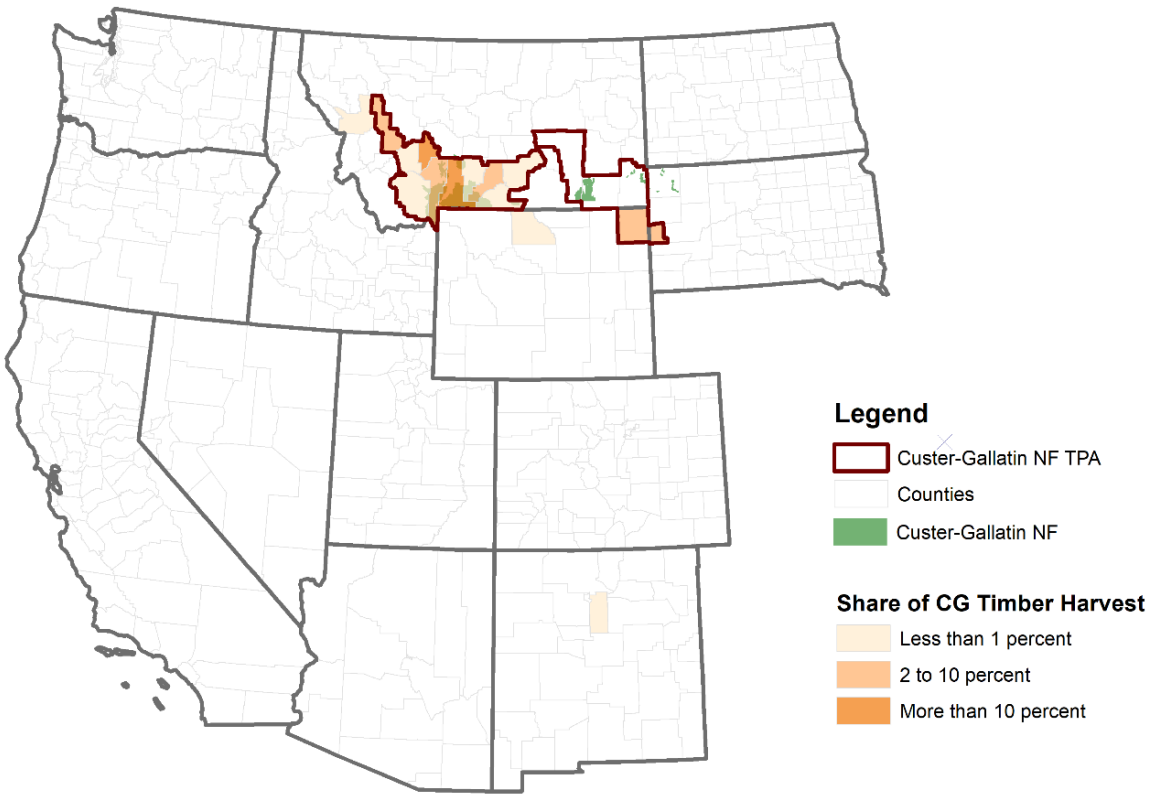


**Figure 2** – Counties receiving timber from the Custer-Gallatin National Forest and CG Timber-Processing Area.

Based on analysis of the above timber flow trends, 15 counties were identified as encompassing the Custer-Gallatin NF TPA. In addition to the nine Montana counties in the study area, four other counties in Montana, one county in Wyoming and one county in South Dakota contained mills that received a sufficient volume of timber from the study area to be included in the TPA (figure 2). A total of 23 primary wood products facilities operate within the TPA, of which 17 were active and received timber from the Custer-Gallatin study area (table 4). A list of all mills residing in the TPA regardless of whether they received and processed timber from the Custer-Gallatin NF study area is included in Appendix B.

**Table 4 –** Active timber-processing facilities in the Custer-Gallatin NF timber-processing area, 2022

| **Type** | **2022** |
|---|---|
| Sawmill | 6 |
| Post or pole | 1 |
| Log home/house log | 9 |
| Firewood | 1 |
| **Total** | **17** |

Hayes et al. 2021; Marcille et al. 2021

## Timber-Processing Capacity, Capability, and Utilization

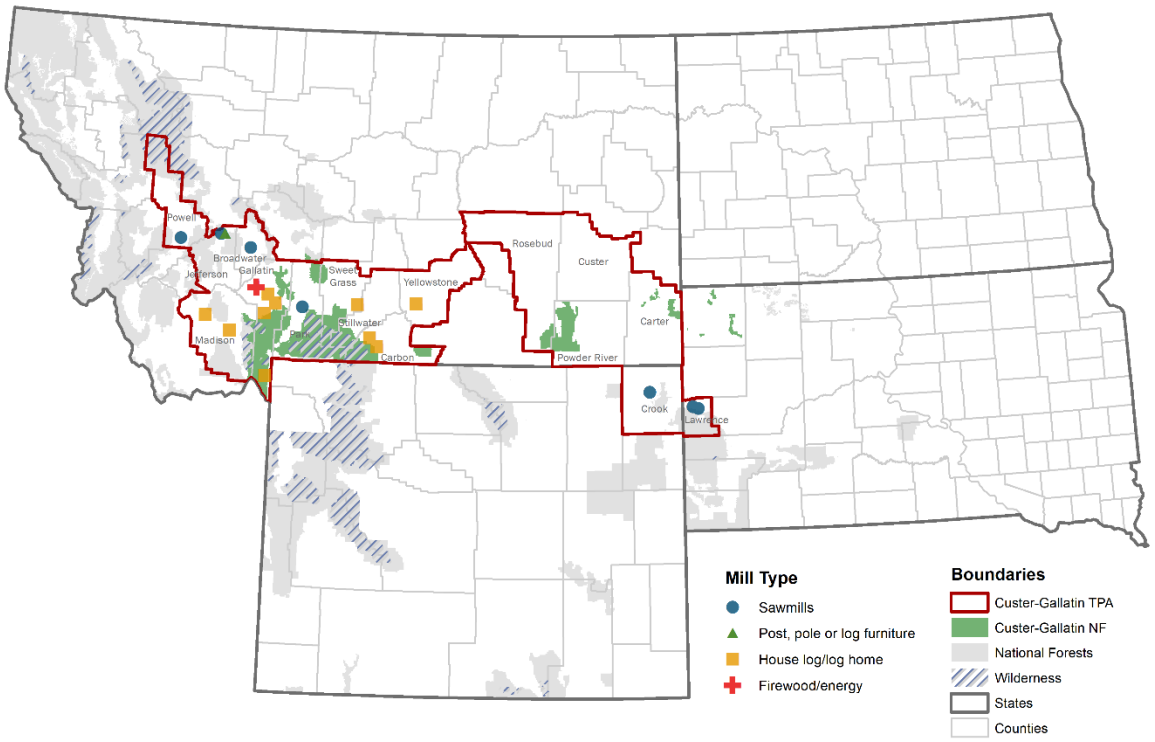


**Figure 3** – Location and type of timber-processing facilities receiving timber from the Custer-Gallatin NF study area.

Capacity to process timber in the Custer-Gallatin NF TPA during 2021 was estimated at 492,124 CCF (242,036 MBF) and was adjusted to reflect the closures of the R-Y Timber sawmill in Townsend, MT (table 5). Timber-processing capacity within the study area represented 12 percent of the total capacity in the TPA. More than 80 percent (397,454 CCF or 197,387 MBF) of timber-processing capacity in the Custer-Gallatin 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 18 percent of total timber-processing capacity, while slightly more than one percent of capacity in the TPA could efficiently utilize trees less than 7 inches dbh. Forty percent of total capacity to process timber in the TPA resides with mills in Montana. However, the distribution of capacity by size class varies significantly by state. Nearly all (94 percent) of capability to process trees less than 7 inches dbh resides in Montana, while two-thirds of capability in the 7-9.9-inch size class is located in Montana with the remaining capacity concentrated in South

Dakota. Mill capability unable to process trees less than 10 inches dbh was distributed across Montana, South Dakota and Wyoming.

**Table 5** – Annual capacity and capability of mills to process trees by size class in the Custer-Gallatin NF TPA, 2021[a]

| *Hundred cubic feet (CCF)* | | *Thousand board feet, Scribner (MBF)* | |
|---|---|---|---|
| **Tree dbh** | **Capability** | **Tree dbh** | **Capability** |
| < 7 in. | 6,361 | < 7 in. | 2,085 |
| 7 - 9.9 in. | 88,309 | 7 - 9.9 in. | 42,564 |
| ≥ 10 in. | 397,454 | ≥ 10 in. | 197,387 |
| **Total capacity** | **492,124** | **Total capacity** | **242,036** |

Source: Hayes et al. 2021; Marcille et al. 2021

[a]Adjusted to reflect mill closures since 2018

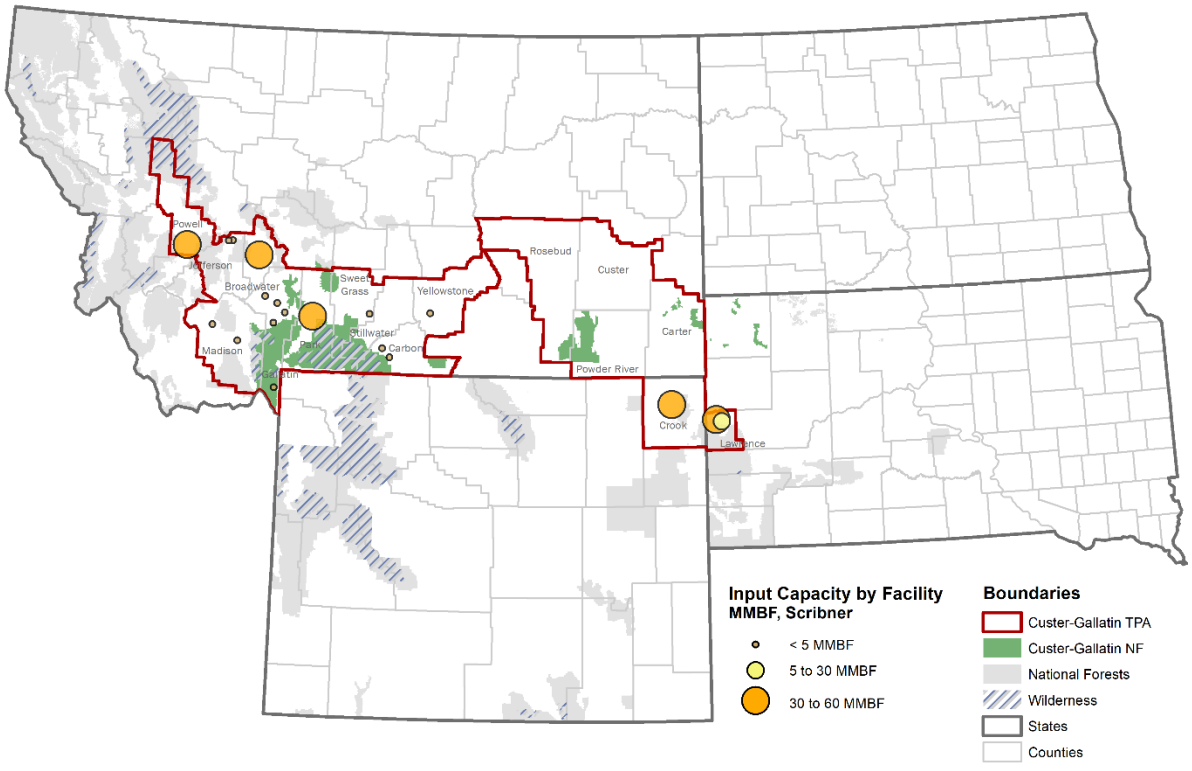


**Figure 3** – Capacity of mills receiving timber from the Custer-Gallatin NF study area (includes inactive mills).

Mills in the TPA processed 303,885 CCF (148,396 MBF) of timber in 2018--the most recent year in which a full census was conducted. Assuming a similar level of production in 2021, approximately 62 percent of total 2021 capacity (on a cubic foot basis) within the TPA would have been utilized, after accounting for mill closures since 2018. Mills in Montana and South Dakota each processed forty percent of the total timber processed in the TPA with the remainder processed by mills in Wyoming. Trees with a dbh 10 inches or greater comprised 73 percent of the annual volume processed in the TPA, while 25 percent came from trees 7-9.9 dbh, and two 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 largest size class (>10 inches dbh). A moderate volume of unused capability existed in the 7 to 9.9 inch dbh size class (11,590 CCF). However, mills in the TPA utilized all of their capability to process trees less than 7 inches dbh.

**Table 6** – Annual volume of timber processed by tree size class for the Custer-Gallatin NF TPA, 2018.

| *Hundred cubic feet (CCF)* | | *Thousand board feet, Scribner (MBF)* | |
|---|---|---|---|
| **Tree dbh** | **Volume used** | **Tree dbh** | **Volume used** |
| < 7 in. | 6,604 | < 7 in. | 2,164 |
| 7 - 9.9 in. | 76,719 | 7 - 9.9 in. | 36,806 |
| ≥ 10 in. | 220,562 | ≥ 10 in. | 109,426 |
| **Total processed** | **303,885** | **Total processed** | **148,396** |

Source: Hayes et al. 2021; Marcille et al. 2021

## Discussion

The capacity and capability information used in this report represent mills that received timber from the study area's nine counties and characterizes market dynamics in 2018 with some updates to capacity changes in 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 Custer-Gallatin TPA. The authors estimate that in 2018, 737 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 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 Custer-Gallatin NF study area is included in Appendix B.

**Spatial distribution of capacity**

As demonstrated in Figure 4, 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 log furniture and post and small pole facilities. Capability in the 7 to 10-inch dbh category was distributed across multiple counties containing stud mills. Remaining capability not able to process trees <10 inches dbh was largely concentrated in house log facilities and random length mills. 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.

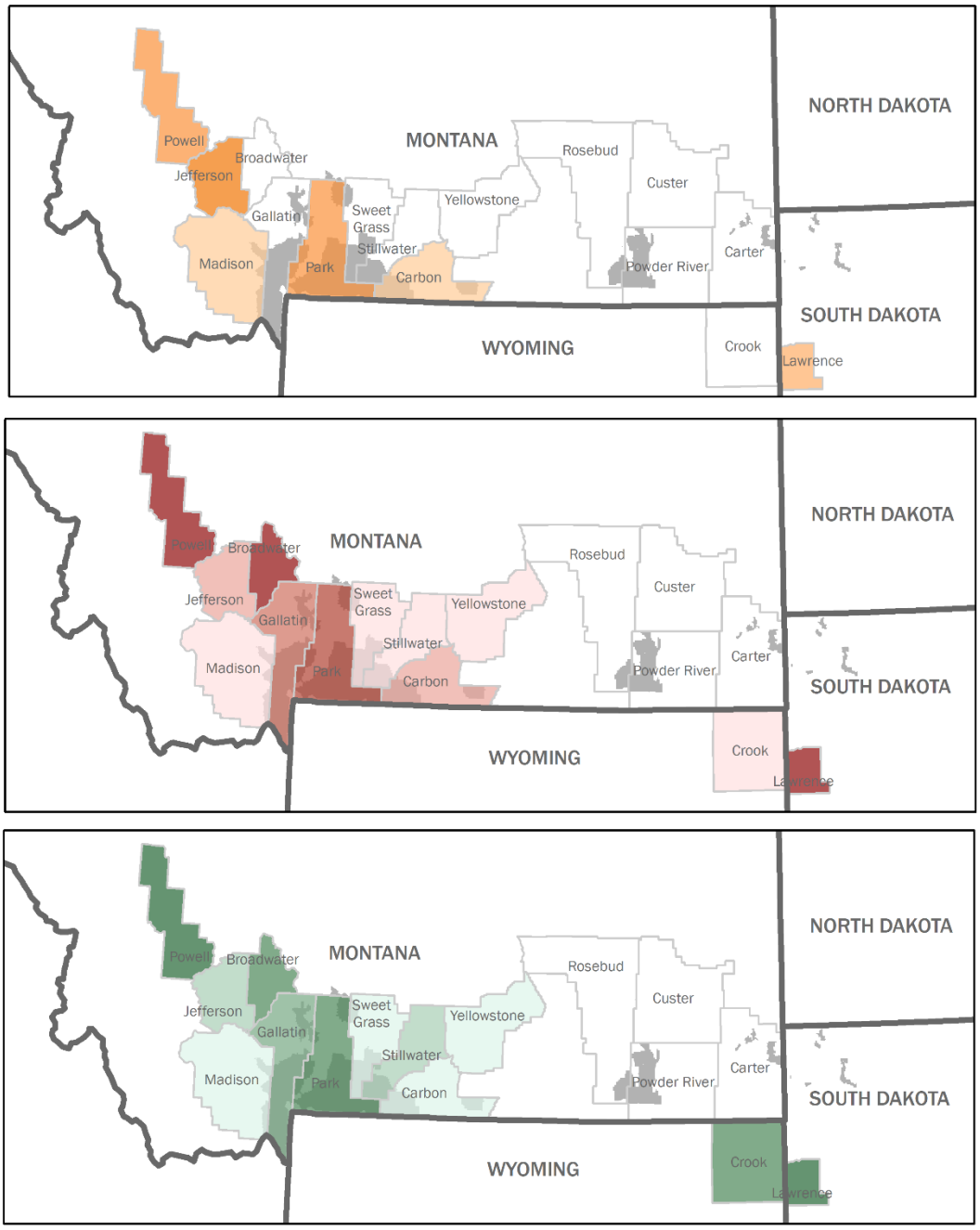


**Figure 4** – Capability to process logs by size class among mills receiving timber from the Custer-Gallatin NF study area.

A moderate amount of the capability to use smaller diameter trees was being used to process larger trees or going unused. Slightly more than 15 percent of capability in the less than 7-inch dbh category was utilized to process trees less than 7-inch dbh, while nearly 80 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 the two largest size classes during 2018 (figure 5). 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 Powell and Park County took in more than 2,000 CCF in timber in the 7 to 10-inch dbh class than they were estimated to efficiently and economically process. Broadwater, Crook, Gallatin, Lawrence, Park, Stillwater, Sweet Grass and Yellowstone counties all took in more timber in the smallest size class than they were estimated to efficiently process, perhaps owing to the higher than average volume of salvage harvest occurring in the region during 2018.

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.

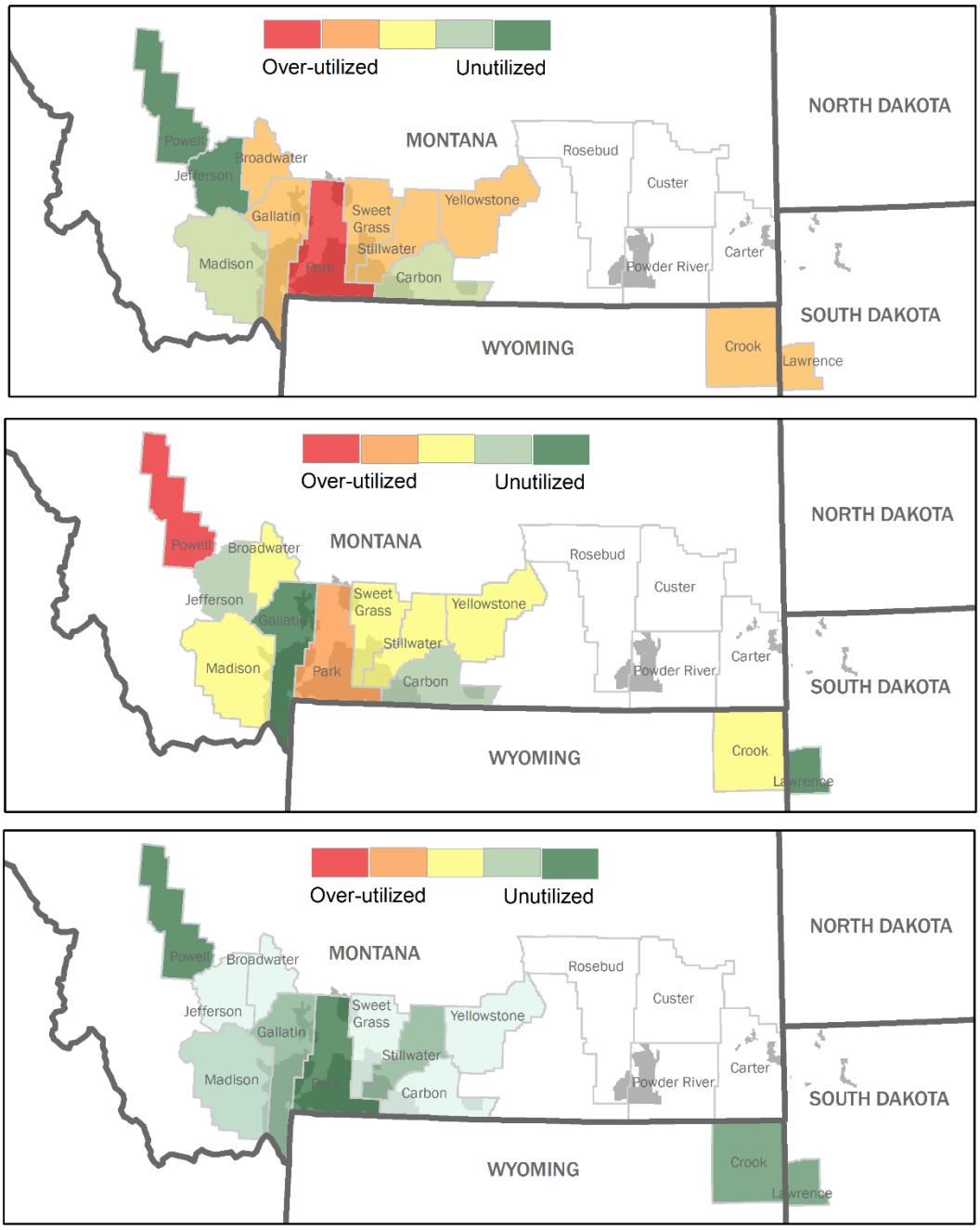


**Figure 5**—Unused capacity among active mills receiving timber from the study area by size class and county.

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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 a. 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 Custer-Gallatin National Forest TPA counties (includes facilities that did not receive timber from the study area).

| Mill Name | Mill Type | County | State |
|---|---|---|---|
| A Very Unique Log Home Inc. | House log/log home | Carbon | MT |
| B&J Sawmill | Sawmill | Stillwater | MT |
| Beartooth Log Smiths | House log/log home | Carbon | MT |
| Devils Tower Forest Products | Sawmill | Crook | WY |
| Gone Beaver Handcrafted Logs | House log/log home | Gallatin | MT |
| Goodman House Logs | House log/log home | Madison | MT |
| Hilgard Log Homes | House log/log home | Gallatin | MT |
| Hills Product Group / McLaughlin sawmill | Sawmill | Lawrence | SD |
| Huckaba Custom Designs | Log furniture | Jefferson | MT |
| Log Builders, Inc. | House log/log home | Yellowstone | MT |
| Logmaster Log Homes | House log/log home | Sweet Grass | MT |
| Lumberjack Log Homes | House log/log home | Gallatin | MT |
| Marks Lumber | Sawmill | Jefferson | MT |
| Marks-Miller Post and Pole | Post and pole | Jefferson | MT |
| Myrstol Post and Pole | Post and pole | Park | MT |
| R-Y Timber, Inc. - Livingston | Sawmill | Park | MT |
| S & D Firewood | Firewood | Gallatin | MT |
| Spearfish Forest Products, Inc. | Sawmill | Lawrence | SD |
| Sun Mountain Lumber | Sawmill | Powell | MT |
| T.R. Post and Pole, LLC | Post and pole | Lawrence | SD |
| Terry's Custom Log Railings | Log furniture | Madison | MT |
| Trout Creek Log Homes | House log/log home | Powell | MT |
| Whispering Pines Pole Co. | Post and pole | Powell | MT |