FOREST INDUSTRY TECHNICAL REPORT **NO. 7** FALL 2021

TIMBER USE, PROCESSING CAPACITY AND CAPABILITY WITHIN THE PIKE AND SAN ISABEL NATIONAL FORESTS TIMBER-PROCESSING AREA

BY ERIC A. SIMMONS, TODD A. MORGAN, STEVEN W. HAYES AND LUKE RYMNIAK

Introduction

Insect and disease outbreaks in the central Rocky Mountains reached epidemic levels in the past two decades resulting in vast stands of dead trees across parts of Wyoming, Colorado and South Dakota. In the counties where the Pike and San Isabel National Forests are located, annual mortality across all ownerships from insect and disease on timberland[1] is estimated to be 157,155 hundred cubic feet (CCF), about 63 percent of total annual mortality in the area (USDA, 2018). In comparison, fire accounts for 14 percent of mortality, and logging combined with other human caused mortality accounts for 2 percent, remaining mortality is from other (i.e. weather, animals, vegetation) or unknown causes (USDA, 2018).

The states and the U.S. Forest Service have increased investments in forest health, hazardous fuels mitigation and safety protection on private and public lands (Wyoming State Forestry Division 2017; State of Colorado 2017; USFS MBRNF 2017). 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 rates adequate for forest management goals and economically sustainable for the industry (Keegan et al. 2005; Keegan et al. 2006). The expressed need to treat millions of acres in the western United States to meet management objectives has made accurate information on timber milling capacity and the capability of mills to handle timber of various sizes an important consideration for managers.

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 support document for the Pike and San Isabel National Forests and seeks to:

1. Examine the harvest of timber from the counties containing the Pike and San Isabel National Forest's timberland – the "study area."
2. Analyze the timber flow and identify the Pike and San Isabel National Forest's "timber-processing area" – the counties containing facilities that received timber harvested from the study area.
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 use of timber. The study focuses on facilities that exclusively use timber in round form (i.e.,

[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.)

logs). Facilities that use only mill residuals (e.g., sawdust or chips) are not included.

Definitions and Methods

This analysis is based on 2016 data for Colorado mills (Hayes et al. in press) and follows the methods outlined in the Region 2 region-wide report (Simmons et al. 2019). When 2016 data for a mill was not available, prior (2012 or 2007) data was used as a baseline and adjusted to reflect 2016 harvest and market conditions. Mill survey data from Hayes et al. (in press), USFS Cut and Sold reports (USFS 2016) and conversations with mill owners, were used to analyze timber harvest and flow from all ownerships within the study area (i.e., the counties containing the Pike and San Isabel National Forests timberland).

The Pike and San Isabel timber-processing area (TPA) includes the counties in the study area and counties containing mills that received timber from the study area during 2016. If historic (2012) mill survey data indicated a substantial flow of timber into a county, the county would be included in the TPA even if recent (2016) flows were relatively small or nonexistent. Finally, all other counties receiving timber from the study area were included if the volume from the study area represented more than 10 percent of the total timber received in that county.

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 generally 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 because 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 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 and sufficient raw material for all shifts and products produced. Estimates in this report include the capacity of facilities that use timber in round form; this includes sawmills and facilities processing timber into house logs, log homes, posts, poles, log furniture, excelsior, fuel pellets, firewood and landscaping chips.

In contrast, "capability" refers to the volume of trees of a certain size class (measured as diameter at breast height – dbh) that timber processors can efficiently and economically 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).

For each mill in the TPA, an estimate of the mill's capability to process timber of a given size was made based on literature (Wagner et a. 1998, 2000; Keegan et al. 2005, 2006; Stewart et al. 2004), conversations with mill owners and the most recent BBER mill census data – taking into consideration the financial feasibility and physical characteristics of the mill. For this report, three tree size classes were used: <7 inches dbh, 7-9.9 inches dbh, and ≥10 inches dbh. BBER researchers first assigned capability to efficiently process timber in the <7 inch and 7-9.9 inch dbh classes. Capability to process trees ≥ 10 inches dbh was then calculated as the remaining proportion of total capacity not capable of efficiently using trees <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.

The Pike and San Isabel National Forests Study Area

The Pike and San Isabel National Forests study area is situated primarily in the central front range of Colorado, spreading over 14 counties (Figure 1). The area contains 2.5 million acres of timberland (USDA, 2018), 52 percent (1.3 million acres) is owned and managed by the U.S. Forest Service (Table 1) of which 581,550 acres are considered suitable for timber production[2] (Sidon 2019).

The total volume of timber harvested and utilized from all ownerships in the study area was an estimated 42,557 CCF (16,171 MBF) in 2016 (Table 2). Timber harvested from the Pike and San Isabel National Forests was estimated to account for 49 percent (20,893 CCF) of the timber harvested in the 14 counties. The species composition of the timber harvested in the study area was ponderosa pine (29 percent), lodgepole pine (27 percent), Engelmann spruce (21 percent), Douglas-fir (16 percent), with smaller volumes of aspen, blue spruce and subalpine fir.

Pike-San Isabel Timber-Processing Area

A national forest's timber-processing area (TPA) establishes the geographic region potentially influenced by timber harvested from that forest by analyzing the flow of timber harvested from

[2] Lands suited for timber production – area that defines where timber harvest for the purpose of timber production may occur. Timber harvest for purposes other than timber production may also occur here.

Table 1. Acres of timberland[1] by county and ownership in the Pike-San Isabel National Forest study area.

County	National forest	Private	Other federal	State	Other public	Total
Chaffee	228,539	17,908	1,572	6,290	--	254,309
Clear Creek	61,430	22,858	--	10,620	5,715	100,623
Costilla	--	190,872	--	--	--	190,872
Custer	91,315	53,814	--	6,191	--	151,320
Douglas	134,825	14,345	--	--	4,888	154,058
El Paso	85,200	67,709	8,192	4,915	13,325	179,341
Fremont	31,924	61,376	67,209	14,980	--	175,489
Huerfano	60,522	35,995	25,483	--	--	122,000
Jefferson	81,802	101,336	--	12,095	41,413	236,646
Lake	38,044	34,007	7,871	--	--	79,922
Las Animas	6,834	165,810	--	6,834	--	179,478
Park	367,371	91,057	35,674	3,100	--	497,202
Pueblo	7,940	12,884	--	--	--	20,824
Teller	110,319	82,326	26,304	7,014	--	225,963
Grand total	**1,306,065**	**952,297**	**172,305**	**72,039**	**65,341**	**2,568,047**

[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.)

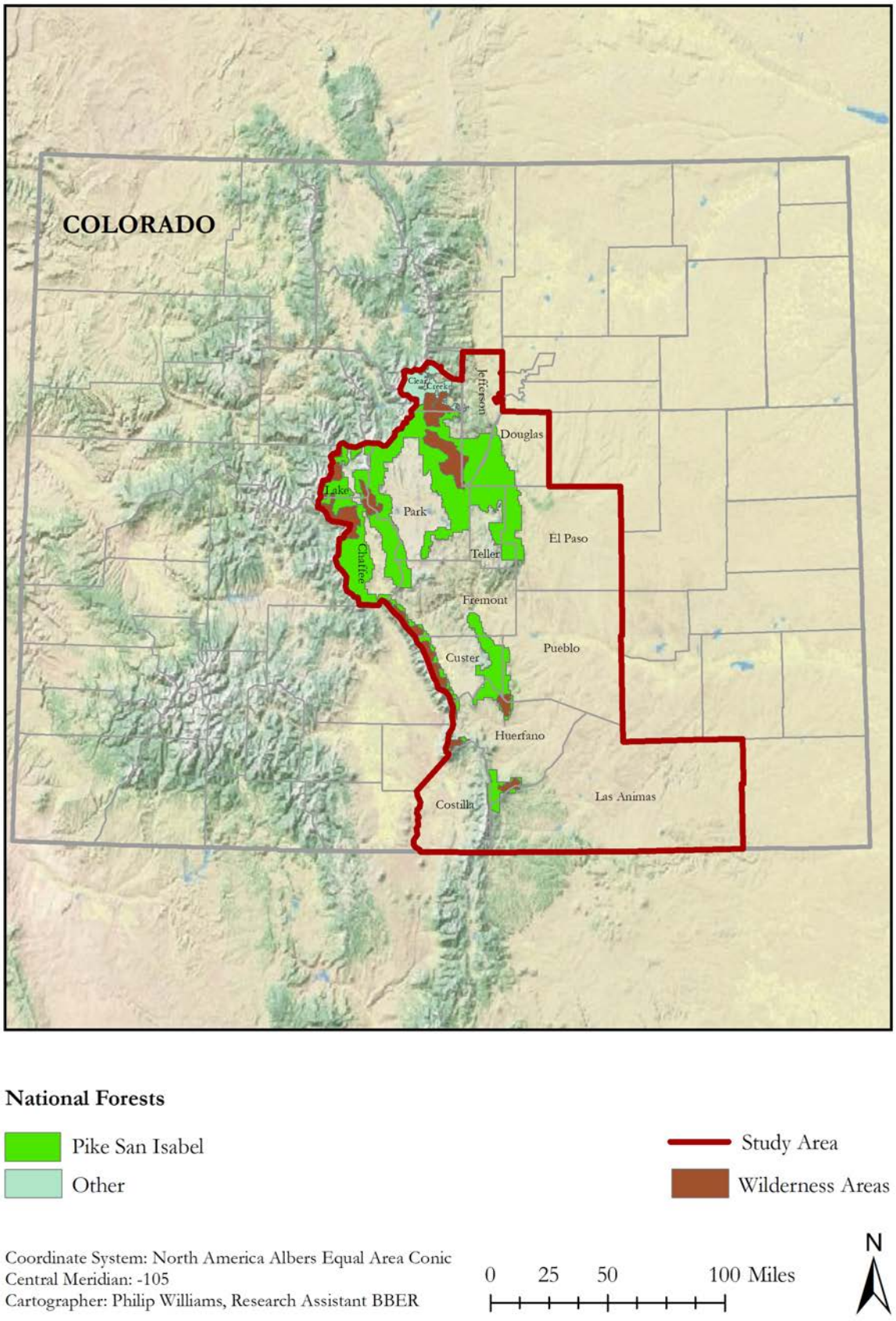
Source: USDA Forest Service, Forest Inventory and Analysis Program, Tue Dec 18 20:21:21 GMT 2018. Forest Inventory EVALIDator web-application Version 1.8.0.00. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Research Station. [Available only on internet: http://fsxopsx1056.fdc.fs.usda.gov:9001/Evalidator/evalidator.jsp]

Table 2. Timber harvest by county and ownership in the Pike-San Isabel National Forest study area, 2016.

County	National forest	Private	Other federal	State	Other public	Total
	Hundred cubic feet (CCF)					
Chaffee	2,029	379	--	--	--	2,408
Clear Creek	242	--	--	--	--	242
Costilla	--	2,303	--	--	--	2,303
Custer	3,875	2,926	--	--	--	6,801
Douglas	513	--	--	--	--	513
El Paso	--	--	--	--	--	--
Fremont	--	289	--	289	--	579
Huerfano	8,713	5,066	126	--	--	13,905
Jefferson	489	--	--	--	--	489
Lake	882	--	--	--	--	882
Las Animas	--	--	--	--	--	--
Park	1,555	947	--	--	--	2,503
Pueblo	--	--	--	--	--	2,663
Teller	2,595	4,924	882	--	868	9,268
Total	**20,893**	**19,497**	**1,008**	**289**	**868**	**42,557**

Source: Source: Hayes et. al. (in press); Simmons et. al. 2019.

Figure 1. Pike and San Isabel National Forests study area.



all ownerships within the study area. The analysis also describes the area and extent to which timber processors are dependent upon the timber harvested in these counties, and federal timber more specifically.

The Pike and San Isabel National Forests TPA is made up of 20 counties, including 19 counties in Colorado and Colfax County in New Mexico (Figure 2). In addition to the 14 counties in the study area, five other Colorado counties with timber-processing facilities received timber from the study area, including Montrose County which is home to the state's largest sawmill. Within the Pike and San Isabel National Forests TPA there were 25 facilities operating as of 2016 (Table 3). The authors suggest that the Pike and San Isabel National Forests managers (e.g., timber sale administrators and forest planners) contact the facilities in the TPA to verify their current operating status as the forest plan and specific projects are being developed.

Timber Flow

Of the 42,557 CCF (17,772 MBF) of timber harvested in the Pike-San Isabel study area, over 20 percent (8,761 CCF) was processed in the county of harvest, 58 percent (24,597 CCF) was processed elsewhere within the study area, and 22

Table 3. Active timber-processing facilities in the Pike and San Isabel National Forests TPA, 2016.

Type	2016
Sawmills	15
Houselogs	5
Post/Poles	3
Fuel pellet	1
Other	1
Total	**25**

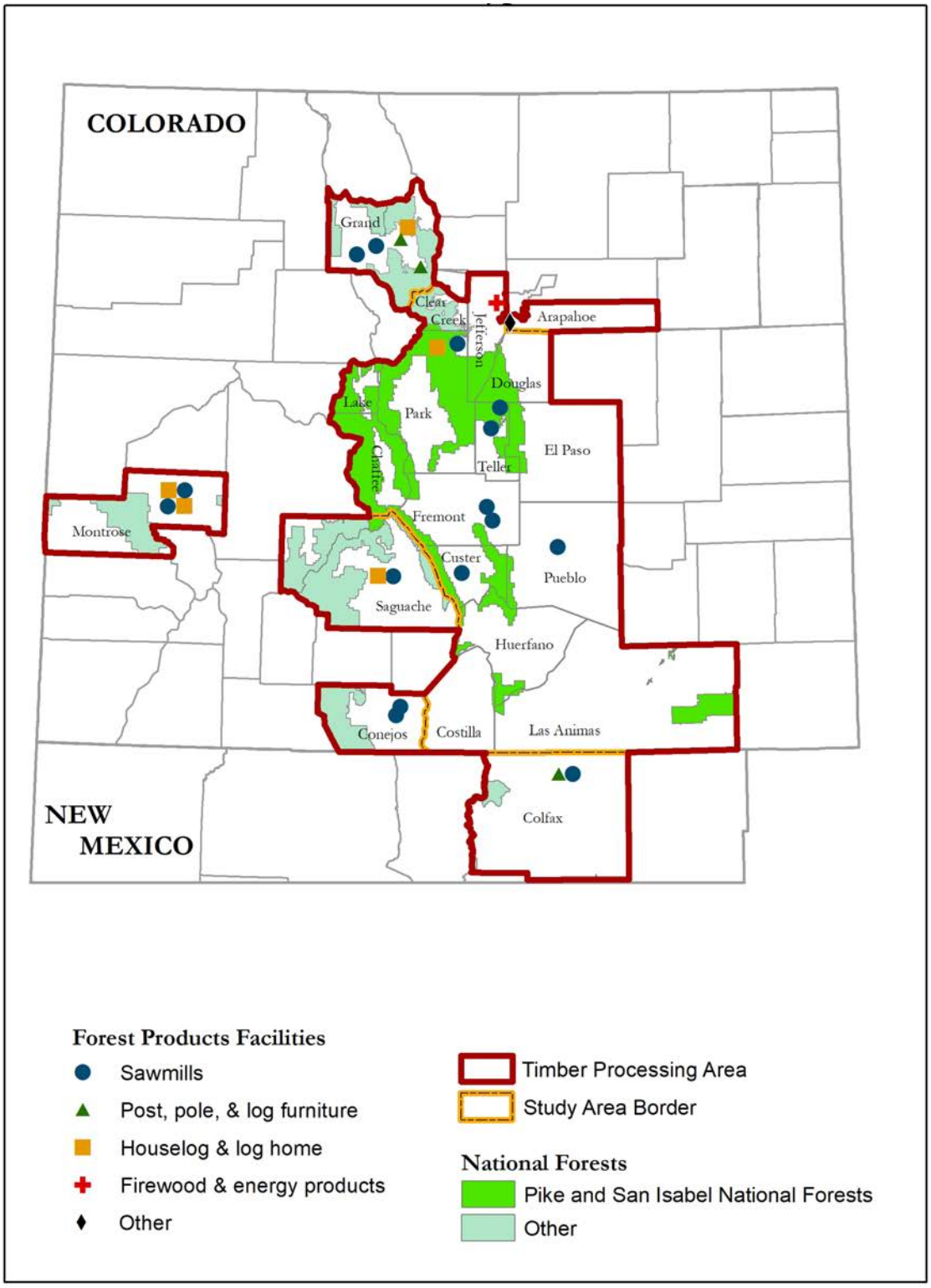
Source: Hayes et. al. (in press); Simmons et. al. 2019.

Table 4. Timber flow from the Pike and San Isabel National Forests study area, 2016.

County of harvest	Processed within the county of harvest	Processed elsewhere within study area	Processed outside study area
	Percentage of harvest by county		
Chaffee	--	21.2	78.8
Clear Creek	--	--	100.0
Costilla	--	--	100.0
Custer	3.9	39.2	57.0
Douglas	--	100.0	--
El Paso	--	--	--
Fremont	100.0	--	--
Huerfano	--	100.0	--
Jefferson	100.0	--	--
Lake	--	100.0	--
Las Animas	--	--	--
Park	100.0	--	--
Pueblo	100.0	--	--
Teller	24.4	66.1	9.5
Total	**20.6**	**57.8**	**21.6**

Source: Hayes et. al. (in press); Simmons et. al. 2019.

Figure 2. Pike-San Isabel TPA and timber-processing facilities.



Coordinate System: NAD 1983 NSRS2007 Contiguous USA Albers
Central Meridian: -105
Cartographer: Philip Williams, Research Assistant BBER

0 25 50 100 Miles

N

percent (9,199 CCF) was processed outside the study area but within the Pike-San Isabel TPA (Table 4).

Nine of the 25 active facilities in the TPA are located within the study area, most of the remaining facilities are in adjacent or nearby counties in Colorado. Facilities within the study area processed 33,358 CCF (12,676 MBF) of the timber from the study area of which 46 percent came from national forest timberlands. The majority of the remaining national forest timber harvested in the study area was processed by Montrose Forest Products in Colorado and Western Wood in New Mexico. This flow of timber indicates that landowners within the study area are relying on facilities outside the immediate area to purchase timber, suggesting mills outside the study area may be better able to compete for timber than mills within the study area or may have better developed supply chains due to larger volumes of timber they process.

Timber-Processing Capacity and Capability

Capacity to process timber in the Pike and San Isabel National Forests TPA during 2016 was 314,500 CCF (124,481 MBF). Capacity within the study area was 78,050 CCF (28,553 MBF) just 25 percent of the total capacity in the TPA, further indicating that the Pike and San Isabel National Forests and other timber owners in the area are relying on or marketing to the TPA's broader timber market even though capacity in the study area exceeded harvest volume during 2016.

The authors estimate that 60 percent (190,499 CCF or 87,523 MBF) of timber-processing capacity in the Pike and San Isabel National Forests TPA is not capable of efficiently utilizing trees < 10 inches dbh (table 5). Capability to efficiently utilize trees 7-9.9 inches dbh accounts for 28 percent of total timber-processing capacity; whereas about 12 percent (36,424 CCF) of total capacity in the TPA can efficiently utilize trees < 7 inches dbh.

Table 6 shows that mills in the TPA processed 219,311 CCF (83,234 MBF), indicating that approximately 70 percent (on a cubic foot basis) of total capacity within the TPA was utilized. National forests supplied 69 percent (about 152,230 CCF or 57,801 MBF) of the timber processed in the TPA, which indicates there is a strong dependence by those mills on national forest timber and a reciprocal dependence by the national forests on those mills. Nearly 60 percent of the volume processed in the TPA was comprised of trees with dbh ≥ 10 inches. Another 26 percent came from trees 7-9.9 dbh, while the remaining 14 percent was made up of trees < 7 inches dbh.

At 69 percent utilization in 2016, there is unutilized capability at sawmills and houselog facilities to process trees ≥ 10 inch dbh (59,148 CCF or 27,129 MBF). Approximately 71 percent

Table 5. Annual capacity and capability of mills to process trees by size class for the Pike and San Isabel National Forests TPA, 2016.

Hundred cubic feet (CCF)		*Thousand board feet, Scribner (MBF)*	
Tree dbh	**Capability**	**Tree dbh**	**Capability**
< 7 in.	36,424	< 7 in.	6,514
7 - 9.9 in.	87,577	7 - 9.9 in.	30,444
≥ 10 in.	190,499	≥ 10 in.	87,523
Total capacity	**314,500**	**Total capacity**	**124,481**

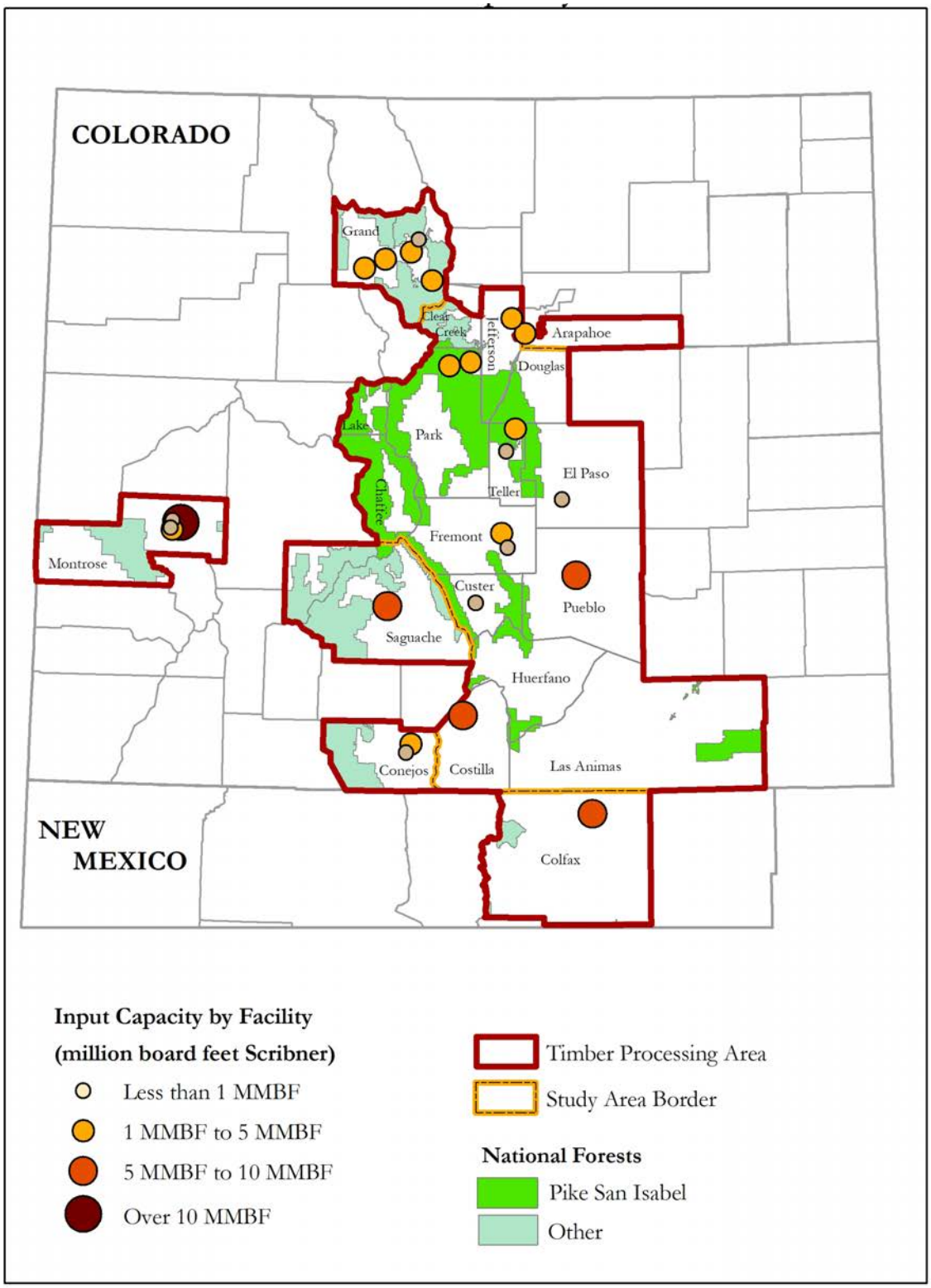
Source: Hayes et. al. (in press); Simmons et. al. 2019.

Table 6. Annual volume of timber processed by tree size class for the Pike and San Isabel National Forests TPA, 2016.

Hundred cubic feet (CCF)		*Thousand board feet, Scribner (MBF)*	
Tree dbh	**Volume used**	**Tree dbh**	**Volume used**
< 7 in.	30,848	< 7 in.	4,417
7 - 9.9 in.	57,112	7 - 9.9 in.	18,423
≥ 10 in.	131,351	≥ 10 in.	60,394
Total processed	**219,311**	**Total processed**	**83,234**

Source: Hayes et. al. (in press); Simmons et. al. 2019.

Figure 3. Pike-San Isabell timber-processing capacity by facility.



Lost Lake on the San Isabel National Forest, Colorado. (Andrew Wojtanik)

of the capability to process trees < 10 inches dbh was used in 2016. Mills utilized 87,960 CCF (22,840 MBF) of the estimated 124,001 CCF (36,958 MBF) capable of processing trees <10 inches dbh. Capability in the < 7 inch dbh class had the highest utilization rate (85 percent), indicating limited opportunity to increase commercial harvest and use of the small trees without industry investment to increase capacity to use small trees.

Discussion

One of the two largest sawmills in Region 2 is in the Pike-San Isabel TPA (i.e. Montrose Forest Products). This facility accounts for a considerable amount of the processing capability for trees ≥ 10 inches dbh. In addition, facilities processing houselogs account for the majority of the remaining capability in the ≥ 10 inch dbh size class. Many sawmills in the region have some capability to use trees 7–9.9 inches dbh. However, the feasibility and profitability of using smaller trees is improved with green trees, since more lumber can be recovered and operating costs are lower with live trees than dead or salvaged trees. Similar relationships among log size and log quality for live versus dead trees relative to value have been documented by Fahey et al. (1986) and Loeffler et al. (2018).

As in most of the interior west, several (9 of 15) smaller sawmills in the Pike and San Isabel National Forests TPA produce other products (e.g., firewood, posts, animal bedding, or pellets) in addition to lumber. This product diversification has augmented their capability to use smaller trees. When these multi-product sawmills are combined with facilities making other products (e.g., posts, poles, firewood, or chips) using trees in the 7 – 9.9 inch dbh class they account for 61 percent (53,509 CCF) of the capability in the 7-9.9 inch dbh class. However, 76 percent of this capacity is utilized. Capability to process trees < 7 inches dbh tends to be concentrated among facilities that produce posts, small poles, chips, mulch, shavings and log furniture. Although 16 percent of the capability in the <7 inch dbh class was unused it is less than 2 percent (5,576 CCF) of the total timber-processing capacity in the TPA.

Considering that it is less capital intensive (i.e., less expensive) to increase post and pole capacity than to refit a larger sawmill to process smaller diameter logs into lumber, with sufficient markets and timber supplies some facilities may consider making the investments to increase small log capabilities. Some of these smaller facility operators expressed the sentiment that recent federal efforts (e.g., timber sales and stewardship projects) favor

large landscape projects, which are not economically viable for the smaller operators to bid on and thus can be a barrier to engaging more of this small-tree capability.

While the Pike and San Isabel National Forests TPA has unutilized capability to process small-diameter timber, several mills already reported using greater volumes of small diameter timber than they felt was financially sustainable for their operation. This is likely a reflection of the national forests and other land owners wanting to remove substantial quantities of small trees as part of efforts to reduce fire hazard, conduct forest restoration and mitigate the impacts of widespread tree mortality. When considering removing trees from the landscape, land managers should balance their need to remove small and/or dead trees with the local industry's ability to profitably use that material. Offering larger quantities of small and/or dead trees than the industry can profitably use can lead to unsold sales and fewer acres being treated.

References

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. 32 p.

Hayes, Steven W.; Cory A. Bingaman, Todd A. Morgan, Eric A. Simmons, Kate C. Marcille and John Shaw. In press. The Four Corners Timber Harvest and Forest Products Industry, 2016. Resour. Bull. RMRS-RB-XXX. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. http://www.bber.umt.edu/pubs/forest/fidacs/FC2016.pdf

Keegan, Charles E.; Morgan, Todd. A.; Wagner, Francis G.; Cohn, Patricia J.; Blatner, Keith A.; Spoelma, Timothy P.; Shook, Steven R. 2005. Capacity for Utilization of USDA Forest Service, Region 1 Small-Diameter Timber. Forest Products Journal 55(12): 143-147.

Keegan, Charles E.; Morgan, Todd A.; Gebert, Krista M.; Brandt, Jason P.; Blatner, Keith A.; Spoelma, Timothy P. 2006. Timber-Processing Capacity and Capabilities in the Western United States. Journal of Forestry 104(5): 262-268.

Loeffler, Dan; Anderson, Nathaniel M. 2018. Impacts of the Mountain Pine Beetle on Sawmill Operations, Costs and Product Values in Montana. Forest Products Journal 68(1): 15-24.

Sidon, Josh; Regional Economist, USDA Forest Service, Rocky Mountain Region, personal communication July 29, 2019.

Simmons, E.A., T.A. Morgan, S.W. Hayes, C.P. McIver, C.P., and P.W. Williams. 2019. Timber Use, Processing Capacity and Capability Within the USDA Forest Service Region 2 Timber-Processing Area. Forest Industry Technical Report BBER-FITR-5. University of Montana, Bureau of Business and Economic Research, Missoula, MT. 16p. http://www.bber.umt.edu/pubs/forest/capacity/TechReportRegion2-2019.pdf

State of Colorado. 2017. 2016 Report on the Health of Colorado's Forests: Fire and Water. Denver, CO: Colorado Department of Natural Resources, 2017. 36 p.

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.

USDA Forest Service, Forest Inventory and Analysis Program, Tue Dec 18 20:21:21 GMT 2018. 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]

U.S. Forest Service (USFS). 2016. Forest Products Cut and Sold from the National Forests and Grasslands. U.S. Department of Agriculture. Accessed December 7, 2017. https://www.fs.fed.us/forestmanagement/products/cut-sold/index.shtml

U.S. Forest Service, Medicine Bow-Routt National Forests & Thunder Basin National Grassland (USFS MBRNF). Mountain Pine Beetle Epidemic. Accessed September 16, 2017. https://www.fs.usda.gov/detail/mbr/home/?cid=stelprdb5139168.

Wagner, Francis G.; Fiedler, Carl E.; Keegan, Charles E. 2000. Processing Value of Small-Diameter Sawtimber at Conventional Stud Sawmills and Modern High-Speed, Small-Log Sawmills in the Western United States – A Comparison. Western Journal of Applied Forestry 15(4): 208-212.

Wagner, F.G., C.E. Keegan, R.D. Fight and S.A. Willits. 1998. Potential for Small-Diameter Sawtimber Utilization by the Current Sawmill Industry in Western North America. Forest Products Journal 48(9). p30. 5p.

Wyoming State Forestry Division. 2017. State and Private Forestry Fact Sheet: Wyoming 2017. National Association of State Foresters. Accessed September 19, 2017. http://stateforesters.org/sites/default/files/publication-documents/WYFY2017Standard%20%281%29.pdf

Notes