

ECONOMIC IMPACTS TO OREGON'S FOREST SECTOR

Full Report | September 2021



Oregon Forest
Resources Institute

2020 LABOR DAY FIRES



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Acknowledgments

The authors of this study extend thanks to the Oregon Forest Resources Institute (OFRI) staff, the many forest managers and foresters who provided input, and reviewers. OFRI established a Project Advisory Committee to guide and assist with this study, and their input was invaluable. Project Advisory Committee members were:

- Travis Joseph – American Forest Resource Council
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Public timberland managers also provided key input:

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- Ron Zilli – Oregon Department of Forestry
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ABOUT MASON, BRUCE & GIRARD

Mason, Bruce & Girard (MB&G) has a 100-year history as expert forestry and natural resource consultants in Oregon. Founded in Portland in 1921 by legendary forester David T. Mason, an early and vocal advocate for science-based, sustained yield forestry in the U.S., MB&G has completed several economic studies, including an assessment of woody biomass energy potential in 2006 and an analysis of the forest sector's contribution to the state's economy in 2012. The same year, MB&G completed an economic assessment of forest restoration on Oregon's eastside national forests for the Oregon Department of Energy.

ABOUT FOREST ECONOMIC ADVISORS

Forest Economic Advisors (FEA) is a leading provider of forest sector economic analysis and forecasting in the U.S. Backed by FEA's proprietary economic models, its analysts bring decades of experience and market knowledge to this project. Among FEA's many regular publications are the *North American Timber Quarterly* forecast covering regional log markets across North America's major producing regions, monthly macroeconomic and end-use forecasts, and sector forecasts for lumber, panels and engineered wood.

ABOUT THE OREGON FOREST RESOURCES INSTITUTE

The Oregon Legislature created the Oregon Forest Resources Institute (OFRI) in 1991 to support and enhance Oregon's forest products industry by advancing public understanding of forests, forest management and forest products, and encouraging sustainable forestry through landowner education. A 13-member board of directors governs OFRI. It is funded by a portion of the forest products harvest tax.

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1.0 EXECUTIVE SUMMARY

The Labor Day 2020 windstorm resulted in five simultaneous “megafires” in Oregon – fires greater than 100,000 acres in size – and 12 other fires ranging from 112 to 50,951 acres. These fires either started or blew up on September 7 and 8, 2020, and in a matter of days, over one million acres burned. While 2020 was not the largest fire year in Oregon’s history, the Labor Day 2020 fires burned more acres in the Cascades than any other year and set a record for fire acreage on lands protected by the Oregon Department of Forestry. Also unusual is the fact that nearly half of the burned area was privately owned timberland, and it is private timberlands that provide the bulk of Oregon’s timber harvest. These fires destroyed thousands of structures, displaced tens of thousands of people, and caused nine deaths. Hundreds of millions of dollars were spent fighting the fires. The restoration and reforestation job facing Oregon’s forest managers is monumental.

This analysis evaluates nine of the largest Labor Day fires and three other fires that burned before Labor Day. To estimate the economic impacts of the fires on Oregon’s Forest Sector, this study quantifies the impacts of the fires on Oregon’s Forest Sector in terms of:

- forestland acreage burned
- volume and value of timber on the burned acres
- long-term impact on future timber supply
- sector-specific impacts on loggers, small landowners and nurseries
- the costs of forest restoration
- the impact on employment in the Forest Sector

Findings

The 12 fires analyzed in this study encompassed nearly 971,000 acres containing nearly 15 billion board feet (Bbf) of green timber prior to the fires. Processing all of that timber through Oregon’s Forest Sector would generate over \$30 billion of end-product value.

Across all of the fires, about 45% of the acres were burned with high severity – greater than 75% canopy loss. About 25% of the acres within the fire perimeters were unburned.

Private lands account for 47% of the acres within the fire perimeters, 17% of the volume on burned acres, and 19% of the value of timber on the burned acres. Private landowners are expected to salvage about 860 million board feet (MMbf), which is 64% of the total expected salvage.

Timber volumes and values on burned public federal lands were proportionately higher as these lands typically have older timber. Salvage from the burned public lands will be more limited than on private lands due to limitations imposed by policies, budgets, staffing and the likelihood of environmental challenges.

Across all owners, expectations are that about 106,000 burned acres will undergo salvage harvest, producing about 1.4 Bbf with an end-product value of \$2.6 billion. Overall, about 14% of the value of the timber on acres burned with medium or high severity is expected to be recovered.

The loss of timber on merchantable and pre-merchantable timber stands will reduce future harvests by 115 to 265 MMbf per year over the next 40 years. This will cost 1,200 to 3,000 jobs in Oregon’s Forest Sector.

Taking into consideration the unrecovered value of the burned timber on burned acres available for sustainable harvest and the costs of restoration and business losses, **the economic impact of the fires on Oregon’s Forest Sector is about \$5.9 billion.**

2.0 OVERVIEW OF LABOR DAY 2020 FIRES

Hot, dry east winds swept across Western Oregon on Labor Day 2020, creating conditions that resulted in five megafires (greater than 100,000 acres), another five fires in the range of 10,000 acres to 50,000 acres, and seven smaller fires ranging from 100 to 4,000 acres. These fires all started or blew up on September 7 and 8; within days, Oregon had over 1 million acres burning. For most people involved in Oregon's Forest Sector, these were the largest and fastest moving fires of their careers.

This study quantifies the economic impacts of the Labor Day 2020 fires on Oregon's Forest Sector. The Oregon Forest Resources Institute (OFRI) commissioned Mason, Bruce & Girard (MB&G) and Forest Economic Associates (FEA) to provide a comprehensive overview of fire impacts across Oregon's Forest Sector.

While this report focuses on Oregon's Forest Sector, the authors recognize that the fires have important and substantial economic and social impacts beyond the Forest Sector: nine fatalities; 50,000 people evacuated from their homes; over 6,000 homes, businesses and structures destroyed; several communities burned; and over a half million people on evacuation warning. Air quality was hazardous to human health for ten days across Western Oregon, exposing four million to potential health hazards. Over 6,000 firefighters and hundreds of engines, heavy equipment and aircraft were deployed. Suppression costs were reported at \$354 million.

Others have previously analyzed and publicized some of those impacts, and future analysis and research is likely. Currently available publications include:

- the 2019 report of the Governor's Council on Wildfire Response, which provides a good overview of fire history and trends, a broad discussion of all impacts, and strategies to address increasing fire risk¹
- OFRI's 2012 and 2019 Forest Reports, which provide background data about Oregon's Forest Sector and its economic contributors
- a 2018 Headwaters Economics report, which compares fire suppression costs to other fire costs, including in some cases, loss of timber value²
- OFRI's analysis of the 2017 wildfire season³

¹ "Governor's Council on Wildfire Response: November 2019: Report and Recommendations," https://www.oregon.gov/gov/policy/Documents/FullWFCReport_2019.pdf

² "Full Community Costs of Wildfire" – Headwaters Economics, <https://headwaterseconomics.org/wildfire/homes-risk/full-community-costs-of-wildfire/>

³ "Oregon's 2017 Wildfire Season: Time for a Crucial Conversation," (2018) <https://oregonforests.org/sites/default/files/2018-01/OFRI%202017%20Wildfire%20Report%20-%20FINAL%2001-02-18.pdf>

This report is organized as follows:

- Section 2 provides a broad overview of the scope and scale of the Labor Day 2020 fires.
- Section 3 lays out the objectives of this study and the methodology used.
- Section 4 quantifies the acres burned in the fires.
- Section 5 quantifies the timber volumes in the areas burned by fires.
- Section 6 quantifies the value of the timber in the areas burned by the fires.
- Section 7 discusses factors affecting the recovery of burned timber.
- Section 8 discusses restoration and reforestation of the burned areas.
- Section 9 discusses additional impact of the fires on Oregon’s Forest Sector.
- Section 10 summarizes the findings.
- Appendices A-E cover Methods, Impacts by Fire, Impacts by County, Impacts by Market Area and Deterioration.

The findings of this study are based on publicly available data and reflect the study team’s assumptions derived from interviews, surveys, observation and experience. To make this report more readable, each section first describes the relevant findings, and then details the assumptions. Appendix **A: Methods** describes the methodology in more detail.

We join with all Oregonians in thanking those who fought the fires, those who provided food, shelter and comfort to those displaced by the fires, and those who are engaged in cleaning up the fire damage and rebuilding the affected communities.

2.1 Location and Setting

When moist air from the Pacific Ocean moves west across Oregon over the Cascade Mountains, the air rises and cools, dropping moisture as rain and snow on Westside forests, which are dominated by Douglas-fir and western hemlock. Oregon’s Eastside forests are drier and, as a result, natural fire is more common on the Eastside than the Westside.

Labor Day 2020 brought an unusual weather pattern – strong, hot, dry winds blew from the Eastside over to the Westside. Multiple ignitions started many fires along the western slope of the Cascades. While firefighters were able to stop some fires while they were small, several turned into large conflagrations.

Figure 1 shows the location of the fires that are the subject of this report. Included are the five Labor Day mega-fires over 100,000 acres (Lionshead, Beachie Creek, Holiday Farm, Riverside, Archie Creek), four large Labor Day fires that have important impacts to Oregon’s Forest Sector (Slater, South Obenchain, 242, Thielsen) and three fires that burned prior to Labor Day but have important impacts to the Eastern market area (White River, Green Ridge, P515). Collectively, these fires are referred to in this report as the “Labor Day 2020 fires.” Note that other fires that burned on Labor Day 2020 are not included in this report as they have limited impact on Oregon’s Forest Sector.

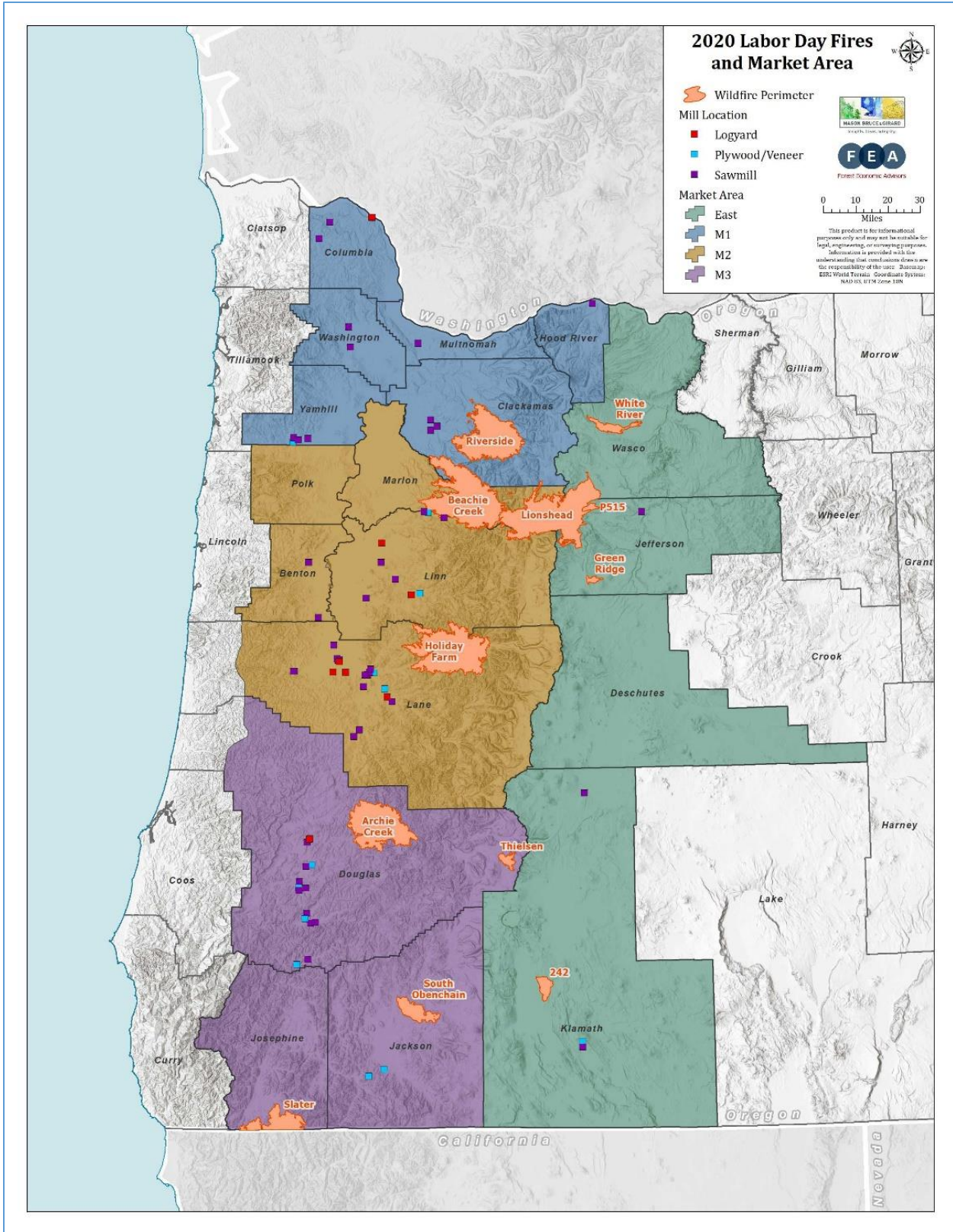


Figure 1: 2020 Oregon wildfires. This report includes the Labor Day fires greater than 10,000 acres that have impacted Oregon’s Forest Sector.

Figure 2 shows that about 840,000 of the total acres burned in 2020 were on the west side of the Cascades, making the 2020 fires unusual both in terms of the number of acres burned and their location. According to a recent study, the Labor Day 2020 fires were the largest fire events in the Cascade Mountains.⁴

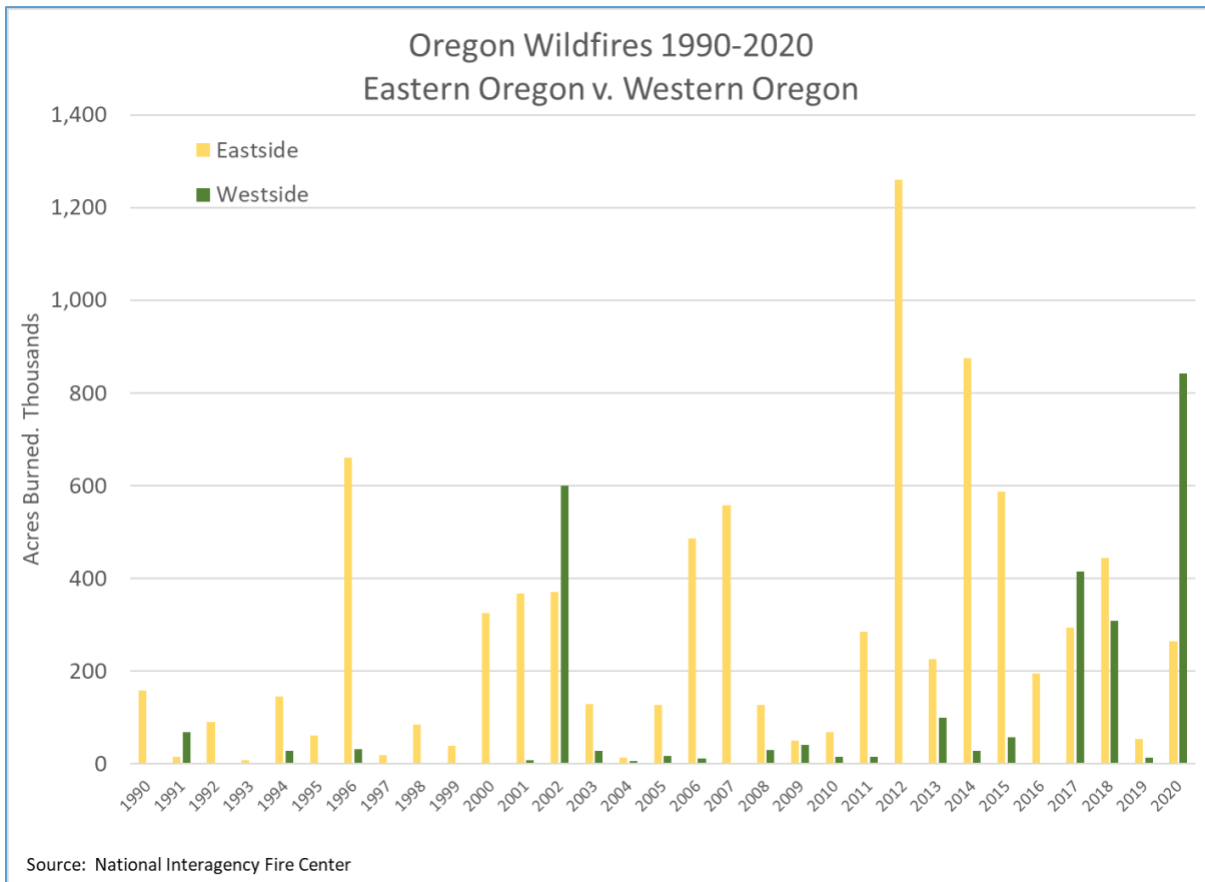


Figure 2: Annual acreage burned in Oregon, Eastside and Westside of the Cascade Mountains.

2.2 Acres Burned by Fire

The five megafires (Lionshead, Beachie Creek, Holiday Farm, Riverside, and Archie Creek) totaled about 799,000 acres, or 87% of the acres burned by the 12 fires included in this study (**Figure 3, Table 1**).⁵ Note that acres shown in the figures and tables in this section are forested acres within the fire perimeters. Non-forested acres and acres in roads are excluded.

As is typical of wildfire in forested landscapes, not all of the acres within the fire perimeter burned with the same intensity. About 25% of acres were classified as unburned, and 45% were burned with high severity (see

⁴ J.T. Abatzoglou, D. E. Rupp, L.W. O'Neill and M. Sadegh, "Compound extremes drive the western Oregon wildfires of September 2020." *Geophysical Research Letters*, 48, e2021GL092520 (2021). <https://doi.org/10.1029/2021GL092520>

⁵ In this report, "acres burned" means acres within the fire perimeters reported by the National Interagency Fire Center (NIFC). Some acres within the fire perimeters sustained little or no damage; other acres were not forested prior to the fires. The percentage reported here include non-forest acreage.

Section 3.1.1 for definitions). The remaining 30% of the acres were about evenly split between low and medium severity. Of the larger fires, Archie Creek burned hottest, with over 59% of the acres burning with high severity.

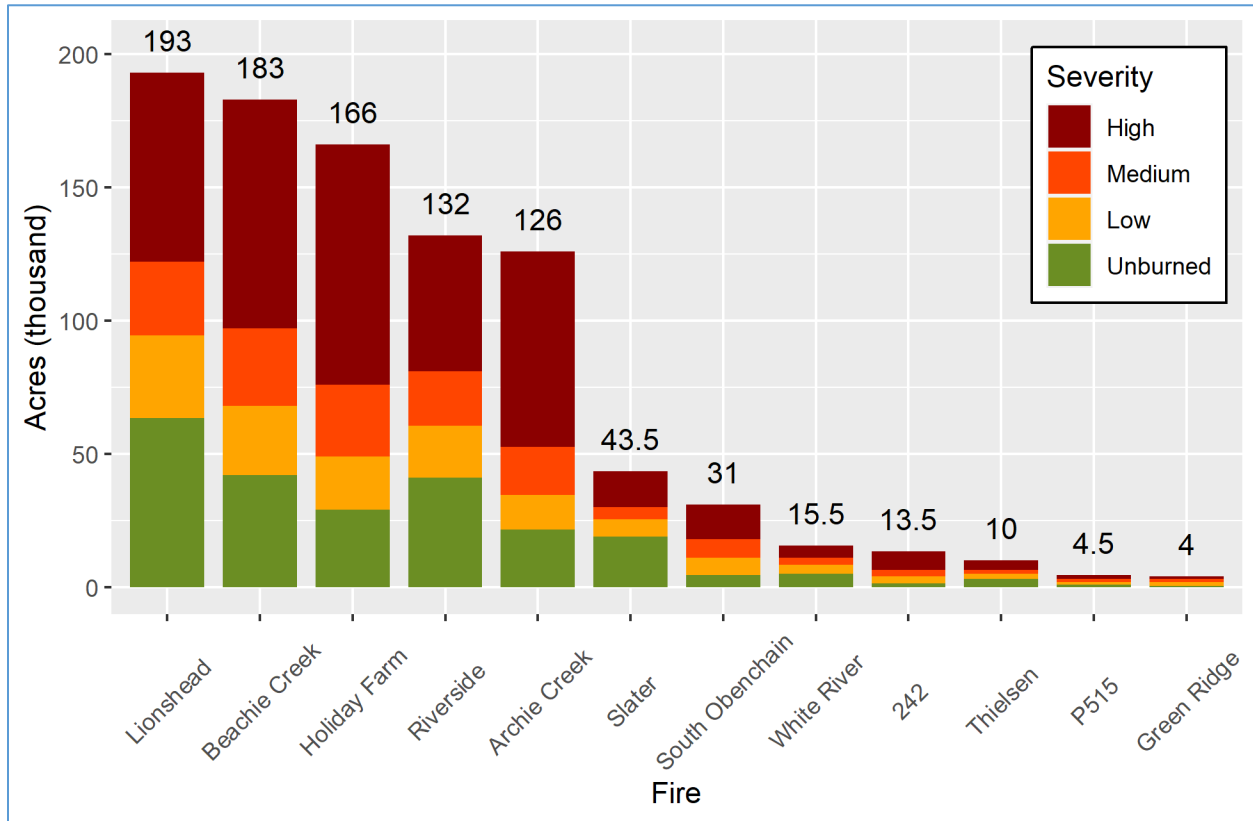


Figure 3: Acres burned by fire and severity.

Table 1: Acres burned by fire and severity.

| Fire | Forested Acres by Fire Severity | | | | Total |
|-----------------|---------------------------------|----------------|----------------|----------------|----------------|
| | High | Medium | Low | Unburned | |
| Lionshead | 71,200 | 27,300 | 31,100 | 63,300 | 192,900 |
| Beachie Creek | 86,000 | 28,800 | 25,800 | 42,000 | 182,600 |
| Holiday Farm | 89,900 | 26,900 | 20,100 | 28,900 | 165,800 |
| Riverside | 50,800 | 20,600 | 19,500 | 41,000 | 131,900 |
| Archie Creek | 73,600 | 17,800 | 12,800 | 21,300 | 125,500 |
| Slater | 13,700 | 4,300 | 6,600 | 19,200 | 43,800 |
| South Obenchain | 12,800 | 7,000 | 6,500 | 4,700 | 31,000 |
| White River | 4,500 | 2,400 | 3,300 | 4,800 | 15,000 |
| 242 | 6,800 | 2,600 | 2,500 | 1,400 | 13,300 |
| Thielsen | 3,500 | 1,400 | 1,800 | 2,800 | 9,500 |
| P515 | 1,500 | 800 | 1,100 | 1,000 | 4,400 |
| Green Ridge | 1,200 | 900 | 1,500 | 600 | 4,200 |
| Total | 415,500 | 140,800 | 132,600 | 231,000 | 919,700 |

2.3 Acres Burned by Owner Group

The fires burned through federal land managed by the US Forest Service (USFS) and the Bureau of Land Management (BLM), state land managed by the Oregon Department of Forestry (ODF), and private lands. For this study, private lands are further classified as either Large Private or Other Private (see Section 3.1.1 for definitions). To maintain confidentiality, acres of Tribal forests are included with Other Private.

While federal lands (USFS and BLM) accounted for 51% of the total forested acres, these fires were unusual in that they included a sizeable portion of private land – 261,000 acres of Large Private forestland and 164,000 acres of Other Private forestland (**Figure 4** and **Table 2**).

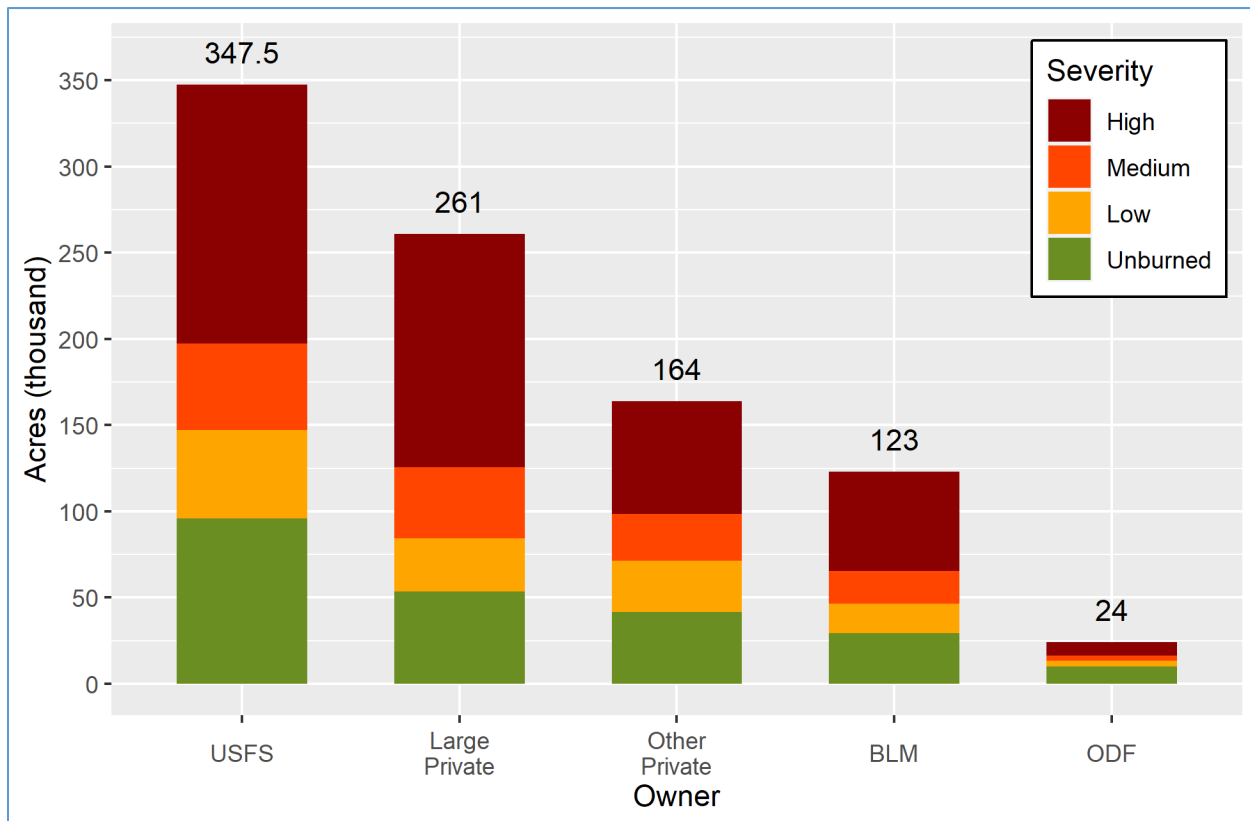


Figure 4: Acres burned by ownership and fire severity.

Table 2: Acres burned by ownership and fire severity.

| Owner | Forested Acres by Fire Severity | | | | Total |
|---------------|---------------------------------|----------------|----------------|----------------|----------------|
| | High | Medium | Low | Unburned | |
| USFS | 149,900 | 50,700 | 50,900 | 95,900 | 347,400 |
| Large Private | 135,400 | 41,000 | 30,800 | 53,500 | 260,700 |
| Other Private | 65,400 | 27,100 | 30,200 | 41,700 | 164,400 |
| BLM | 57,400 | 18,900 | 17,000 | 29,700 | 123,000 |
| ODF | 7,300 | 3,100 | 3,600 | 10,000 | 24,000 |
| Total | 415,400 | 140,800 | 132,500 | 230,800 | 919,700 |

Figure 5 shows land ownership patterns across Oregon. On the Westside of the Cascades, Other Private dominate the lower elevations, Large Private forests are found at mid-elevations, and USFS lands are at the higher elevations. The locations of the fires explain the loss by owner group shown in **Figure 4**.

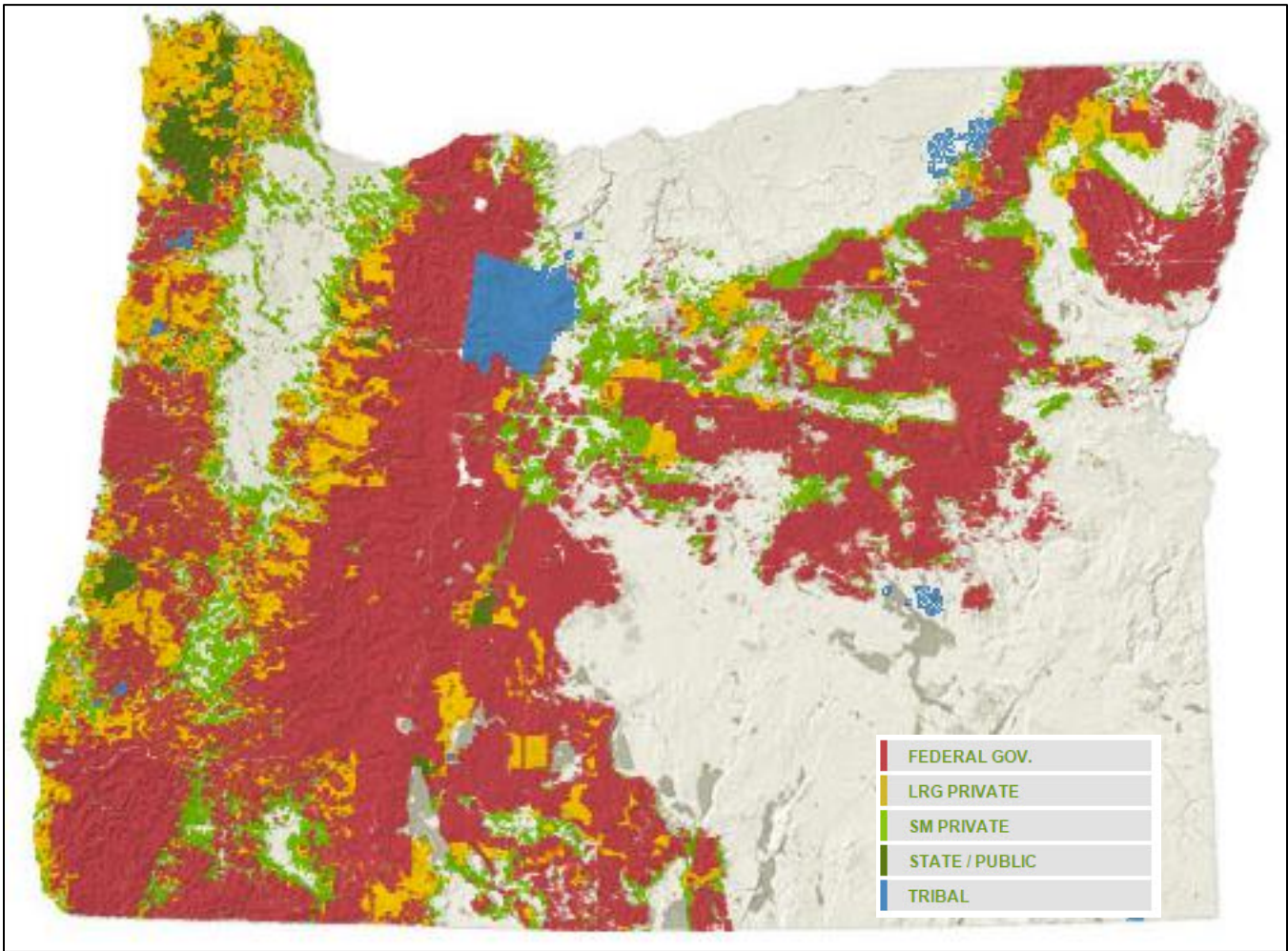


Figure 5: Oregon forest land ownership patterns. Source: Oregon Department of Forestry.

2.4 Acres Burned by County

The 2020 fires were unusual in that they burned more acres in the northern Westside counties, which typically experience higher rainfall than the southern Westside counties. As these larger fires were closer to Oregon’s population centers, many urban Oregonians were displaced by the fires. A stagnant weather pattern, furthermore, trapped the smoke on the Westside of the Cascades, affecting a large percentage of Oregon’s population.

Several counties were affected by more than one fire (Table 3).

Table 3: Acres by fire by county.

| Fire | Forested Acres by County | | | | | | | | | | Total Fire Acres |
|----------------------------|--------------------------|----------------|---------------|---------------|---------------|---------------|----------------|---------------|----------------|---------------|------------------|
| | Clackamas | Douglas | Jackson | Jefferson | Josephine | Klamath | Lane | Linn | Marion | Wasco | |
| Lionshead | 500 | - | - | 64,500 | - | - | - | 12,900 | 88,000 | 26,900 | 192,800 |
| Beachie Creek | 44,000 | - | - | - | - | - | - | 14,900 | 123,700 | - | 182,600 |
| Holiday Farm | - | - | - | - | - | - | 152,900 | 12,900 | - | - | 165,800 |
| Riverside | 131,900 | - | - | - | - | - | - | - | - | - | 131,900 |
| Archie Creek | - | 125,500 | - | - | - | - | - | - | - | - | 125,500 |
| Slater | - | - | - | - | 43,700 | - | - | - | - | - | 43,700 |
| South Obenchain | - | - | 30,900 | - | - | - | - | - | - | - | 30,900 |
| White River | - | - | - | - | - | - | - | - | - | 14,900 | 14,900 |
| 242 | - | - | - | - | - | 13,200 | - | - | - | - | 13,200 |
| Thielsen | - | 9,500 | - | - | - | - | - | - | - | - | 9,500 |
| P515 | - | - | - | 4,500 | - | - | - | - | - | - | 4,500 |
| Green Ridge | - | - | - | 4,200 | - | - | - | - | - | - | 4,200 |
| Total County Acres: | 176,400 | 135,000 | 30,900 | 73,200 | 43,700 | 13,200 | 152,900 | 40,700 | 211,700 | 41,800 | 919,700 |

Figure 6 and Table 4 show the distribution of fire severity by county. Marion, Clackamas, Lane, and Douglas counties each had at least 70,000 acres burned with medium or high severity.

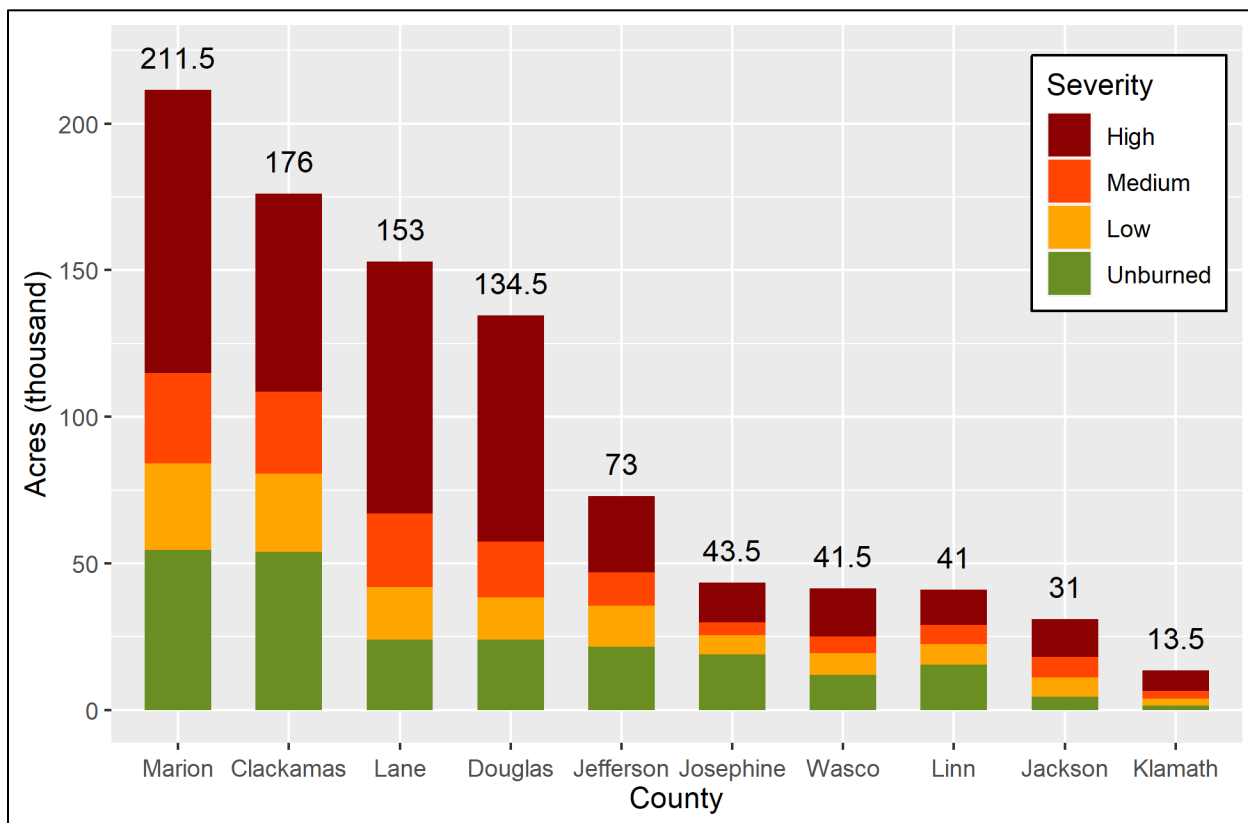


Figure 6: Acres by county and fire severity.

Table 4: Acres by county and fire severity.

| County | Forested Acres by Fire Severity | | | | Total |
|--------------|---------------------------------|----------------|----------------|----------------|----------------|
| | High | Medium | Low | Unburned | |
| Marion | 96,600 | 31,200 | 29,400 | 54,700 | 211,900 |
| Clackamas | 67,600 | 28,200 | 26,600 | 54,000 | 176,400 |
| Lane | 86,000 | 24,900 | 17,900 | 24,100 | 152,900 |
| Douglas | 77,100 | 19,200 | 14,600 | 24,100 | 135,000 |
| Jefferson | 26,200 | 11,400 | 14,200 | 21,400 | 73,200 |
| Josephine | 13,700 | 4,300 | 6,600 | 19,200 | 43,800 |
| Wasco | 16,700 | 5,700 | 7,300 | 11,900 | 41,600 |
| Linn | 12,000 | 6,400 | 7,100 | 15,300 | 40,800 |
| Jackson | 12,800 | 7,000 | 6,500 | 4,700 | 31,000 |
| Klamath | 6,800 | 2,600 | 2,500 | 1,400 | 13,300 |
| Total | 415,500 | 140,900 | 132,700 | 230,800 | 919,700 |

2.5 Acres Burned by Age Class

Figure 7 and **Table 5** tally acres burned by age class by owner group (see **Appendix A: Methods**). These distributions generally reflect the pre-fire age class distributions expected for each owner group across the larger landscape. Since Large Private forest landowners manage timber on shorter rotations, they typically have more acres in the younger age classes than do the USFS or BLM lands, where timber is older and substantial acres are managed as reserves.⁶ See Section 3.1.1 for age class definitions.

⁶ This study does not evaluate correlations between pre-fire forest conditions and fire severity.

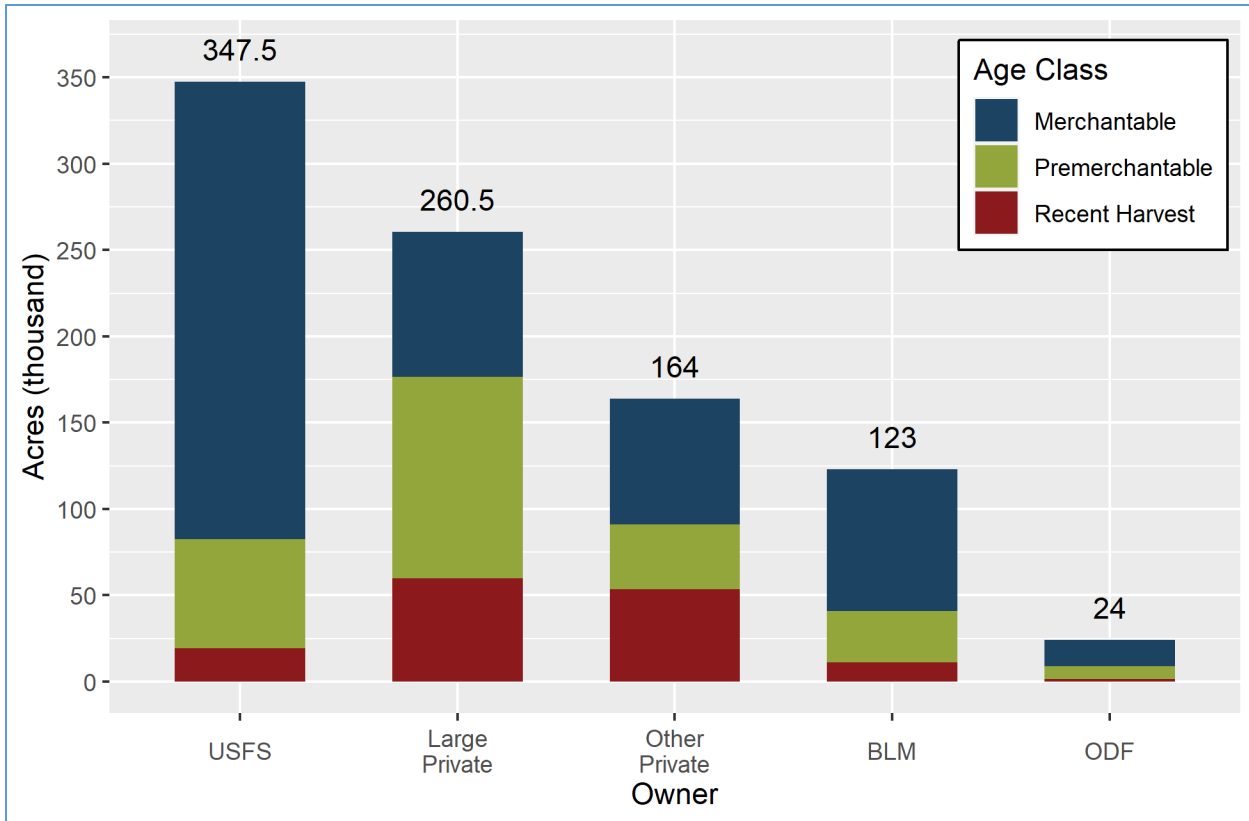


Figure 7: Acres by ownership and age class.

Table 5: Acres by ownership and age class.

| Owner | Forested Acres by Age Class | | | Total |
|---------------|-----------------------------|-----------------|----------------|----------------|
| | Merchantable | Premerchantable | Recent Harvest | |
| USFS | 265,200 | 62,900 | 19,300 | 347,400 |
| Large Private | 84,200 | 116,600 | 59,800 | 260,600 |
| Other Private | 73,100 | 37,700 | 53,600 | 164,400 |
| BLM | 82,200 | 30,100 | 10,800 | 123,100 |
| ODF | 15,000 | 7,700 | 1,300 | 24,000 |
| Total | 519,700 | 255,000 | 144,800 | 919,700 |

2.6 Acres Burned by Market Area

Figure 1 delineates four timber market areas and locates each fire with respect to the market areas and the mills in each market area. Figure 8 and Table 6 summarize acres burned by market area and burn severity. Market Area M2 experienced the most burned acres. Market Areas M2 and M3 had a greater share of high-severity burn than the other market areas.

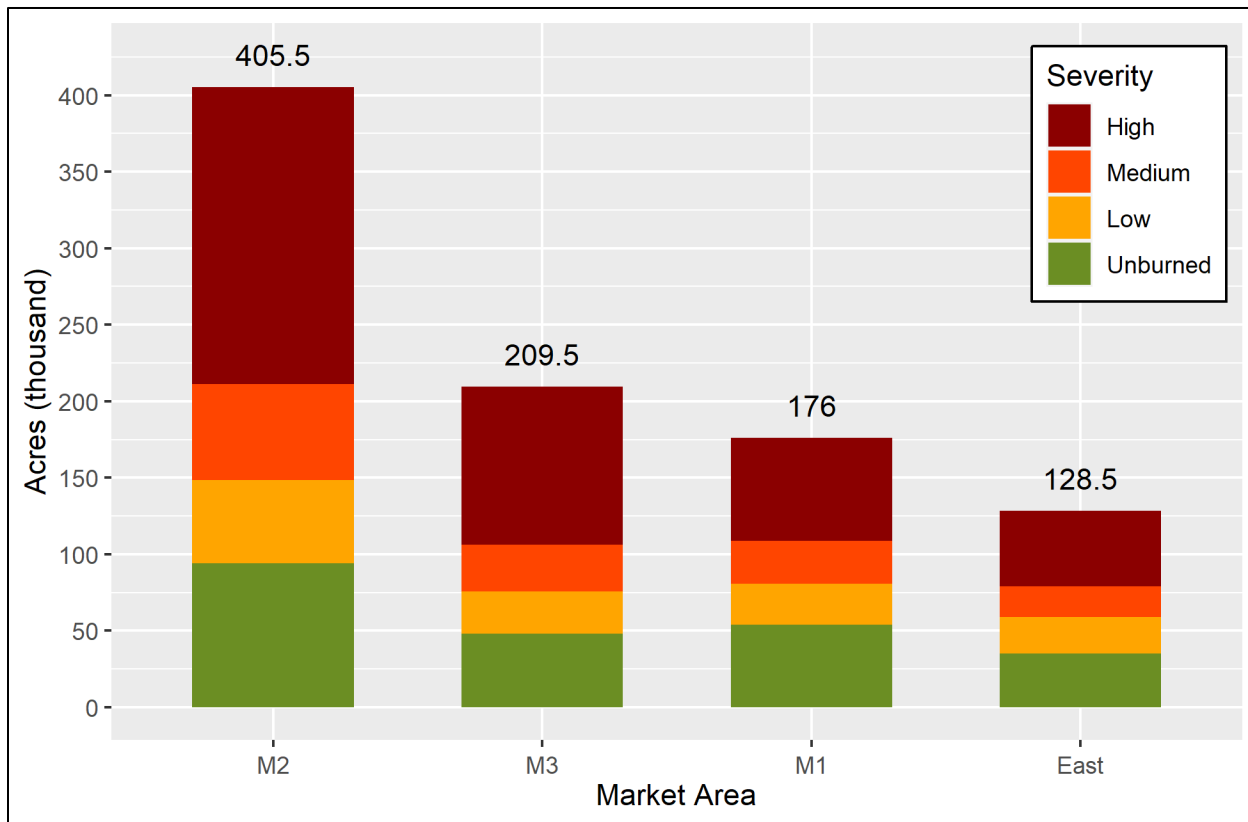


Figure 8: Acres burned by market area and fire severity.

Table 6: Acres burned by market area and fire severity.

| Market Area | Forested Acres by Fire Severity | | | | Total |
|--------------|---------------------------------|----------------|----------------|----------------|----------------|
| | High | Medium | Low | Unburned | |
| M2 | 194,600 | 62,400 | 54,300 | 94,100 | 405,400 |
| M3 | 103,500 | 30,500 | 27,700 | 47,900 | 209,600 |
| M1 | 67,600 | 28,200 | 26,600 | 54,000 | 176,400 |
| East | 49,700 | 19,800 | 24,000 | 34,800 | 128,300 |
| Total | 415,400 | 140,900 | 132,600 | 230,800 | 919,700 |

3.0 STUDY OBJECTIVES AND METHODS

This report quantifies, to the extent possible, the economic impacts of the Labor Day 2020 fires on Oregon's Forest Sector in terms of:

- acres burned, timber volume burned, and the economic value of the timber on the burned acres
- the scope and scale of forest restoration efforts, including the amount and economic value of the burned timber likely to be salvaged
- changes to the short- and long-term flows of timber harvest from the burned areas
- economic impacts of the fires on loggers, small private landowners, nurseries, etc.

Economic value in this report means the value of the end products produced by Oregon's Forest Sector. This report quantifies the economic value of the timber that was lost while recognizing that on some land, current forest management policies, regulations or objectives preclude capture of the full economic value.

3.1 Methods

An estimate of the economic impact of the 2020 Labor Day fires must consider many factors: the extent and severity of the fires; the nature of the land affected by the fires; the volume and characteristics of the timber burned; landowner objectives for the burned land; market values for the timber and wood products derived from the timber; and the costs of extracting and delivering the wood to manufacturing centers. The net economic impact must also account for recovery of the value of burned timber through salvage harvest.

The economic impact estimates in this study rely heavily on publicly available data about the fires and the forest land burned. Key assumptions are informed by interviews and surveys of affected parties. This section gives an overview of the data, assumptions and process for the fire impact estimates. A more detailed discussion of methods is found in Appendix A: Methods.

3.1.1 Definitions

Terms specific to this report follow.

Economic value of burned timber – The objective of this study is to estimate the impact of the fires on Oregon's Forest Sector in its entirety. The valuation metric used for this study is the value of the end products that could be realized if the timber had been processed by Oregon's forest product manufacturers. This valuation metric captures the value of the timber to the landowner, all of the contractors involved in extracting and delivering the logs, the primary wood product manufacturers, and all of the suppliers and contractors throughout the sector.

While the study's authors recognize that forestland provides a variety of additional priced and unpriced benefits, such as clean water, recreation, carbon sequestration, and other ecosystem services, estimating these values are beyond the scope of this study.

Fire Severity – In this report, fire severity is measured by the percentage of the canopy killed by fire, as calculated by the USFS and recorded in the Rapid Assessment of Vegetative Condition after Wildfires (RAVG) data files. This study classifies fire severity into four categories:

- Unburned – no damage to canopy
- Low Severity – less than 25% of the canopy lost to fire
- Medium Severity – 25% to 75% of the canopy lost to fire
- High Severity – more than 75% of the canopy lost to the fire

Merchantable – Timber that has sufficient size and quality to be made into a primary wood product such as lumber, veneer, plywood, pulp, etc. With the exception of “Probable Salvage,” timber volumes in this report have not been adjusted for post-fire defect.

Oregon’s Forest Sector – This study focuses on the portion of Oregon’s Forest Sector related to the production of primary wood products from Oregon’s manufacturers. Included are all of the subsectors related to growing and harvesting timber for manufacture. **Figure 9** illustrates the Forest Sector.

Owner Group

- USFS – National Forest lands managed by the US Forest Service, including the O&C “controverted” lands
- BLM – O&C and Public Domain lands managed by the Bureau of Land Management
- ODF – Board of Forestry Lands and 482 acres of Common School Lands managed by the Oregon Department of Forestry
- Large Private – lands owned and managed by companies and financial institutions
- Other Private – lands owned by small woodland owners, Native American tribes, conservation organizations and a few acres managed by the Bureau of Reclamation

Salvage harvest – The harvest of timber from burned acres to recover economic value. In this study, trees that are cut but not utilized for wood products are not counted as salvage harvest.

Timber volumes – In this study, timber volumes are expressed in Scribner board feet using long log scale assuming 36’ average log length.

- Mbf – thousand board feet of timber. There is typically four to five Mbf on a log truck.
- MMbf – million board feet. A typical sawmill consumes 100-200 MMbf per year.
- Bbf – 1 billion board feet. Oregon’s average annual timber harvest typically ranges between 3.6 to 4.0 Bbf.



Figure 9: Oregon's Forest Sector.

3.1.2 Data Sources

The geographic scope for each fire is based on the November 13, 2020, fire perimeters published by the National Interagency Fire Center (NIFC). Fire severity data is derived from percent canopy cover loss layer from the USFS Rapid Assessment of Vegetation Condition (RAVG) data.

Land within the fire perimeters was classified into three age groups (0-8 years, 9-34 years, 35 years and older) using an image classification tool proprietary to Mason Bruce & Girard (MB&G). Sentinel 2 and LANDSAT 8 images from 2019 and 2020 were used to estimate the in-place, pre-fire age group data. Future harvest impacts rely on pre-fire age class distribution data derived from the USFS Forest Inventory and Analysis (FIA) data and are further informed by MB&G experience and observations.

Timber volume estimates are based on the USFS/OSU GNN data sets. Expectations for salvage recovery, and restoration treatments were informed by interviews with land managers and others.

3.1.3 Key Assumptions

This study strives to provide a contemporary and consistently defined overview of economic impacts that occur over a large area managed by a variety of timberland owners. There are few systematically collected post-fire data available. A variety of assumptions are therefore required to derive the estimates. **Appendix A: Methods** has a more detailed discussion of processes and assumptions. Below are a few key assumptions.

Commercial timber value – The objective of this study is to quantify the economic impacts of the 2020 Labor Day fires. A large component of the impact is the loss of commercial value of the timber killed in the fire. For this study, the commercial value of timber is the value of the products produced by primary producers of Oregon’s Forest Sector, and includes lumber, veneer, plywood, posts/poles/pilings, export logs, reconstituted board, pulp and paper products. Subsequent calculations show how the total commercial value is distributed among landowners, loggers, log haulers and manufacturers.

Landowner Objectives – This study quantifies the economic loss for all of the timber burned by the fires, regardless of the objectives of the landowner or land manager. Estimates of volume and value of burned timber that will be recovered through salvage harvest, however, are based on information about landowner intentions, which reflect current landowner objectives.

This study does not attempt to estimate any value associated with ecosystem services, carbon sequestration or any other nonmarket values.

Fire intensity – Not all the acres within the fire perimeters burned with the same intensity, and not all of the timber within the fire perimeters was damaged. For this study, estimates of fire damage are based on a fire severity index that measures the percent of the canopy cover loss. These data are collected and reported in the RAVG GIS layers produced by the USFS based on satellite imagery from October 9, 2020 (**Appendix A: Methods** contains more details). For this study, fire severity is reported in four categories: Unburned, Low Severity, Medium Severity, and High Severity (see Section 3.1.1 for definitions). **Figure 10** and **Figure 11** show a satellite image and the subsequent fire severity classification.



Figure 10: Area showing mixed canopy cover in the central portion of the Holiday Farm Fire, where some areas went completely unburned adjacent to areas with complete canopy cover loss.

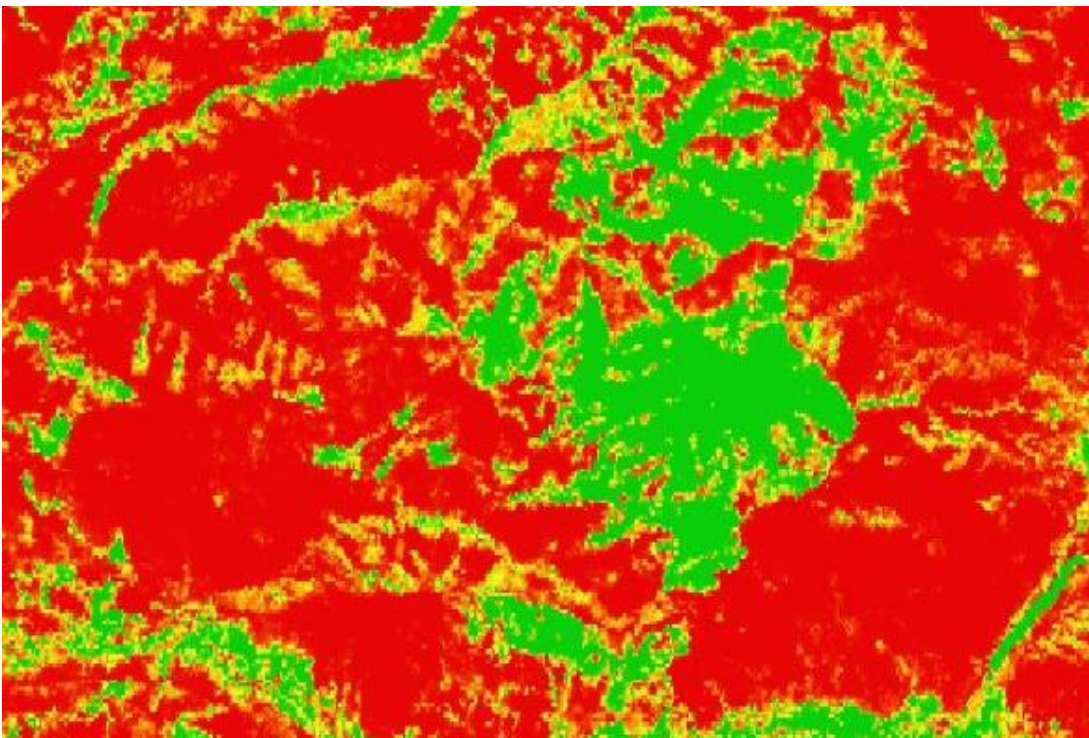


Figure 11: Central area of the Holiday Farm Fire (precisely the same location as Figure 10), showing the RAVG severity estimate based on canopy cover loss. Green indicates unburned, yellow <25%, orange 25-75%, and red >75% canopy cover loss.

Discussions with Large Private landowners suggest that acres burned with medium- and high-intensity fire are likely candidates for salvage logging and reforestation. Unburned acres, and acres burned with low-intensity fire will not likely be salvaged or need specific reforestation efforts. To standardize the calculation of economic impact, this study applies this convention to all burned acres, regardless of ownership.

Merchantability and silviculture – While different landowners have different approaches to timber management, this study applies a consistent set of silvicultural assumptions across all landowners. Timber stands 35 years and older are considered available for regeneration or restoration harvest.

Defect and reduction factors – Pre-fire gross timber volumes were converted to pre-fire net volumes assuming a factor of 7.5% for normal breakage and defect. Additional post-fire reduction factors recognize that each owner group proposes different restoration strategies, requiring further reductions for defect, treatment intensity, and pace of operations. This study makes defect and reduction factor assumptions specific to each owner group, which are described in more detail in **Appendix A: Methods**.

Merchantable acres – Pre-fire age classification assigns the merchantable age class to 35 years old and greater. This classification is likely suitable for Westside Large Private and Other Private lands. The USFS and BLM, however, have stated a likely focus on restoration in forests aged 50 years and older. Expected volume must be reduced for these ownerships by the fraction of ages between 35 and 50 years. Details are found in **Appendix A: Methods**.

Rate of salvage harvest – Each landowner estimates a time horizon in which to complete restoration operations. Since deterioration of timber scheduled for salvage harvest increases with time, estimates of recoverable salvage volumes must reflect each owner group's expectations. Details of the assumptions are found in **Appendix A: Methods**.

Availability for harvest – Management of federal and state timberland is guided by forest management plans that allocate some lands to uses that preclude timber management. Under the Northwest Forest Plan (NWFP), for example, sustainable timber management is limited to the Land Use Allocations (LUA) that fall outside of Congressionally Withdrawn Areas, Riparian Reserves, and Late Successional Reserves. Similarly, the BLM has identified a Harvest Land Base among NWFP LUA that is available for sustainable harvest. The ODF seeks to protect existing stands with complex structure. Regulations under the Oregon Forest Practices Act limit harvest activity within riparian areas on private lands. Riparian management assumptions are explained further in **Appendix A: Methods**.

Acres within fire perimeters but that are not forested do not contribute to estimates of fire-damaged acres or production of timber volume from restoration treatments.

Reforestation costs – This study estimates the cost of a standard set of reforestation activities, including site preparation, planting and brush control. Costs of natural regeneration are not estimated.

3.1.4 Accounting Framework

A key objective of this study is to estimate the economic impacts of the fires on Oregon's Forest Sector. The loss of commercial value of the trees damaged by the fires is fundamental to the analysis. Also important, however, is the value of the fire-damaged trees that can or will be recovered through salvage harvest. The accounting framework for this study accounts for both the value of the timber lost and the likely recovery of value through salvage harvest.

Table 7 is an example of the accounting framework that is used in this report to describe the impacts of the fires in terms of acres burned, timber volumes and timber values. The rows are defined below.

Table 7: Accounting framework for economic damages from timber on the burned acres.

| | Row | Acres | | | | | Total |
|-------------------------------------|-----------|---------------|---------------|--------------|---------------|---------------|----------------|
| | | USFS | BLM | ODF | Large Private | Other Private | |
| Total Acres | 1 | 364,300 | 129,300 | 25,200 | 271,400 | 180,700 | 970,900 |
| Non-Forest and Roads | 2 | 16,900 | 6,300 | 1,100 | 10,700 | 16,200 | 51,200 |
| Forested Acres | 3 | 347,400 | 123,000 | 24,100 | 260,700 | 164,500 | 919,700 |
| Unburned and Low Severity | 4 | 132,400 | 43,300 | 12,600 | 73,100 | 63,500 | 324,900 |
| Medium and High Severity | 5 | 215,000 | 79,700 | 11,500 | 187,600 | 101,000 | 594,800 |
| Pre-merchantable | 6 | 53,600 | 27,000 | 5,100 | 137,000 | 58,600 | 281,300 |
| Merchantable | 7 | 161,400 | 52,700 | 6,300 | 50,600 | 42,400 | 313,400 |
| Unavailable for Sustainable Harvest | 8 | 108,700 | 37,800 | 400 | 6,200 | 3,300 | 156,400 |
| Available for Sustainable Harvest | 9 | 52,700 | 14,900 | 6,000 | 44,400 | 39,000 | 157,000 |
| Probable Salvage Acres | 10 | 18,400 | 11,000 | 4,800 | 38,000 | 33,600 | 105,800 |

Row 1 – Total Acres. These are the acres within the fire perimeters. (Row 1 = Row 2 + Row 3.)

Row 2 – Non-Forest Acres. Acres classified as non-forest or roads. Road acres are withdrawn at a rate of 3% overall, not by a spatial layer of road networks. Road acres do not have any commercial timber volume.

Row 3 – Forested Acres. These are areas with continuous tree cover within fire perimeters. (Row 3 = Row 4 + Row 5.)

Row 4 – Unburned and Low Severity. Forested acres that are either unburned or burned with low severity. Fire damage on these acres is minimal and the assumption is that these acres will likely not have salvage harvest or need reforestation.

Row 5 – Medium and High Severity. Forested acres that burned with either medium or high severity. Based on interviews and observation, the assumption is that most private landowners will attempt salvage harvest and active reforestation on acres in this category. (Row 5 = Row 6 + Row 7.)

Row 6 – Pre-merchantable. These are the forested acres burned with medium or high severity that are less than 35 years old. While some private landowners may salvage harvest some of these acres, this study assumes younger acres will not provide enough merchantable logs to support salvage efforts. Reforestation may occur on some pre-merchantable acres with high burn severity.

Row 7 – Merchantable. These are forested acres burned with medium or high severity that are 35 years old and greater, and could support a salvage harvest. (Row 7 = Row 8 + Row 9.)

Row 8 – Unavailable for sustainable harvest. Some of the merchantable acres burned with medium or high severity are unavailable for salvage harvest due to management decisions, policies and/or regulation. The 1993 Northwest Forest Plan, for example, categorizes USFS acres to different land use allocations, some of which preclude management of the land for long-term multiple-rotation timber harvest. For this analysis, only USFS lands that fall outside of withholdings and reserves are considered available for long-term multiple-rotation harvest.⁷ Similarly, the BLM’s 2016 Resource Management Plan identifies a Harvest Land Base (HLB) LUA, which is available for long-term multiple-rotation harvest. Land Use Allocations for State Land managed by ODF do not

⁷ This may overestimate the USFS lands available for long-term multiple-rotation management as some of the lands in the matrix may be precluded from timber management for reasons outside the NWFP.

specifically preclude long-term multiple-rotation harvest, but ODF seeks to initially limit harvest in acres designated for development of complex forest structure. On private land, the Forest Practices Act generally precludes harvest in riparian areas. Across all ownership, some portion of the unavailable acres might be salvaged after a fire, typically when the salvage can be shown to further management objectives.

Row 9 – Available for sustainable harvest. These are the forested acres, burned with medium or high severity, of merchantable age, available for long-term multiple-rotation forest management.

Row 10 – Probable Salvage. These are the acres likely to have salvage harvest. Federal and State agencies reported salvage targets on an acre basis. Salvage acreage targets for private land are based on survey responses, observations and experience. Salvage targets are specified in **Appendix A: Methods**.

3.2 Limitations of this Study

This report focuses on economic losses to the Forest Sector. There are many other economic impacts and, given the scope and scale of the fire, those losses may be substantial. Such impacts include:

- non-commercial natural resource losses and compromised ecosystem services
- personal injury and wide-scale health effects associated with wildfire smoke
- loss of real property and infrastructure
- loss of employment
- loss of commercial value stemming from recreation uses of the forest

This study, however, does not address these impacts. This study, furthermore, offers no insight or opinion about the origin and cause of the fires or liability for damages. This study does not provide any insight into the dynamics of the fires nor the distribution of impacts between each fires ownership groups. Calculations and estimates offered in this study should not be used to calculate damages under ORS statutes.

4.0 ACREAGE BURNED

Key Findings

Across all landownerships:

- 971,000 acres were within fire perimeters of the Labor Day 2020 fires.
- 595,000 forested acres were burned with medium or high severity.
- 157,000 acres are on lands available for long-term, multiple-rotation timber management.
- 106,000 acres will likely be salvage harvested.

About 51% of the acres within the fire perimeters are on federal land, 47% on private land and 2% on state land.

Private lands account for about 68% of the acres expected to be salvaged.

About 73% of the acres burned with medium or high severity on Large Private land were in pre-merchantable age classes and most will not be salvage harvested.

4.1 Results

The accounting of economic impacts begins with a classification and evaluation of the acres burned by the fires. Wildfires typically inflict damage unevenly across the landscape – on some acres nearly all the trees are killed, on other acres relatively few trees are burned. Economic impacts also must reflect the age and nature of the timber burned, management objectives and practices for each owner group, and the likelihood of salvage.

Table 8 summarizes the acres within the perimeters of the 12 Labor Day 2020 fires included in this study, using the accounting framework developed for this study. Similar information is summarized by individual fire, county and market areas in **Appendices B, C and D**, respectively.

Table 8: Classification of acres burned, by owner group. Acres may not sum due to rounding.

| | Acres | | | | | | |
|-------------------------------------|-----------|---------------|---------------|--------------|---------------|---------------|----------------|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
| Total Acres | 1 | 364,300 | 129,300 | 25,200 | 271,400 | 180,700 | 970,900 |
| Non-Forest and Roads | 2 | 16,900 | 6,300 | 1,100 | 10,700 | 16,200 | 51,200 |
| Forested Acres | 3 | 347,400 | 123,000 | 24,100 | 260,700 | 164,500 | 919,700 |
| Unburned and Low Severity | 4 | 132,400 | 43,300 | 12,600 | 73,100 | 63,500 | 324,900 |
| Medium and High Severity | 5 | 215,000 | 79,700 | 11,500 | 187,600 | 101,000 | 594,800 |
| Pre-merchantable | 6 | 53,600 | 27,000 | 5,100 | 137,000 | 58,600 | 281,300 |
| Merchantable | 7 | 161,400 | 52,700 | 6,300 | 50,600 | 42,400 | 313,400 |
| Unavailable for Sustainable Harvest | 8 | 108,700 | 37,800 | 400 | 6,200 | 3,300 | 156,400 |
| Available for Sustainable Harvest | 9 | 52,700 | 14,900 | 6,000 | 44,400 | 39,000 | 157,000 |
| Probable Salvage Acres | 10 | 18,400 | 11,000 | 4,800 | 38,000 | 33,600 | 105,800 |

Across all 12 fires, about 51% of the acres burned were on federal land (USFS and BLM), 47% were on private land (Large Private and Other Private) and about 2% were on state land managed by ODF (Row 1).

About 5% of the burned acres are classified as non-forest or roads. Some of these acres are developed land and sustained heavy economic damages to property and real estate, but those impacts are not tallied in this report.

Of the 920,000 acres of forested land located within the fire perimeters, about 325,000 acres (35%) are classified as being unburned or having burned with low severity. Interviews with forest managers indicate that

most of these acres did not sustain enough damage to require salvage harvest or additional investments in forest restoration.

Of the 313,000 forested merchantable acres that burned with medium or high severity (**Table 8**, row 7), about 157,000 acres (50%) are available for long-term multiple rotation timber management (**Table 8**, Row 9). The proportions vary by owner – most of the Large Private and Other Private lands are available, while much smaller portions of the federal land are available for harvest.

Table 9, **Table 10** and **Table 11** summarize Rows 1, 5 and 9 from **Table 8**, by fire.

Table 9: Total acres within the fire perimeters, by fire.

| Total Acres in Fire Perimeter | | | | | | |
|-------------------------------|----------------|----------------|---------------|----------------|----------------|----------------|
| Fire | USFS | BLM | ODF | Large Private | Other Private | Total |
| Lionshead | 104,800 | - | 500 | 6,200 | 93,100 | 204,600 |
| Beachie Creek | 50,500 | 38,600 | 23,900 | 61,600 | 19,000 | 193,600 |
| Holiday Farm | 31,200 | 18,500 | 100 | 110,800 | 13,300 | 173,900 |
| Riverside | 83,000 | 12,600 | - | 39,400 | 3,000 | 138,000 |
| Archie Creek | 26,400 | 40,400 | - | 46,400 | 18,400 | 131,600 |
| Slater | 39,300 | 2,700 | 600 | 1,500 | 1,600 | 45,700 |
| South Obenchain | - | 14,800 | - | 5,500 | 12,400 | 32,700 |
| White River | 8,700 | 1,700 | - | - | 7,000 | 17,400 |
| 242 | 9,200 | - | - | - | 5,200 | 14,400 |
| Thielsen | 9,900 | - | - | - | - | 9,900 |
| P515 | - | - | - | - | 4,600 | 4,600 |
| Green Ridge | 1,200 | - | - | - | 3,100 | 4,300 |
| Owner Total | 364,200 | 129,300 | 25,100 | 271,400 | 180,700 | 970,900 |

Table 10: Forested acres burned with medium or high severity, by fire.

| Forested Acres Burned at Medium and High Severity | | | | | | |
|---|----------------|---------------|---------------|----------------|----------------|----------------|
| Fire | USFS | BLM | ODF | Large Private | Other Private | Total |
| Lionshead | 54,600 | - | 200 | 2,400 | 50,700 | 107,900 |
| Beachie Creek | 39,900 | 21,400 | 11,200 | 41,100 | 9,100 | 122,700 |
| Holiday Farm | 20,000 | 15,400 | - | 81,600 | 7,000 | 124,000 |
| Riverside | 49,200 | 4,800 | - | 21,400 | 1,100 | 76,500 |
| Archie Creek | 17,700 | 27,200 | - | 37,000 | 13,100 | 95,000 |
| Slater | 18,100 | 300 | - | 700 | 200 | 19,300 |
| South Obenchain | - | 9,800 | - | 3,500 | 8,100 | 21,400 |
| White River | 2,600 | 800 | - | - | 4,200 | 7,600 |
| 242 | 7,000 | - | - | - | 3,200 | 10,200 |
| Thielsen | 5,400 | - | - | - | - | 5,400 |
| P515 | - | - | - | - | 2,600 | 2,600 |
| Green Ridge | 500 | - | - | - | 1,800 | 2,300 |
| Owner Total | 215,000 | 79,700 | 11,400 | 187,700 | 101,100 | 594,800 |

Table 11: Forested acres of merchantable age available for sustainable harvest, burned with medium or high severity.

| Forested Acres Burned at Medium and High Severity Available for Sustainable Harvest | | | | | | |
|---|---------------|---------------|--------------|---------------|---------------|----------------|
| Fire | USFS | BLM | ODF | Large Private | Other Private | Total |
| Lionshead | 12,300 | - | 100 | 1,500 | 27,900 | 41,800 |
| Beachie Creek | 5,400 | 4,400 | 5,800 | 8,400 | 2,300 | 26,300 |
| Holiday Farm | 6,400 | 2,400 | - | 16,500 | 1,400 | 26,700 |
| Riverside | 15,000 | 1,000 | - | 4,100 | 100 | 20,200 |
| Archie Creek | 4,900 | 6,800 | - | 12,900 | 2,900 | 27,500 |
| Slater | 5,900 | - | - | 300 | 100 | 6,300 |
| South Obenchain | - | 300 | - | 800 | 900 | 2,000 |
| White River | 800 | - | - | - | 1,000 | 1,800 |
| 242 | 600 | - | - | - | 200 | 800 |
| Thielsen | 1,400 | - | - | - | - | 1,400 |
| P515 | - | - | - | - | 1,100 | 1,100 |
| Green Ridge | - | - | - | - | 1,100 | 1,100 |
| Owner Total | 52,700 | 14,900 | 5,900 | 44,500 | 39,000 | 157,000 |

4.2 Assumptions for Estimates of Salvage Acres

Row 10 of **Table 8** summarizes assumptions about the acreage likely to be harvested, based on interviews and observations. Assumptions follow:

The acres reported in Rows 1 through 9 of **Table 8** are based on a consistent set of data processing operations applied consistently across all ownerships and all fires. **Appendix A: Methods** describes these processes in detail. Estimating the likely extent of salvage requires a number of assumptions based on interviews, surveys and observation. Those assumptions are discussed in this section.

About 595,000 acres (65% of the forested land base) burned with a medium or high intensity – causing greater than 25% canopy mortality. **Figure 4** illustrates that most of this was high severity – greater than 75% of the canopy was burned. Interviews with managers of Large Private forest lands indicate that where there is sufficient merchantable volume, these acres will be salvaged and reforested.⁸ This study assumes that acres that are 35 years and older have sufficient volume to consider salvage logging prior to reforestation, while burned acres less than 35 years old will need to be reforested without salvage harvest.⁹ Of the forested acres burned by medium and high severity fire, about 313,000 acres (53%) are old enough to support salvage logging. The remaining 281,000 acres (47%) are pre-merchantable – too young to support salvage harvest. This is a general rule used for the purposes of the analysis. Conditions on the ground vary. We recognize that some acreage older than 35 may not have sufficient recoverable volume to support an economic harvest, while some areas less than age 35 will have economically recoverable products.

⁸ Salvage prior to reforestation is generally preferred by managers of Large Private forestland. Proceeds from the salvage harvest can help finance reforestation. The harvest operation, furthermore, removes the standing dead trees, which minimizes post-fire fuel loads and reduces post-fire safety hazards.

⁹ Some private landowners have salvage-harvested acres younger than 35 years.

Not all the severely burned timberland is available for harvest. Management of public lands, for example, is guided by forest management plans that allocate land for different uses, some of which proscribe salvage harvest. Regarding availability for salvage harvest, this study assumes:

- USFS land managers report that salvage harvest will be limited by budget and personnel – staffing and funding have not increased because of the fire. Over the next few years, the agency expects to dedicate most resources to removing hazard trees from the 1,200 miles of road within the fire boundaries. The agency states, furthermore, that the likelihood of legal challenges to salvage plans over larger areas will limit operations. The USFS will therefore focus its effort on improving safety along roads, recreation sites and administrative sites. At the time of this report, the USFS has prepared one roadside salvage sale (Slater Fire) that covers about 4,100 acres of salvage. Environmental groups have filed a lawsuit challenging the sale. If the lawsuit is decided in favor of the USFS, the agency will prepare and offer another three or four similar sales.

The salvage acres in Row 10 reflect the study team’s assumptions about the distribution of roads within the burned area, buffer widths and age classes. The USFS has not yet estimated the acres or volumes of expected salvage. The salvage estimate in Row 10 reflects conservative assumptions about hazard tree salvage made by the study team, including removal only of trees leaning toward roadways (a 50% reduction factor).

On BLM lands, area salvage is permitted on lands in the HLB identified in the BLM’s 2016 Resource Management Plans. Land Use Allocations outside the HLB encompass about 38,000 acres of the 53,000 severely burned merchantable acres, leaving about 15,000 acres available for harvest. BLM land managers seek to salvage all the acres 50 years and older in the HLB where at least 50% of the canopy cover was lost, but will also take into consideration lack of access, occupancy by sensitive species, sensitive soils, and other considerations related to economic viability, operational feasibility, RMP management direction, ESA consultation, internal capacity, and the rate of decay in potential salvage areas. Land managers at the BLM reported intent to salvage between 8,000 and 14,000 acres, so this study assumes that the midpoint of that range, or 11,000 acres, of salvage will be conducted on the HLB.

BLM also has about 160 miles of roads within the fire perimeters but has not yet made estimates of acres or volumes for hazard tree removal, and hazard tree volume is not included in the estimate of likely salvage.

- On State Forest Lands, the 2010 Forest Management Plan identifies acres that are or will grow into complex forest structure as the Desired Future Condition (DFC). About 3,000 acres of the existing 16,500 acres of DFC were burned with medium or high severity.

ODF recently modified the Implementation Plan for the Santiam State Forest and shows a range of intended salvage.¹⁰ The midpoints of the ranges are 3,125 acres for clearcuts and 1,663 acres for partial cutting, for a total of 4,788 acres. The acreage in **Table 8** is the midpoint of the range.

¹⁰ Note that several environmental groups have filed suit with the intent to stop ODF’s planned salvage harvest.

- On private land, harvest is regulated by the Oregon Forest Practices Act, which imposes limitations on harvest in riparian areas. Private landowners report that fire salvage is permitted in some riparian areas and is even encouraged if salvage will lead to prompt reforestation of riparian areas.¹¹ This study makes a conservative assumption that fire salvage harvest will occur in 50% of riparian areas.

Large Private landowners began salvaging burned acres as soon as the fires were extinguished, and continue to do so. Interviews suggest that most landowners intend to salvage and then regenerate all the merchantable acres that burned with medium and high severity. In fact, some have salvaged acres younger than the 35-year age used to delineate merchantability in this study. This study, however, assumes that ultimately the Large Private landowners will be able to salvage 80% of the merchantable acres.

- Other Private landowners face unique challenges when trying to salvage burned timber, as discussed in Section 8.5. This study assumes that Other Private landowners will be able to harvest about 50% of the available merchantable acres that burned with medium and high severity.

¹¹ In some cases, leaving large woody debris in riparian areas is a desirable outcome.

5.0 VOLUME OF TIMBER BURNED

Key Findings

Across all landownerships:

- 15 Bbf of timber is located within fire perimeters of the Labor Day 2020 fires.
- 9 Bbf of timber is on acres burned with medium or high severity.
- 4 Bbf of timber is on merchantable acres available for long-term multiple-rotation timber management.
- 1.4 Bbf of timber will likely be salvage harvested.

Private lands will account for about 64% of the salvage volume.

About 71% of the timber on Large Private lands that burned with medium or high severity will likely be recovered in salvage harvest. Comparable figures for other owner groups are 44% for ODF, 26% for Other Private, 10% for BLM and 4% for USFS.

5.1 Results

Table 12 reports the volume within the fire perimeters. Timber volume estimates are derived from publicly available inventory data as described in **Appendix A: Methods**. Rows 1-9 report green timber volumes prior to the fire. Row 10 is an estimate of the salvage volume that will be recovered from the salvage acres in **Table 8**, and volumes have been adjusted for anticipated harvest methods and fire-related deterioration.

Table 12 shows that the fire perimeters contained nearly 15 Bbf of timber across all owner groups.¹² Of that, more than 9 Bbf was on land burned with medium and high severity. Due to landowner objectives and regulations, about 3.9 Bbf (42%) is on land that is available for harvest. This study estimates that about 1.4 Bbf will ultimately be salvaged.

Table 12: Classification of timber volume on burned acres, by landowner. Volumes may not sum due to rounding.

| | Row | Volume (Mbf) | | | | | Total |
|-------------------------------------|-----------|----------------|----------------|---------------|----------------|----------------|------------------|
| | | USFS | BLM | ODF | Large Private | Other Private | |
| Total Volume | 1 | 8,761,000 | 3,276,000 | 379,000 | 1,752,000 | 768,000 | 14,936,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 8,761,000 | 3,276,000 | 379,000 | 1,752,000 | 768,000 | 14,936,000 |
| Unburned and Low Severity | 4 | 3,413,000 | 1,116,000 | 217,000 | 693,000 | 333,000 | 5,772,000 |
| Medium and High Severity | 5 | 5,348,000 | 2,160,000 | 162,000 | 1,060,000 | 436,000 | 9,166,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 5,348,000 | 2,160,000 | 162,000 | 1,060,000 | 436,000 | 9,166,000 |
| Unavailable for Sustainable Harvest | 8 | 3,548,000 | 1,544,000 | 10,000 | 130,000 | 40,000 | 5,272,000 |
| Available for Sustainable Harvest | 9 | 1,801,000 | 616,000 | 152,000 | 930,000 | 396,000 | 3,895,000 |
| Probable Salvage Mbf | 10 | 204,000 | 216,000 | 71,000 | 748,000 | 111,000 | 1,350,000 |

The likely salvage volume as a percentage of the merchantable volume on acres burned with medium or high severity reflects management objectives of the landowners and varies considerably. Large Private landowners are expected to harvest about 748 MMbf, which is 71% of the merchantable timber that burned (1,060 MMbf).

¹² All volumes are expressed on a common basis – net Scribner long-log volume in Mbf (see definitions in Section 3.1.1).

The same calculation for other landowners yields: 44% for ODF, 26% for Other Private, 10% for the BLM and 4% for the USFS. Assumptions behind the probable salvage estimates are found in Section 5.2.

Figure 12 shows historic harvest by owner group, providing context for the timber volumes shown in **Table 12**. Oregon’s annual harvest over the last five years averages about 3.8 Bbf. At 15 Bbf, therefore, the timber volume on all the acres within the fire perimeters is equivalent to about four years of statewide timber harvest. The merchantable timber on forested acres burned with medium or high severity is roughly equivalent to about 2.5 years of statewide harvest. The probable salvage volume estimated in this report is equivalent to about 44% of the annual average statewide harvest.

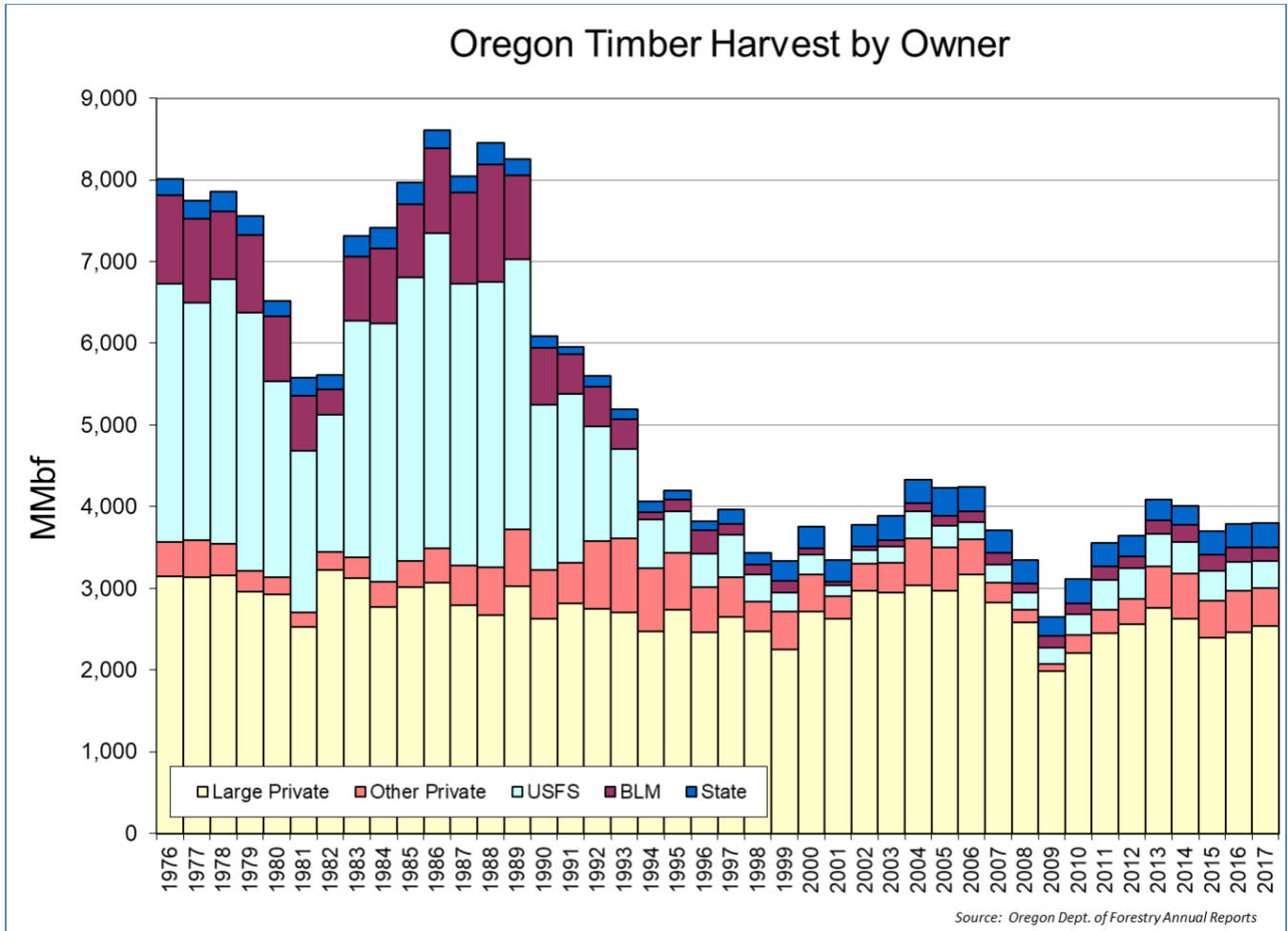


Figure 12: Historic Oregon timber harvest (MMbf) by owner group.

Table 13, Table 14, and Table 15 summarize Rows 5, 9 and 10 from Table 12, by fire.

Table 13: Volume on forested acres burned with medium or high severity, by fire.

| Volume (Mbf) Burned at Medium and High Severity | | | | | | |
|--|------------------|------------------|----------------|----------------------|----------------------|------------------|
| Fire | USFS | BLM | ODF | Large Private | Other Private | Total |
| Lionshead | 1,364,000 | - | 3,000 | 36,000 | 216,000 | 1,619,000 |
| Beachie Creek | 997,000 | 629,000 | 158,000 | 197,000 | 59,000 | 2,040,000 |
| Holiday Farm | 607,000 | 518,000 | - | 427,000 | 44,000 | 1,596,000 |
| Riverside | 1,208,000 | 107,000 | - | 94,000 | 3,000 | 1,412,000 |
| Archie Creek | 511,000 | 878,000 | - | 294,000 | 68,000 | 1,751,000 |
| Slater | 453,000 | 3,000 | - | 4,000 | 1,000 | 461,000 |
| South Obenchain | - | 20,000 | - | 7,000 | 7,000 | 34,000 |
| White River | 53,000 | 6,000 | - | - | 10,000 | 69,000 |
| 242 | 25,000 | - | - | - | 2,000 | 27,000 |
| Thielsen | 119,000 | - | - | - | - | 119,000 |
| P515 | - | - | - | - | 12,000 | 12,000 |
| Green Ridge | 11,000 | - | - | - | 12,000 | 23,000 |
| Owner Total | 5,348,000 | 2,160,000 | 162,000 | 1,060,000 | 436,000 | 9,166,000 |

Table 14: Volume on forested acres of merchantable age available for sustainable harvest, burned with medium or high severity.

| Volume (Mbf) Burned at Medium and High Severity Available for Sustainable Harvest | | | | | | |
|--|------------------|----------------|----------------|----------------------|----------------------|------------------|
| Fire | USFS | BLM | ODF | Large Private | Other Private | Total |
| Lionshead | 374,000 | - | 3,000 | 35,000 | 204,000 | 616,000 |
| Beachie Creek | 163,000 | 186,000 | 148,000 | 169,000 | 52,000 | 718,000 |
| Holiday Farm | 271,000 | 115,000 | - | 367,000 | 38,000 | 791,000 |
| Riverside | 536,000 | 37,000 | - | 81,000 | 2,000 | 656,000 |
| Archie Creek | 196,000 | 275,000 | - | 268,000 | 60,000 | 799,000 |
| Slater | 192,000 | - | - | 4,000 | 1,000 | 197,000 |
| South Obenchain | - | 3,000 | - | 7,000 | 6,000 | 16,000 |
| White River | 20,000 | - | - | - | 9,000 | 29,000 |
| 242 | 9,000 | - | - | - | 1,000 | 10,000 |
| Thielsen | 41,000 | - | - | - | - | 41,000 |
| P515 | - | - | - | - | 11,000 | 11,000 |
| Green Ridge | - | - | - | - | 11,000 | 11,000 |
| Owner Total | 1,802,000 | 616,000 | 151,000 | 931,000 | 395,000 | 3,895,000 |

Table 15: Probable fire salvage volume, by fire.

| Fire | Volume (Mbf) from Probable Salvage Harvest | | | | | Total |
|--------------------|--|----------------|---------------|----------------|----------------|------------------|
| | USFS | BLM | ODF | Large Private | Other Private | |
| Lionshead | 42,000 | - | - | 27,000 | 33,000 | 102,000 |
| Beachie Creek | 19,000 | 65,000 | 71,000 | 137,000 | 22,000 | 314,000 |
| Holiday Farm | 31,000 | 40,000 | - | 298,000 | 16,000 | 385,000 |
| Riverside | 61,000 | 13,000 | - | 66,000 | 1,000 | 141,000 |
| Archie Creek | 22,000 | 97,000 | - | 211,000 | 25,000 | 355,000 |
| Slater | 22,000 | - | - | 3,000 | 1,000 | 26,000 |
| South Obenchain | - | 1,000 | - | 5,000 | 2,000 | 8,000 |
| White River | 2,000 | - | - | - | 4,000 | 6,000 |
| 242 | 1,000 | - | - | - | 1,000 | 2,000 |
| Thielsen | 5,000 | - | - | - | - | 5,000 |
| P515 | - | - | - | - | 2,000 | 2,000 |
| Green Ridge | - | - | - | - | 5,000 | 5,000 |
| Owner Total | 204,000 | 216,000 | 71,000 | 748,000 | 111,000 | 1,350,000 |

5.2 Assumptions for Estimates of Salvage Volumes

The Probable Salvage Volume in Row 10 of **Table 12** incorporates downward adjustments that reflect assumptions about salvage harvest practices. When setting up a salvage sale, some land managers are expected to harvest all of the trees in the burned area, while others plan to leave some of the trees not killed by the fire.

The salvage volumes have also been adjusted downward to reflect assumptions about deterioration of the fire-killed timber. Due to weather checking, breakage, charred wood and insect damage, not all of the salvage volume will be recoverable. **Appendix E** contains information on the causes and rate of deterioration of fire-killed timber. Section 7.2 discusses rate of harvest and Section 7.3 has more details about deterioration assumptions.

Adjustments to salvage volume are made by owner group:

- The USFS plans to harvest only roadside hazard trees that are dead or will likely die in the next three to five years and are leaning toward the road. This study assumes that, on average, the USFS will find that 90% of the trees on the acres burned with high severity will be considered dead or dying (see Section 2.3 for distribution of fire damage by owner group). While there is no estimate of the percentage of trees leaning toward the road, the USFS agrees that a 50% reduction is reasonable at this time. The USFS further assumes a 20% reduction in volume for additional breakage and defect for stands sold in the first year, and that breakage and defect will increase over time. Finally, a 10% reduction is applied to reflect the difference between the 35-year merchantability of this study versus the unlikelihood of the agency selling timber from acres less than 50 years old. Applying these factors together suggest that about 32% of the timber on probable salvage acres will be recovered.

- The BLM intends to salvage harvest on Harvest Land Base acres where the majority of the trees are dead or dying. BLM timber harvest will retain some of the timber in snags and/or live trees – 15% in the low intensity timber area and at least 5% in the moderate intensity timber area. BLM expects a 20% deduction for defect and breakage. The combined reduction factor for the BLM is 47.6% volume recovery on the salvaged acres.

The BLM estimates that volume sold will be about 101 MMbf in FY2021 and at least 57 MMbf in FY2022 (long log scale). Longer-term plans are not finalized, but a total of 222 MMbf is likely to be harvested through FY2023, likely meaning a FY2023 harvest of 64 MMbf.

- According to ODF, they intend to recover 51-100 MMbf of burned timber through salvage on the Santiam State Forest. This study assumes the midpoint of that estimated harvest range, or 76 MMbf, will be recovered; that 21% of trees on burned areas survived, and that green trees will not be salvaged. The ODF is likely to implement salvage across the merchantable age class in stands 35 years and older. Delays could result in deterioration of around 12% of the timber, for an expected volume recovery of 69.7% in salvaged stands.
- Initially, Large Private landowners reported little or no additional defect in the fire-killed timber. As more time passes, however, some landowners are seeing some deterioration. This study assumes that ultimately, these landowners will see a 6% reduction in volume. See Sections 7.2 and 7.3 for more details.
- Other Private landowners got a later start on salvage harvest and face a unique set of challenges as described in Section 8.5. Delays and a slower rate of harvest means that Other Private landowners will realize more post-fire deterioration than Large Private landowners. This study assumes that, on average, these landowners will see a 14% reduction in salvage volumes. This study also assumes that Sections 7.2 and 7.3 have more details.

6.0 VALUE OF TIMBER BURNED

Key Findings

Across all landownerships, the value of wood products that could have been produced by Oregon's Forest Sector from the timber within the fire perimeters of the Labor Day 2002 fires is:

- *\$30 billion on all acres within the fire perimeters of the Labor Day 2020 fires*
- *\$18 billion on forested acres that burned with medium or high severity*
- *\$7.5 billion on acres that are available for long-term, multiple-rotation timber management*
- *\$2.6 billion on acres that will likely be salvage harvested*

The stumpage value of the 9.2 Bbf of merchantable timber on acres burned with medium or high severity is \$3.4 billion. The stumpage value of the 7.5 Bbf of timber that is unlikely to be salvaged is \$2.8 billion. These are some of the direct losses to the forest landowners.

6.1 Results

Oregon's primary wood product manufacturers provide markets with a wide variety of products – lumber, veneer, plywood, posts, poles, pilings, export logs, pulp, paper, and non-structural panels. The objective of this study is to estimate the economic impact of the fires across Oregon's entire Forest Sector.

The valuation metric used for this study, therefore, is the value of the end products that could be realized if the timber had been processed by Oregon's forest product manufacturers. This valuation metric captures the value of the timber to the landowner, all of the contractors involved in extracting and delivering the logs, the primary wood product manufacturers, and all of the suppliers and contractors throughout the timber economy. Section 6.2 discusses the derivation of unit values.

Table 16 values the timber volume reported in **Table 12** from the acres reported in **Table 8**. Again, Rows 1-9 are based on green pre-fire volumes, and Row 10 is an estimate of the value of the timber that will be recovered through salvage harvest.

Across all landowners, the timber found within the fire perimeters has an end-product value of nearly \$30 billion. About 57% is found on USFS lands, 22% on BLM lands, 19% on private lands, and 2% on state lands. On acres burned with medium or high severity, the timber had a pre-fire value of over \$17.6 billion. This includes the present value of the future harvest of pre-merchantable acres, and the current value on merchantable land. The current value of the merchantable timber on lands available for sustainable harvest and burned with medium or high severity is about \$7.5 billion. Of that, this study estimates that about \$2.6 billion will be recovered in salvage harvest.

The salvage value of \$2.6 billion (Row 10) offsets almost 15% of the \$17.6 billion of timber value on lands burned with medium or high severity (Row 5). The percentage of loss offset by salvage varies considerably by owner: USFS 4%, BLM 10%, ODF 41%, Large Private 58%, and Other Private 22%.

Table 16: Classification of the value of the timber on burned acres, by landowner. Volumes may not sum due to rounding.

| Value (2020 \$US, Thousands) | | | | | | | |
|-------------------------------------|-----------|-------------------|-------------------|-------------------|---------------------|-------------------|---------------------|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
| Total Value | 1 | \$ 17,212,000 | \$ 6,469,000 | \$ 769,000 | \$ 3,975,000 | \$ 1,698,000 | \$ 30,123,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 17,212,000 | \$ 6,469,000 | \$ 769,000 | \$ 3,975,000 | \$ 1,698,000 | \$ 30,123,000 |
| Unburned and Low Severity | 4 | \$ 6,695,000 | \$ 2,208,000 | \$ 437,000 | \$ 1,506,000 | \$ 715,000 | \$ 11,561,000 |
| Medium and High Severity | 5 | \$ 10,517,000 | \$ 4,261,000 | \$ 332,000 | \$ 2,469,000 | \$ 983,000 | \$ 18,562,000 |
| Pre-merchantable | 6 | \$ 200,000 | \$ 94,000 | \$ 20,000 | \$ 425,000 | \$ 142,000 | \$ 881,000 |
| Merchantable | 7 | \$ 10,317,000 | \$ 4,167,000 | \$ 312,000 | \$ 2,044,000 | \$ 841,000 | \$ 17,681,000 |
| Unavailable for Sustainable Harvest | 8 | \$ 6,844,000 | \$ 2,978,000 | \$ 19,000 | \$ 250,000 | \$ 77,000 | \$ 10,168,000 |
| Available for Sustainable Harvest | 9 | \$ 3,473,000 | \$ 1,189,000 | \$ 293,000 | \$ 1,794,000 | \$ 764,000 | \$ 7,513,000 |
| Probable Salvage \$ | 10 | \$ 394,000 | \$ 417,000 | \$ 136,000 | \$ 1,443,000 | \$ 214,000 | \$ 2,604,000 |

Stumpage value represents the income received by landowners from the sale of standing timber and is an important component of the impact of the fires on the Forest Sector. Net stumpage to the landowner varies considerably by owner group.¹³ Applying a five-year average stumpage value of \$370/Mbf¹⁴ to the 9.2 Bbf (Table 12 Row 5) of timber on acres burned with medium and high intensity indicates a total loss of nearly \$3.4 billion in stumpage value. The stumpage value of the 7.8 Bbf of timber on those acres and not expected to be salvaged (Table 12 Row 5 minus Row 10) is \$2.9 billion.

The delivered log value represents the value of the timber delivered to the mill and includes the stumpage plus the value added by the harvesting and delivery process. At an average value of \$700/Mbf,¹⁵ the delivered value of timber on the acres burned with medium and high severity totals \$6.4 billion and the delivered value of the timber on those acres and not expected to be salvaged is nearly \$5.5 billion.

Table 17, Table 18, and Table 19 summarize Rows 5, 9 and 10 from Table 16, by fire.

¹³ Logging and haul are typically more costly on public timberland due to extra contractual requirements. Similarly, federal and state timberland managers typically spend considerably more on timber sale preparation and harvest administration.

¹⁴ Source: Forest Economic Advisors historic average westside stumpage price, 2016-2020 in 2020 \$'s (90% Douglas-fir/10% whitewoods mix).

¹⁵ Source: Forest Economic Advisors historic average westside delivered price, 2016-2020 in 2020 \$'s (90% Douglas-fir/10% whitewoods mix).

Table 17: Value of timber on forested acres burned with medium or high severity, by fire.

| Value (2020 \$US, Thousands) Burned at Medium and High Severity | | | | | | |
|---|----------------------|---------------------|-------------------|---------------------|-------------------|----------------------|
| Fire | USFS | BLM | ODF | Large Private | Other Private | Total |
| Lionshead | \$ 2,667,000 | \$ - | \$ 6,000 | \$ 72,000 | \$ 463,000 | \$ 3,208,000 |
| Beachie Creek | \$ 1,954,000 | \$ 1,243,000 | \$ 324,000 | \$ 478,000 | \$ 139,000 | \$ 4,138,000 |
| Holiday Farm | \$ 1,197,000 | \$ 1,021,000 | \$ 1,000 | \$ 1,031,000 | \$ 106,000 | \$ 3,356,000 |
| Riverside | \$ 2,399,000 | \$ 216,000 | \$ - | \$ 231,000 | \$ 9,000 | \$ 2,855,000 |
| Archie Creek | \$ 1,003,000 | \$ 1,717,000 | \$ - | \$ 629,000 | \$ 162,000 | \$ 3,511,000 |
| Slater | \$ 891,000 | \$ 5,000 | \$ - | \$ 9,000 | \$ 3,000 | \$ 908,000 |
| South Obenchain | \$ - | \$ 47,000 | \$ - | \$ 18,000 | \$ 22,000 | \$ 87,000 |
| White River | \$ 103,000 | \$ 12,000 | \$ - | \$ - | \$ 25,000 | \$ 140,000 |
| 242 | \$ 52,000 | \$ - | \$ - | \$ - | \$ 6,000 | \$ 58,000 |
| Thielsen | \$ 231,000 | \$ - | \$ - | \$ - | \$ - | \$ 231,000 |
| P515 | \$ - | \$ - | \$ - | \$ - | \$ 24,000 | \$ 24,000 |
| Green Ridge | \$ 20,000 | \$ - | \$ - | \$ - | \$ 24,000 | \$ 44,000 |
| Owner Total | \$ 10,517,000 | \$ 4,261,000 | \$ 331,000 | \$ 2,468,000 | \$ 983,000 | \$ 18,562,000 |

Table 18: Value of timber on forested acres of merchantable age available for sustainable harvest, burned with medium or high severity.

| Value (2020 \$US, Thousands) Burned at Medium and High Severity Available for Sustainable Harvest | | | | | | |
|---|---------------------|---------------------|-------------------|---------------------|-------------------|---------------------|
| Fire | USFS | BLM | ODF | Large Private | Other Private | Total |
| Lionshead | \$ 721,000 | \$ - | \$ 6,000 | \$ 67,000 | \$ 394,000 | \$ 1,188,000 |
| Beachie Creek | \$ 315,000 | \$ 358,000 | \$ 286,000 | \$ 326,000 | \$ 101,000 | \$ 1,386,000 |
| Holiday Farm | \$ 523,000 | \$ 222,000 | \$ - | \$ 708,000 | \$ 74,000 | \$ 1,527,000 |
| Riverside | \$ 1,033,000 | \$ 71,000 | \$ - | \$ 156,000 | \$ 4,000 | \$ 1,264,000 |
| Archie Creek | \$ 378,000 | \$ 531,000 | \$ - | \$ 518,000 | \$ 115,000 | \$ 1,542,000 |
| Slater | \$ 370,000 | \$ - | \$ - | \$ 7,000 | \$ 3,000 | \$ 380,000 |
| South Obenchain | \$ - | \$ 6,000 | \$ - | \$ 13,000 | \$ 11,000 | \$ 30,000 |
| White River | \$ 38,000 | \$ - | \$ - | \$ - | \$ 17,000 | \$ 55,000 |
| 242 | \$ 17,000 | \$ - | \$ - | \$ - | \$ 2,000 | \$ 19,000 |
| Thielsen | \$ 79,000 | \$ - | \$ - | \$ - | \$ - | \$ 79,000 |
| P515 | \$ - | \$ - | \$ - | \$ - | \$ 21,000 | \$ 21,000 |
| Green Ridge | \$ - | \$ - | \$ - | \$ - | \$ 22,000 | \$ 22,000 |
| Owner Total | \$ 3,474,000 | \$ 1,188,000 | \$ 292,000 | \$ 1,795,000 | \$ 764,000 | \$ 7,513,000 |

Table 19: Value of probable fire salvage volume, by fire.

| Fire | Value (2020 \$US, Thousands) from Probable Salvage Harvest | | | | | | |
|--------------------|--|-------------------|-------------------|---------------------|-------------------|---------------------|--|
| | USFS | BLM | ODF | Large Private | Other Private | Total | |
| Lionshead | \$ 82,000 | \$ - | \$ - | \$ 51,000 | \$ 65,000 | \$ 198,000 | |
| Beachie Creek | \$ 36,000 | \$ 126,000 | \$ 136,000 | \$ 265,000 | \$ 42,000 | \$ 605,000 | |
| Holiday Farm | \$ 59,000 | \$ 78,000 | \$ - | \$ 576,000 | \$ 31,000 | \$ 744,000 | |
| Riverside | \$ 117,000 | \$ 25,000 | \$ - | \$ 127,000 | \$ 2,000 | \$ 271,000 | |
| Archie Creek | \$ 43,000 | \$ 186,000 | \$ - | \$ 408,000 | \$ 48,000 | \$ 685,000 | |
| Slater | \$ 42,000 | \$ - | \$ - | \$ 6,000 | \$ 1,000 | \$ 49,000 | |
| South Obenchain | \$ - | \$ 2,000 | \$ - | \$ 10,000 | \$ 5,000 | \$ 17,000 | |
| White River | \$ 4,000 | \$ - | \$ - | \$ - | \$ 7,000 | \$ 11,000 | |
| 242 | \$ 2,000 | \$ - | \$ - | \$ - | \$ 1,000 | \$ 3,000 | |
| Thielsen | \$ 9,000 | \$ - | \$ - | \$ - | \$ - | \$ 9,000 | |
| P515 | \$ - | \$ - | \$ - | \$ - | \$ 3,000 | \$ 3,000 | |
| Green Ridge | \$ - | \$ - | \$ - | \$ - | \$ 9,000 | \$ 9,000 | |
| Owner Total | \$ 394,000 | \$ 417,000 | \$ 136,000 | \$ 1,443,000 | \$ 214,000 | \$ 2,604,000 | |

6.2 Assumptions for Timber Values

In 2017, Oregon’s Forest Sector consumed 3.9 Bbf of logs and produced \$7.4 billion of wood products.¹⁶ Adjusting the 2017 prices to the average product prices for 2016-2020 results in an average product value of \$1,929/Mbf log scale.¹⁷ The merchantable volume in **Table 12** was multiplied by this factor, resulting in the dollar figures in shown in **Table 16**.

The value of pre-merchantable acres burned (Row 6) is based on a future value at harvest at age 45, discounted back to the present with a 5% discount rate. This is a conservative estimate as it does not include any loss of value to acres unburned or burned with low intensity.

Information about whether or how burned wood might affect end product values is not available. Salvage values shown in Row 10, therefore, have not been adjusted for potential discounts. This means the result may over-estimate the value of the salvaged timber.

The figures in **Table 16** report the value of the mix of end products made by Oregon’s Forest Sector, and therefore represents the value of the timber spread across the entire Forest Sector. In practice, the distribution of that value within Oregon’s Forest Sector depends on policies and procedures reflected in each landowner’s forest management decisions, cost structure, log marketing strategies, etc. **Table 20** shows a typical breakdown of the components of value for private timberland based on some general averages typical for Large Private forestland.

¹⁶ University of Montana, Forest Industry Research Program, *Oregon forest products industry and timber harvest, 2017: Highlights and Summary Data Tables*, (December 12, 2019_.

¹⁷ To the extent that federal lands have larger timber that may have more value than the average timber harvested in 2019, this is a conservative estimate for the end-product values that could be manufactured from the timber inside the fire perimeters.

Table 20 suggests that manufacturing, sales, and shipping account for about 60% of the end-product value and that raw material – logs delivered to the manufacturers – accounts for about 40% of the value. That relationship, however, varies considerably between the manufacturing sectors. Raw material, for example, constitutes a larger share of sawmill costs than paper mill costs. Even so, **Table 20** can be used to evaluate the lost value of the burned timber to various sub-sectors of Oregon’s Forest Sector.

Table 20: Distribution of end-product value through the Forest Sector.

| Measure of Value | \$/Mbf Log Scale | % of Value | Value of Timber on Burned Acres (2020 \$US 1,000s) | Value of Timber on Burned Acres & Not Salvaged (2020 \$US 1,000s) |
|--------------------------------|------------------|------------|--|---|
| Net stumpage to landowner | \$ 370 | 19% | \$ 3,391,000 | \$ 2,892,000 |
| Production costs | \$ 330 | 17% | \$ 3,025,000 | \$ 2,579,000 |
| Delivered log value | \$ 700 | 36% | \$ 6,416,000 | \$ 5,471,000 |
| Manufacturing, sales, shipping | \$ 1,229 | 64% | \$ 11,265,000 | \$ 9,606,000 |
| End product value | \$ 1,929 | 100% | \$ 17,681,000 | \$ 15,077,000 |

7.0 FACTORS AFFECTING RECOVERY OF BURNED TIMBER

Row 10 in each of **Table 8**, **Table 12**, and **Table 16** shows the results of this study’s assumptions about the acres, volume and value of timber on burned acres that will be harvested and hauled to the manufacturers. These estimates are based on interviews and observations through May 2021. Descriptions of assumptions are shown in **Appendix A**. The following sections provide more background and context around the salvage effort.

7.1 Data Availability

Timely and comprehensive data specific to salvage from the Labor Day 2020 fires does not exist. The log price reporting services do not distinguish between green and salvage volumes or prices, nor does ODF’s annual harvest report. At some future time, aerial imagery could be used to estimate the acres of salvage harvest. But the volume and price of the salvage timber will be known with certainty only to each individual landowner, and most consider detailed information to be confidential.

As a result, the best way to get information about the fire salvage effort is to talk to the forest land managers involved in the salvage effort. This study relies on public statements, surveys, conversations, observations and experience of the study team.

7.2 Rate of Salvage

Table 12 shows probable total salvage volume based on the assumptions in this study, but landowners report different plans regarding the pace of salvage and the time frame over which operations will take place. **Table 21** reports expectations of the rate of salvage harvest based on responses in interviews and surveys. Data and assumptions are discussed below.

Table 21: Anticipated rate of salvage harvest.

| Owner | Percent Harvested per Year | | | |
|---------------|----------------------------|--------|--------|--------|
| | Year 1 | Year 2 | Year 3 | Year 4 |
| USFS | 5% | 32% | 32% | 31% |
| BLM | 5% | 73% | 22% | 0% |
| ODF | 47% | 22% | 16% | 15% |
| Large Private | 60% | 40% | 0% | 0% |
| Other Private | 20% | 70% | 10% | 0% |

Timberland managers intent on salvaging burned timber have every incentive to hasten harvest. Wood quality of fire-killed timber begins to deteriorate as the dead trees dry and check. Insect damage is expected as the weather warms in the first post-fire season and accelerates in every subsequent season. **Appendix E** discusses these factors in more detail.

Landowners face different obstacles in mobilizing salvage efforts:

The USFS expects that salvage will likely start in its FY2021 and continue through FY2024.¹⁸ At the time of the survey, however, the agency was just beginning the assessment phase of the work to prepare salvage contracts. The USFS notes that while many acres were burned, the affected National Forests do not have any additional staff or budget to address fire salvage. Minimal volume removal is expected in FY2021. While environmental groups have sued to stop roadside hazard tree removal projects on the Slater Fire, this study assumes that the agency will be able to proceed as planned. This study assumes salvage harvest will proceed on an even pace through 2024.

The BLM has postponed work on some green timber sales and shifted focus to burned timber. BLM has also shifted some timber sale preparation resources from the Coast to help with salvage in the Cascades. BLM currently intends to sell about 46% of the salvage timber in its FY2021, and at least another 26% in FY2022, with the remainder to follow. BLM will sell the salvage timber with shorter-than-normal contracts – 12 to 18 months – and expects most of the harvest to be completed within 13 months of auction. The BLM will likely extend the contracts on existing green sales if it helps purchasers harvest the salvage timber more quickly.

ODF anticipates that it will sell 47% of the salvage volume in its FY2021, 22% in FY2022 and 16% in FY2023. While environmental groups have sued to stop ODF's planned salvage, this study assumes that the agency will be able to proceed as planned.

Large Private land managers face the fewest regulatory and logistical obstacles and have been quick to mobilize salvage efforts. There are many anecdotes of private landowners beginning salvage operations while the burned timber was still smoking. On average, Large Private landowner survey respondents harvested 40% of the fire-killed timber between September 2020 and March 2021. Respondents report that another 22% of the harvest was anticipated to be completed between April and June 2021, bringing the total cool-weather salvage up to 62%. They anticipate harvesting another 20% by September 2021 and the remainder soon after. There are reports of companies quickly shifting resources from other Pacific Northwest regions to concentrate on salvage of the burned areas.

Large Private landowner survey respondents addressed factors that affect both the amount and rate of salvage harvest:

Markets – Some respondents indicated that log markets had a moderate impact, others reported no impact.

Mill capacity – Respondents show a wide range of impacts (“none” to “severe”) due to mill capacity. Due to capacity limitations, there are reports that some mills are limiting log deliveries.

Availability of loggers – Responses were nearly evenly split whether this is a major, moderate or minor impact.

Availability of log haulers – This was generally ranked as a higher impact than availability of loggers.

Internal resources/staffing – Most respondents indicated no impact.

¹⁸ The federal fiscal year runs October-September; FY2021 runs October 2020 through September 2021. Oregon's FY runs July-June; FY2021 runs July 2020 through June 2021.

Charred wood – Most respondents indicated no impact to minor impact.

Access (damage to roads, bridges, culverts) – Most respondents indicated little impact currently, although some had significant work to do before salvage could begin.

Regulatory requirements – Most respondents indicated no impact to minor impact.

Beetles – Some respondents indicated minor or moderate impact, some said none.

Defected wood – Most respondents indicated no impact or minor impact. Two said this was a moderate impact.

Other Private landowners are working on salvage harvest, but the scope and scale is undetermined. Section 8.5 describes the obstacles facing these landowners. This study assumes that Other Private landowners will salvage fewer acres at a slower pace than the Large Private landowners.

Complicating an estimate of the rate of salvage harvest is the fact that the public agencies (USFS, BLM, and ODF) typically sell multi-year timber sale contracts. Once the contract is sold, it is up to the purchaser to decide how soon to cut the timber. The estimates in **Table 21** reflect the view that all parties have an economic interest in recovering the salvage volume as quickly as possible.

7.3 Deterioration

Timber killed by fire suffers several kinds of deterioration that affect volume and value recovery. For example, once the weather warms, dead timber begins to dry and check, thereby reducing the recovery of useable wood products. Also, beetles will hatch in springtime temperatures and bore into the sapwood of fire-killed trees; beetle galleries reduce lumber grade or render wood unsuitable for milling, either reducing value of final produce or increasing the defect. Some insects spread fungi which stains the wood, further reducing the value of the wood products. **Appendix E** discusses these factors in more detail.

The USFS and BLM land managers expect to see an additional 20% defect in the wood harvested from the salvage sales. This defect expectation is based on extensive agency experience with past salvage operations. Because private land managers were able to start harvesting the burned wood immediately, in contrast, they expect less defect. When surveyed, Large Private land managers expected to see beetle damage beginning summer 2021, and other forms of defect and deterioration in summer of 2021 or summer of 2022.

Table 22 shows expectations for additional fire-related defect and deterioration. For the USFS and BLM, these are the expectations stated by the agencies. For other owners, the defect is based on the expected rate of harvest (**Table 21**) and the expected rate of deterioration (**Appendix E**).

Table 22: Assumptions for fire-related defect and deterioration.

| Owner | Percent Defect |
|---------------|----------------|
| USFS | 20% |
| BLM | 20% |
| ODF | 12% |
| Large Private | 6% |
| Other Private | 14% |

7.4 Hazard Tree Removal

In the initial disaster response, dozens of state and federal highways closed across western Oregon for days to clear hazards of fire-killed trees and downed powerlines. Oregon Highways 22, 126, 138 and 224 were blocked for a month and some roads remain closed at the time of this report. Dead and dying trees constitute a safety hazard and will be removed. The salvage estimates in **Table 12** include hazard tree removal. This section discusses the assumptions further.

Oregon Department of Transportation (ODOT), under FEMA’s direction, has taken the lead on clearing hazard trees from along state highways, regardless of the landowner, and will eventually address hazard tree removal on about 120 miles of federal, state and private land along state highways. Mobilizing foresters, arborists, tree cutters and haulers, archeology crews, etc., has been a massive undertaking.

The USFS reports that it has about 1,200 miles of road within the fire boundaries that need to be evaluated for hazard tree removal, and that the public safety effort will require most of that agency’s post-fire budget and staffing resources for the next couple of years.

The BLM made a calculation of the miles of road within 160 feet of the fire perimeters, as shown in **Table 23**. According to this calculation, private landowners have the most potential for roadside hazard tree removal. Much of this will be addressed during the salvage of Large Private forestlands. Other private landowners that are less willing or able to conduct salvage harvest, however, will face difficulty in financing and mobilizing roadside hazard tree salvage.

Table 23: BLM calculation of road miles within 160 feet of 2020 wildfire perimeters.

| Entity | Road Owner/ Administrator | Property Owner/ Administrator |
|------------------|------------------------------|----------------------------------|
| BLM | 716 | 770 |
| USFS | 1,494 | 1,481 |
| Other Federal | 1 | 30 |
| State | 43 | 200 |
| Local Government | 121 | 3 |
| Private/Unknown | 3,050 | 3,086 |
| Interstate | 12 | - |
| U.S. Highway | 5 | - |
| State Highway | 118 | - |
| Total: | 5,560 | 5,570 |

Targeting potential hazard trees for removal is especially difficult. Many landowners prefer to leave trees that will survive the fire. As a result, the foresters and arborists face a difficult task of determining which fire-affected trees are likely to die within the next 3-5 years. Those dead and dying trees are removed now to help limit future damage and liability from falling trees.

Estimating the volume of hazard tree timber that will ultimately be salvaged is made difficult by the site-specific and multi-objective complexity of salvaging hazard trees. Although the USFS states that hazard tree removal will account for most of its post-fire salvage, by late June 2021, the agency had not yet made the assessments needed to estimate acres to be treated and volume to be removed.

8.0 RESTORATION AND REFORESTATION OF THE BURNED AREA

Forest restoration will take many forms and face many challenges. This section outlines the scope of the restoration work and estimates the costs.

8.1 Overview of Forest Restoration Activities

Restoration and/or reforestation of burned forest land can be costly given the nature and extent of the Labor Day 2020 fires. Such activities can be classified as follows:

Immediate post-fire protection activities. As the fires were burning, the USFS and other agencies began forming interdisciplinary teams to prepare a Burned Area Emergency Rehabilitation (BAER) plan. The BAER plans focus on protecting soil and water resources. Using satellite imagery and broad scale assessment techniques, the BAER teams delineate areas for immediate emergency treatment to limit soil loss and sedimentation of streams and rivers. BAER plans estimate the cost of mitigation measures on USFS and BLM lands as shown below:

Replanting after salvage. Burned acres that are salvage harvested are typically reforested using some variation of standard reforestation practices. The salvaged timber helps to pay for the reforestation costs. The acres that were salvage logged prior to the spring 2021 planting season may not need the normal vegetation control treatment prior to planting, the fires having burned competing vegetation. Foresters who planted spring 2020 report that with the loss of all ground cover, some plantations suffered excessive heat that will affect seedling survival. Burned acres salvaged after the planting season will likely need some kind of pre-planting vegetation control. It is likely that acres salvaged after a couple of years, and acres not salvaged, will have increased occupation by brush that can inhibit seedling growth. These acres will require additional brush control treatments.

On private lands, acres with fire salvage harvest must be reforested under the requirements of the Oregon Forest Practices Act (OFPA). The OFPA does not require reforestation on acres that were not salvaged.

Restoring forests without salvage. Without income from salvage harvest, the landowner must either find some other funding, or rely on natural regeneration – seed from nearby mature trees. Natural regeneration typically extends the restoration time, and results in a more heterogeneous timber stand. After a fire, various early successional species will occupy the burned area. Brush and weeds can both shade out the new seedlings and create moisture stress – both factors delay the time it takes the new trees to reach a “free to grow” state, compared to artificial regeneration practices. Cash outlay, however, is minimized.

Both ODF and some Large Private landowners report use of aerial seeding to reforest areas that are otherwise inaccessible. Aerial seeding has an advantage over natural regeneration in areas where seed trees may not exist after the fire.

Regenerating acres burned with low intensity. Some of the acres burned with low intensity (<25% canopy loss) may be considered understocked. Depending on the age of the stand, some landowners may choose to plant some trees to fill in gaps. Others may rely on natural regeneration. The survey of Large Private landowners did not indicate intent to interplant, but it may be used on family forestlands.

Regenerating pre-merchantable stands. Burned pre-merchantable stands (in this study, stands less than 35 years old) present a special challenge. Since the burned timber has no value, removing the burned stems prior to replanting is an extra cost. Leaving the trees, however, could create future safety hazards, add to fuel loads, and might result in damage to the new trees as the dead stems fall. Survey responses and observation suggest that most Large Private landowners intend to plant under the burned trees.

Reconstruction and repair of infrastructure. The fires damaged roads, bridges, ditches and culverts. ODF, for example, lost its Santiam District office in Lyons. Landowners found that culverts made from plastic material were destroyed and needed to be replaced. Section 8.4 estimates the cost for road restoration.

8.2 Forest Restoration Objectives by Landowner

Interviews and observation suggest that there will be many approaches to restoration/reforestation of the Labor Day 2020 fires. Comprehensive statistics and costs are unavailable at the time of this report – indeed, some landowners are still trying to inventory needs. The following is a summary of responses from landowners.

- The USFS reports that regeneration/reforestation activities will be site-specific and reflect management objectives of the Northwest Forest Plan. Reforestation efforts will likely be focused on stands that burned with at least 50% or more canopy loss. The agency will likely plant about 50% of the acres and rely on natural regeneration for 50% of the acres. This is a higher proportion of planting than typical for the USFS and reflects the high burn intensity and a lower percentage of burn in wilderness areas. Reforestation efforts will restore species composition and other stand conditions that support resilient forests in light of climate stress and future fires.

The agency is currently engaging in soil stabilization, road repairs, stream restoration, control of invasive species and seeding. Much of this activity will occur outside of timber salvage operations.

- The BLM will target stands burned with moderate and high severity for restoration. Natural regeneration on low severity burns will be monitored to ensure effectiveness. Reforestation treatments are considered across all land use allocations and tailored to local conditions. Where salvage does not take place, the BLM will rely on either natural or artificial regeneration. Either way, the agency anticipates three to five years of brush control. After that, activities will be limited due to safety hazards posed by the burned trees. Where salvage does take place, the standard reforestation practices will be employed – site preparation, natural and artificial regeneration, brush control, with a pre-commercial thinning at some point. The BLM does not yet have an estimate of how many acres will be planted.
- ODF has revised the Santiam Forest Implementation Plan to reflect efforts to restore the forest after the Beachie Creek Fire. ODF intends to reforest 12,000 acres as shown in **Table 24** below:

Table 24: Excerpt from ODF forest reforestation plan.

| Reforestation Type | Acres ¹ |
|------------------------------------|--------------------|
| Planting - young stands burned | 3,600 |
| Planting – post-fire harvest units | 3,000 |
| Aerial Seeding | 4,800 |
| Natural Regeneration | 600 |

¹Acres subject to change as more information becomes available

Aerial seeding is slated for areas with difficult or dangerous access and will delay conifer regeneration, which will provide early successional habitats. ODF anticipates site preparation activities on 2,000-3,000

acres, animal damage control on 1,000-3,200 acres, precommercial thinning on up to 1,500 acres and non-commercial tree removal on up to 1,500 acres within the burned areas to minimize fuel loading. Environmental groups have filed suit to stop ODF’s fire salvage efforts.

- On Large Private lands, forest managers indicate that they will replant the acres that were salvaged using standard practices. Some report that they will likely plant somewhat fewer trees per acre, in response to seedling availability. Burned pre-merchantable stands will receive brush control treatments and seedlings will be planted underneath the burned trees. There is a variety of responses about the costs of reforesting the burned acres – ranging from 10% less than usual to 20% more than usual. Most landowners expect to replant a species mix similar to what burned.

Large Private forest managers report a range of assumptions about how quickly they can replant the burned acreage. **Table 26** summarizes the schedules.

- Other Private landowners face the same challenges as the other owner groups, but typically have fewer resources immediately available, as described in Section 8.5. Understanding the collective behavior of the 5,660 small woodlot owners affected by the fire, furthermore, is difficult at this time, as there is no centralized reporting system in place. This study expects that like most landowners, their activity will be focused first on the acres burned with high severity, and at least some of the acres of moderate severity. Where possible, we expect Other Private landowners to rely more on natural regeneration than will Large Private landowners.

8.3 Reforestation: Scope, Scale and Costs

Table 25 estimates the portion of the forested acres burned with high and medium severity that will be planted and naturally regenerated. Estimates for the USFS, ODF and Large Private landowners are based on surveys and interviews. Estimates for BLM and Other Private landowners are assumptions.

Table 25: Estimates reforestation methods of forested acres burned with medium or high severity. Aerial seeding included with natural regeneration. For USFS lands, these are publicly reported reforestation estimates and do not total acres burned with medium or high severity.

| Reforestation | USFS | BLM | ODF | Private | | Total |
|---------------------|--------|--------|-------|---------|--------|---------|
| | | | | Large | Other | |
| %Plant / %Natural | 50/50 | 50/50 | 55/45 | 95/5 | 60/40 | 57/43 |
| Planted Acres | 75,000 | 39,844 | 6,600 | 178,237 | 60,597 | 360,279 |
| Natural Regen Acres | 75,000 | 39,844 | 5,400 | 9,381 | 40,398 | 170,023 |

When asked whether they expected reforestation of the burned acres to be less or more expensive than typical reforestation costs, Large Private land managers had a variety of responses. Some thought that reforestation will cost 10 to 20% more than typical costs, some thought that costs would be about 10% less, and some thought that costs would be equivalent. Some land managers anticipate planting at a 10 to 20% lower density than usual – perhaps to spread the available seedlings over more acres.

At an estimated \$400 per acre for site preparation, planting and brush control (typical costs), the reforestation cost of the planted acres in **Table 25** totals about \$144 million. The cost for natural regeneration will be considerably less.¹⁹

ODF has aerial seeded about 4,800 acres and there is a report of at least one Large Private landowner also aerial seeding some acres. ODF reports that aerial seeding costs about \$32 per acre to distribute 2,500 to 3,000 seeds per acre.

Reforestation effectiveness can be measured in the time it takes the new stand to reach the “free to grow” stage. Planting with standard site preparation and vegetation control typically reaches free to grow within three to five years. Natural regeneration may take 5 to 30 years, depending on the availability of a seed source. Aerial seeding should be 5 to 15 years.

Regenerating the burned acres will span several years. To put the 360,000 acres of planting in **Table 25** in context, it is estimated that in a typical year about 160,000 acres are regenerated after harvest.

Large Private land managers were asked how soon they thought they would be able to replant the burned acres. The responses varied considerably, but most land managers indicate that replanting will be completed by the 2024/2025 planting season. **Table 26** shows the simple averages of the percentage of each respondent’s schedule for replanting burned acres. The replanting schedule from the survey reflects a variety of factors from the rate of salvage harvest, the timing of salvage harvest relative to the fall and spring planting windows, and the availability of seedlings. Given that public land managers expect a slower start to salvage harvest, the replanting schedule on those lands will undoubtedly be stretched beyond that shown in **Table 26**. The USFS, on the other hand, intends to plant many acres without first performing a salvage harvest, and some of those acres will be planted sooner.

Table 26: Estimated schedule for acres planted, Large Private landowners.

| Planting Season | Acres Planted | % Acres Planted |
|------------------------|----------------------|------------------------|
| 2021/2022 | 26,736 | 15% |
| 2022/2023 | 81,949 | 46% |
| 2023/2024 | 42,777 | 24% |
| 2024/2025 | 19,606 | 11% |
| 2025/2026 | 5,347 | 3% |
| Total: | 176,415 | 100% |

8.4 Restoring Roads in Burned Areas

An assessment of fire damage to road systems is beyond the scope of this study. Individual landowners are making assessments, however, and some broad estimates can be made. The following is a case study.

Post-fire road rehabilitation costs above baseline road costs are expected to be incurred in the future. Roads take a beating during fire suppression from heavy traffic from fire vehicles and heavy equipment. There is usually little or no extra water available for watering during fire suppression efforts, so the

¹⁹ These are typical contracting costs and do not include all of the overhead that might be attributed to reforestation – cone surveys and collection, pre-planting surveys, contract preparation, cooler maintenance, stocking surveys, contract administration, etc.

roads get dusted up and there is a lot of surface rock wear. The heat dries the road surface out more, so that increases the dust problem, and usually there is not a lot of attention paid to keeping the road surface and drainage systems intact during the emergency. Plastic culverts are typically melted during fires and need to be replaced. Further, salvage logging includes hauling much larger volumes than would be found with normal harvesting schedules over concentrated segments of roads, which puts additional pressure on the roads; winter season hauling also adds pressure.

Post-fire road work typically includes:

- grading and re-opening roads (cutting out fallen trees, clearing limbs and debris)
- cleaning ditches, drainage structures dips and all drainage features
- some spot rocking (assume five cubic yards per station as an average, assume only small segments would need some additional rock, not the whole road)
- culvert replacement (assume an average of two culverts per mile and assume all culverts were plastic prior to the fire, and all would need to be replaced)
- grass seeding, straw placement and/or other erosion control measures
- some minor gate repairs

Using current costs for culverts, rock, straw, labor, etc., assume an average cost of \$7,700 per mile for road rehabilitation work. Assuming an average of six miles per 640-acre section, the total cost of road rehabilitation equates to \$72 per acre of burned acre.

The case study found an average cost of \$7,700 per mile of road restoration, and that is likely low given that there are only two culverts per mile in the case study. The BLM found that there are about 5,600 miles of road within the burned area (**Table 23**). Assuming that 40% of the acres within the fire perimeter are either unburned or burned with a low severity and do not need restoration, then about 3,360 miles would need restoration. At a cost of \$8,000 per mile, then the total cost of road restoration comes to about \$27 million. It is likely that this is a conservative estimate of road restoration costs across all landowners.

8.5 Challenges Facing Small Woodland Owners

According to ODF,²⁰ a total of 5,660 family forest landowners (defined as individuals, families or other entities owning less than 5,000 acres) were affected statewide by the Labor Day fires. The vast majority, 4,193 landowners, own five acres or less. The remaining 1,467 landowners hold properties ranging in size from five to 5,000 acres.

Family forest landowners face several hurdles to rehabilitating and reforesting their lands after a fire.

The first barrier is financial. Federal cost-share programs aiding landowners after a wildfire are reimbursement-based, which means that the landowner must front the cash to pay contractors to get the work done, then wait for reimbursement. This makes cost share programs a non-starter for many landowners who simply do not have the cash available to pay for the work, even if reimbursement eventually comes.

²⁰ Natural and Cultural Resources Impacts and Recovery Needs / SRF 7. Testimony by Peter Daugherty (ODF) and Renee Davis (OWEB) to the House Special Committee on Wildfire Recovery, (March 8, 2021).

Next is landowner willingness. For a variety of reasons, some landowners are unwilling to become involved in federally funded assistance programs. There is also a large time commitment with short deadlines to complete grant applications. Some landowners may also be dealing with other factors such as the major impact of losing their homes and being displaced from the property.

Third is a lack of technical know-how. Most family forest landowners, quite understandably, don't have the technical background to know how to restore forestlands after a fire. Some may have never been involved with forestry work at all before. The supply of technical assistance is limited relative to the number of landowners who need it. ODF Stewardship Foresters are one of the main sources of technical assistance and must balance landowner assistance with other duties such as firefighting and forest practice act enforcement. ODF has a staff of only 51 Forest Stewardship Forester positions statewide,²¹ plus some other field foresters who can assist at times. In Oregon, the Farm Services Administration (FSA) contract with ODF to provide technical assistance to support their programs, so they do not have their own staff of technical assistance foresters. NRCS has District conservationists on the ground serving landowners, especially after the fire. They have been helping landowners obtain the NRCS and FSA grants shown in **Table 27**.

Upon request, Forest Stewardship Foresters perform a site visit and develop a treatment plan, help the landowner with the cost-share application, and can provide lists of forestry consultants and contractors. The landowner, however, is responsible for selecting and hiring needed contractors or otherwise getting the work done on the ground. The Stewardship Forester then returns to verify the work was accomplished according to the plan and applicable standards, so the landowner can be reimbursed.

OSU Forestry and Natural Resources Extension Agents provide advice and direct landowners to appropriate cost-share programs and other resources; however, on-the-ground assistance is limited in some counties.

Private consulting foresters are another important source of technical assistance that family forest landowners can turn to. They are usually able to offer a wider variety of advisory and on-the-ground services, including planning rehabilitation treatments, procuring contractors and materials, supervising the work, and ensuring a quality result. However, the fees paid to a consulting forester are not reimbursable in federal programs so may not be affordable to some landowners.

Road rehabilitation is often a necessary and expensive need after a wildfire (see Section 8.4). Cross-drain culverts, often made of plastic, are easily destroyed in a wildfire, and must be replaced to maintain drainage and avoid erosion damage from increased water flows. Stream crossings (wooden bridges or metal culverts) can also be compromised by the fire. Oregon regulations require costly forest road reconstruction prior to use, including replacement with higher standard stream crossings, as compared to the standards in effect at time of the original. Federal funding is usually not an option as the engineering required by federal rules is too expensive for most forestry purposes.

Another significant hurdle facing family forest landowners is acquiring seedlings and labor for reforestation. In those areas where salvage logging occurs, the Oregon Forest Practices Act requires subsequent replanting to ensure lands are adequately restocked with trees. Oregon's Phipps State Forest Nursery for many years was the "go to source" for family forest landowners' seedling needs. However, since the Phipps Nursery was closed in 2009, it has been more difficult for family forest landowners to get seedlings from commercial nurseries. Since large landowners typically have longstanding relationships with growers and regularly order large quantities of seedlings on an annual basis, the commercial nursery industry is organized around large-scale order fulfillment. Family forest landowners sometimes struggle to find seedlings readily available. Furthermore, seedling

²¹ <https://www.oregon.gov/odf/Working/Pages/FindAForester.aspx>

production is a two-year process, meaning that seedlings are typically ordered two years in advance of when they are needed. Large landowners with annual seedling orders have the flexibility to shift seedlings where they are needed for the planting seasons immediately after fires. The large quantities of seedlings that will be needed by family forest landowners to recover from the wildfires will not be fully available for two growing seasons once the nurseries ramp up production.

To improve the availability of seedlings to family forest landowners, various groups, such as the Oregon Small Woodlands Association (OSWA), local OSWA chapters, ODF, soil and water conservation districts, and watershed councils, organize consolidated orders for sale to family forest landowners in their area. This has helped boost the nursery pipeline for family forest landowners who are aware of these sources. Family forest landowners have the opportunity to seek federal assistance, including through the Emergency Forest Restoration Program (EFRP) and the Environmental Quality Incentives Program (EQIP).

EFRP, administered by the USDA Farm Service Agency, was established to assist family forest landowners to rehabilitate timberland damaged by natural disasters. Practices available under the EFRP sign-up include removing debris and dead trees from timberland, site preparation and replanting, restoration of fire lanes, fuel breaks, erosion control structures, and associated practices. The program covers up to 75% of the cost to implement the emergency conservation practices.

There have been several sign-up programs since the Labor Day fires, generating \$60 million in requests in 253 applications as of early April (**Table 27**). There may be additional sign-up periods later this year.

Table 27: EFRP support requested by county (as of 4/7/2021).

| County | No. of Applicants | Requested Cost Share Dollars | Acreage |
|------------|-------------------|------------------------------|---------|
| Clackamas | 44 | \$9,640,248 | N/A |
| Douglas | 17 | \$6,249,813 | 1,659 |
| Jackson | 5 | \$1,548,158 | 270 |
| Klamath | 27 | \$2,880,404 | 1,461 |
| Lane | 44 | \$18,017,077 | N/A |
| Lincoln | 12 | \$1,247,736 | N/A |
| Linn | 34 | \$9,676,243 | N/A |
| Marion | 57 | \$7,522,278 | 4,110 |
| Tillamook | 2 | \$126,563 | 155 |
| Wasco | 8 | \$2,851,777 | N/A |
| Washington | 3 | \$315,967 | 74 |
| Total | 253 | \$60,076,264 | 4,339 |

EQIP provides financial and technical assistance to agricultural and forestry producers to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, reduced soil erosion and sedimentation, and improved or created wildlife habitat. The program is administered by the Natural Resources Conservation Service (NRCS). The program covers up to 75% of the cost of an approved practice.

The funding pools available immediately after the Labor Day fires were a narrow set of conservation practice standards to address imminent hazards rather than long-term restoration and reforestation needs. The suite of practices was aimed at providing private landowners the tools to address the immediate need to stabilize the soil in impacted areas, remove hazard trees, seed where appropriate, and mulch to begin to rehabilitate the forest soils. Additional funding pools are being established to provide further funding to family forest landowners (**Table 28**).

Table 28: EQIP statistics (as of 4/7/2021).

| County | No. of Contracts | No. of Acres | Dollars Obligated | \$/Acre |
|-----------|------------------|--------------|-------------------|----------|
| Lake | 3 | 6,109 | \$413,491 | \$ 68 |
| Clackamas | 3 | 1,631 | \$99,035 | \$ 61 |
| Douglas | 13 | 46 | \$51,342 | \$ 1,116 |
| Marion | 6 | 341 | \$83,461 | \$ 245 |
| Tillamook | 2 | 26 | \$12,782 | \$ 492 |
| Total | 27 | 8,153 | \$660,111 | \$ 81 |

Other potential funding sources are being explored to boost the state’s capacity to respond to the wildfire forest restoration needs. According to the ODF, the agency is applying for a block grant under the NRCS Regional Conservation Partnership Program. If approved, funds from the grant could be used to assist landowners. Additional funding from the Oregon Legislature, the NRCS EQIP program, USDA Forest Service State and Private Forestry and Joint Chiefs Landscape Initiative is also being sought. Finally, support from national non-governmental organizations such as the Arbor Day Foundation, American Forest Foundation, and One Tree Planted are also being investigated, particularly in relation to expanding seedling supply.

8.6 Nursery Production

According to a 2020 report on nationwide tree nursery production,²² Oregon and Washington produced 135 million seedlings in FY2019 and had unused capacity that could produce 24 million more seedlings. In addition, existing nurseries have the potential to expand bareroot seedling production by 24 million and container seedlings by 63 million. The total expansion potential (unused capacity plus expanded production) is estimated at 111 million seedlings.

A separate report provides more detail on the estimates of nursery production in Oregon and Washington.²³ This Forest Service report shows that 128.6 million conifer seedlings were produced in FY2019 including 66.9 million in Oregon and 61.7 million at Washington nurseries. An additional 2.7 million conifer seedlings were imported from Canadian nurseries. The remaining 4.0 million seedlings are hardwood species (**Table 29**). Assuming an average planting density of 350 trees per acre, there are enough conifer seedlings to plant 375,041 acres. By comparison, our analysis of fire damages indicates that about 339,000 burned acres will need

²² “Ramping up reforestation in the United States: A guide for policymakers,” *American Forests*, (March 2021).

²³ D.L. Haase, C. Pike, S. Enebak, L. Mackey, Z. Ma, and C. Silva, “Forest Nursery Seedling Production in the United States – Fiscal Year 2019,” (2020).

reforestation across all ownerships over the next three to four years, which means about an extra year’s worth of seedlings are needed.

Table 29: Seeding production in the Pacific Northwest, FY2019 (Source: Haase et. al., 2020).

| State | Hardwood Seedlings Produced | Hardwood Acres Planted | Conifer Seedlings Produced | Canadian Conifer Imports | Conifer Acres Planted ¹ | Total Seedlings Produced or Imported | Total Acres Planted ¹ |
|------------|-----------------------------|------------------------|----------------------------|--------------------------|------------------------------------|--------------------------------------|----------------------------------|
| Oregon | 3,627,300 | 10,364 | 66,872,937 | 390,000 | 192,180 | 70,890,237 | 202,544 |
| Washington | 388,113 | 1,109 | 61,702,571 | 2,298,952 | 182,861 | 64,389,636 | 183,970 |
| Pacific NW | 4,015,413 | 11,473 | 128,575,508 | 2,688,952 | 375,041 | 135,279,873 | 386,514 |

¹Assuming 350 seedlings planted per acre.

The number one barrier to expansion of seedling supply is the labor force, according to a survey of commercial nurseries. Work is seasonal and dependent on H2B visa guest workers. The second most often cited barrier is markets. Large commercial nurseries typically grow on contracts and need several years of sustained increases in orders to justify expansion. Smaller private and state nurseries grow “on spec” – guessing what buyers will need two years in advance. Under this business model, expansion carries more risk.

9.0 ADDITIONAL ECONOMIC IMPACTS

This section addresses impacts to other important components of Oregon’s Forest Sector. To the extent possible, impact estimates are quantified. In some cases, however, impacts cannot yet be quantified, but the narrative helps provide context and perspective to the quantifiable impacts.

9.1 Future Harvest Impacts

About 26% of the 595,000 forested acres that burned with medium or high severity are considered available for long-term multiple-rotation timber management under current plans and regulation (**Table 8**, Row 5 and Row 9). Over the next few years, most of the fire salvage activity will be focused on the portion of these acres that have merchantable timber. But the impact of the fires will be felt for at least the next 40 years – these burned acres will not be providing the future harvest anticipated prior to the fire.

Large private forest landowners and many family forest landowners are managing their land for economic returns derived from periodic harvest. **Table 30** summarizes the impact of the fire on the future harvest that could have been anticipated prior to the fires. In total, about 7.1 Bbf could have been harvested from these lands over the next 40 years.

Table 30: Annual reduction in future timber harvest (MMbf) from private forestland burned with medium or high severity.

| Years | Annual Impacts (MMBF) | | | Total Impacts (MMBF) | |
|---------|-----------------------|---------------|-------|----------------------|------------|
| | Large Private | Other Private | Total | Periodic | Cumulative |
| 2021-25 | 15 | 2 | 17 | 83 | 83 |
| 2026-30 | 78 | 35 | 113 | 567 | 651 |
| 2031-35 | 87 | 35 | 122 | 608 | 1,259 |
| 2036-40 | 94 | 35 | 129 | 647 | 1,906 |
| 2041-45 | 109 | 35 | 144 | 718 | 2,625 |
| 2046-50 | 138 | 34 | 172 | 859 | 3,484 |
| 2051-55 | 170 | 59 | 229 | 1,147 | 4,631 |
| 2056-60 | 201 | 65 | 267 | 1,333 | 5,964 |
| 2061-65 | 168 | 54 | 222 | 1,111 | 7,075 |

The impact of the fires on future harvests from USFS lands is less clear. The NWFP identified a sustainable harvest level from the matrix and adaptive management areas that far exceeds that agency’s actual timber sale levels. While the fires will disrupt sales planned for the next few years, there is still sufficient timber post-fire to allow the USFS to sell timber at recent levels.

The BLM anticipates that it will be able to continue to offer the allowable sale quantity (ASQ) declared in its forest plans, regardless of the fire.

As a result, this report does not project any impacts of the fires on public lands.

9.1.1 Economic Impacts on Oregon’s Forest Sector

Table 16 reports the current value of timber on merchantable acres and the net present value of future harvests from the pre-merchantable and recently harvested acres. As a result, no additional calculation of economic impact is needed. Employment impacts from the loss of future harvests are found in Section 9.6.

9.1.2 Assumptions for Future Harvest Calculations

The estimate of the impact of the fires is based on assumptions, discussed below, about acres available for harvest, and age class distribution.

Acres available for harvest: This calculation assumes that all of the acres available for long-term sustainable management that burned with medium or high severity on Large Private timberland would have contributed to future harvests.

Age class distribution: **Appendix A** discusses the process of classifying burned acres into broad age groups. The future harvest calculation requires more specificity. Acres were distributed within the age groups using USFS Forest Inventory and Analysis data. Plots within each fire, grouped by ownership, were used to generate the current age class distribution for USFS and BLM. On private land, younger age classes (<50 years) were not adequately represented by USFS FIA plots, so LEMMA/GNN age data were used to assist in generating the younger age classes for private lands. **Figure 13** shows the resulting age class distribution.

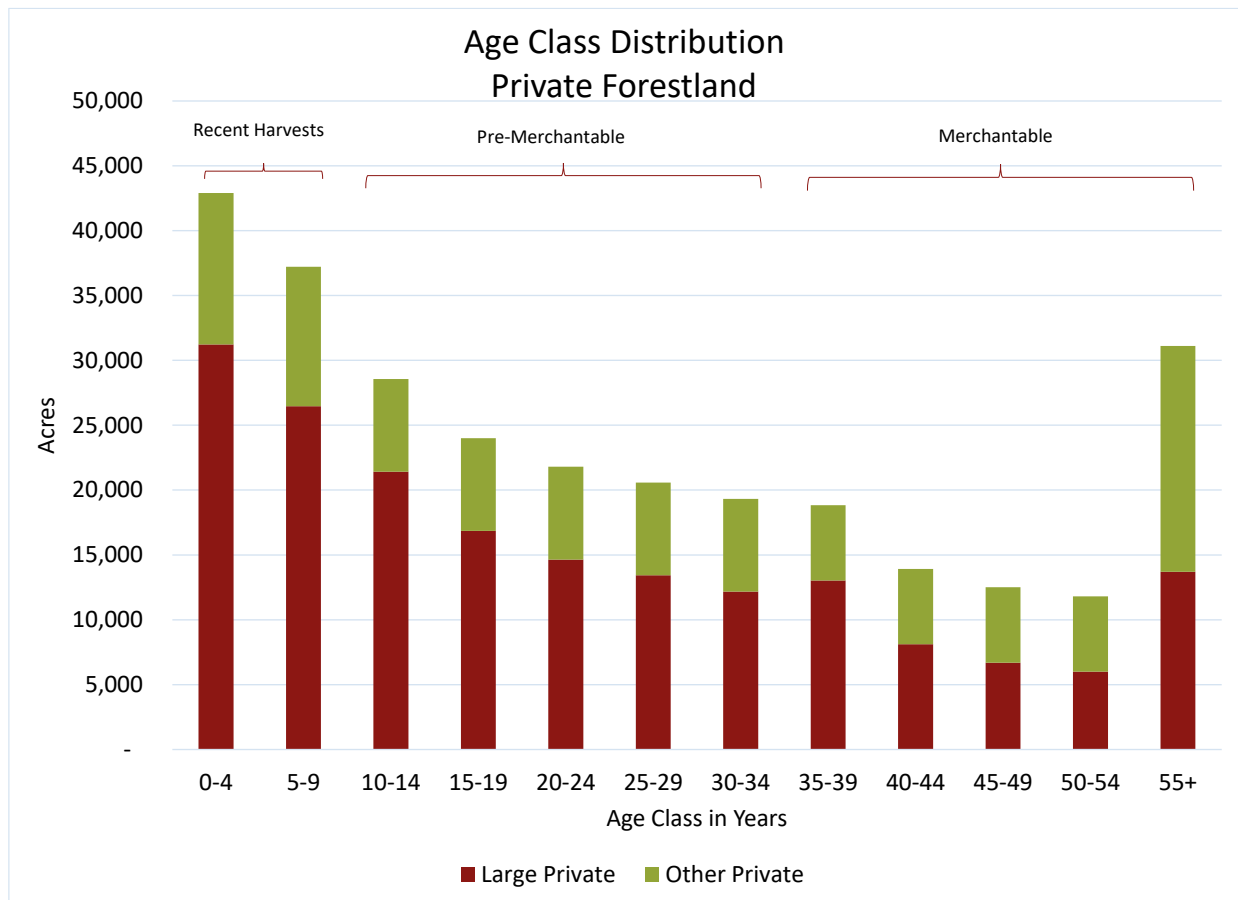


Figure 13: Future harvest volumes and timing.

Merchantable acres are assumed to have 28 Mbf/acre at final harvest. Volumes at final harvest were increased 15% for pre-merchantable and recently harvested acres, reflecting investments in improved seed and more intensive young stand management. For this calculation, future harvest is assumed to occur at age 40.

Since the impact of the loss of merchantable volume is accounted for elsewhere, the volume shown for the first five-year period is only the growth that would have occurred on the younger acres, had they been harvested at age 40.

9.2 Forest Contractors

In Oregon, forest contract operations necessary to grow, manage, access and sustain forestlands are conducted by independent contractors. These are typically small businesses that are paid on a production or project basis, determined in advance through contract negotiations with the service purchaser (usually a forest landowner or timber stumpage purchaser). Forest contractors include firms that conduct forest management activities including timber harvest, silvicultural treatments, road construction and maintenance, reforestation, protection, restoration, site improvement, transportation, hazard reduction, engineering and other professional forestry services.

Associated Oregon Loggers, Inc. (AOL) canvasses its member companies and compiled information about the impact of Oregon's Labor Day 2020 fires. Key points are summarized here. According to AOL, the direct economic impact to forest contract businesses statewide resulting from the September 2020 fires is at least \$100 million,²⁴ and nearly all of this loss was un-insurable or un-insured.

- **Burned assets: \$43 million.** This takes two forms. More than 120 machines (heavy equipment purpose-built for forestry, logging and forest road construction) were destroyed in the forest by the rapidly moving fires. Additionally, the fire burned timber that contractors had partially logged, but not yet completed. The contractors' investment of partially completed work was not compensable nor recoverable.
- **Idled operations: \$22 million.** Forest contract production was halted or delayed due to fire disruptions, dislocations, and forest regulations. This uncompensated idling of production could not be made up later and did not offset fixed costs nor contribute to profits to the forest contract sector.
- **Remobilizations: \$10 million.** Contractors were burdened with additional costs of relocating resources, heavy equipment and labor. Operations were moved out of the forest to safety, moved again during idling, and often moved again to alternate projects post-fire.
- **Replacement cost premiums: \$20 million.** Fire-induced disruptions of the forestry supply chain resulted in significant idling and/or loss of both workforce and equipment. The sudden scope and scale of the subsequent replacement of labor and equipment created extraordinary shortages, which triggered price escalation for both labor and equipment. The replacement cost premiums for replacement equipment and labor were largely unreimbursed by prior contract rates.
- **Equity recapitalization burdens: \$5 million.** An additional economic consequence of the fire-induced disruptions on Oregon forest contractors is the unplanned demands for extra cashflow and capital.

AOL also calculated fire-related impacts to Oregon's forest contract capacity. For example, while the fires burned, harvest was stalled on timber harvest units totaling approximately 150 MMBf. Production lost during

²⁴ Steve Wilent, "Oregon Wildfires: Loggers Take a \$100 Million Hit," *Timber Harvesting & Forest Operations*, (May/June 2021).

the period when contractors were displaced from forest production totaled at least 210 MMbf. In total, the fires disrupted or eliminated at least 360 MMbf of sawlog volume production activity from Oregon forests. Additional forest management project production was also stalled, including forest access road construction and maintenance, forest improvements and forest product transportation.

AOL notes that forest contractors are required by regulation and contractual obligations to provide both forest fire precautions (equipment, labor, training) as well as initial attack response. The cost of this “in kind” fire suppression is borne by the forest contractor. There are many examples of contractors providing unreimbursed fire patrol, equipment and personnel on initial attack for the Labor Day 2020 fires. Estimates of the cost of this work are not available.

After initial attack of these fires, some logging contractor assets were later hired under contract by landowners or agencies to assist with the firefighting attack. ODF can quickly enter into such contracts for fires under state jurisdiction. Contracting with the USFS jurisdiction, however, is more limited, with barriers to deployment.

Forest contractors across Oregon, Washington and Northern California in late 2020 were engaged in a remobilization effort to concentrate forest operations on burn area restoration and salvage. Forest landowners and timber purchasers through October 2020 shifted their work priorities – and contract operations – to new contracts in post-fire “forest restoration” and salvage work, aimed at timber harvest, road reconstruction, hazard reduction and large-scale reforestation.

The sudden shift to fire-killed forest restoration operations has drawn contractors away from their normal working circles located across all four Northwest states. Contractors are conducting salvage and restoration work on approximately 400,000 acres of burned private forestland among the three heavily burned states. Additional contract capacity has been mobilized to address the need for post-fire restoration.

9.3 Damage to Timber Under Contract

The fires burned ongoing timber sales on public and private land, which triggered additional costs to the landowner, contractors, and timber purchasers. These costs have not been estimated, but it is clear that the losses exceed the stumpage value.

- When burned timber is removed from an existing timber sale contract, the landowner loses the investment already made in that timber. Timber under contract has already incurred the costs of sale preparation, regulatory compliance, harvest administration and road work.
- If timber that has been felled has been damaged and cannot be recovered, then the loggers’ investment in the work has been lost.
- Loggers incurred additional costs on fire-affected sales, as they had to remove equipment from the path of the fire, and then move equipment back into the sale area after the fire.
- The landowner, contractor and timber purchaser will face additional administrative work required to modify existing contracts to account for fire damage.

The USFS had 22 timber sales or stewardship contracts affected by the fire. These sales had an original total volume of about 140 MMbf. These sales are still under review and the affected volume has not yet been

determined. Four of the 22 contracts have been mutually canceled and there are two more requests for cancellation. Three sales have had minor volumes of damaged timber added to the contracts. Three sales have had modifications for catastrophic damages. The remaining ten sales are currently undergoing analysis.

On USFS sales, damage from wildfire is a loss borne by the government. The government is not obligated to provide replacement volume.

BLM timber sales affected by the fire are shown in **Table 31**. Volumes are not available yet. Some sales are being modified or extended.

Table 31: Summary of BLM timber sales affected by the fires. Pertains to Western Oregon BLM active timber sales, completed, and proposed FY2017 through FY2024 that fall within the perimeter of 2020 large wildfires.

| Timber Sale Status | Field Office | Sale Name | Gross GIS Acres |
|--------------------|------------------|------------------|-----------------|
| Active | Butte Falls | Obenchain | 161 |
| | | Cemetery Road | 12 |
| | Cascades | Hole in the Road | 130 |
| | | Kernel Klink | 74 |
| | Swiftwater | Styx and Stones | 21 |
| | | Mid Indian | 156 |
| | Upper Willamette | Wild and Woolly | 66 |
| | | Total: | |

On BLM sales, fire risk is borne by the government, unless the fire is caused by the purchaser or its agents.

9.4 Impacts of Salvage on Local Timber Markets

This study estimates that about 1.7 Bbf of timber from the burned area will be salvaged over the next few years. A question outstanding is how much of this salvage will be harvested instead of timber scheduled for harvest pre-fire and how much of the salvage will be in addition to the pre-fire planned harvest.

Forest landowners and agencies with burned timber indicate that for the most part, harvest of green timber will be delayed while the burned timber is salvaged. In the case of some landowners, however, salvage of the burned timber will exceed the pre-fire planned harvest and will therefore constitute an addition to the normal expected level of timber harvest.

In theory, additional timber supply should trigger lower prices, all other things being equal, which should reduce somewhat the level of green timber harvest. It is too early to tell whether that will happen. A few observations indicate the complexities of the situation:

- While the Labor Day 2020 fires were extensive, many of Oregon’s timberland owners were not impacted. Their expectations of and need for revenue from their timberlands is not affected by the fire, and they have every incentive to continue with their annual harvest plans.
- For a variety of reasons, current prices for wood products are very high (see Section 97) and log prices are very good.

- Historic data suggest that harvest from family forest landowners is much more sensitive to price changes than is harvest from Large Private landowners. Current log prices are at a level that family forest landowners typically harvest more.
- Volume and prices of green and burned timber are not being collected or reported by the log price reporting firms.
- During the first several months after the fires, many market participants reported that there was no price differential between green and burned timber. Over the last few months, that appears to be changing in some areas.
- Early in the salvage of Large Private forest lands, many of the logs harvested were smaller diameter timber, and the mills took all that was offered. As salvage progressed, the mills were overwhelmed with small timber and began restricting delivery of smaller logs, hoping to get some larger logs to improve throughput.
- Early salvage of Large Private forest lands required additional logging and hauling capacity in affected regions. Some of this came from other areas of the state, some from out of state. Logging and hauling rates have increased as a result. This will increase costs across the land base. Higher logging costs and less contractor availability may limit harvest from landowners not otherwise affected by the fires.

In Oregon, timber harvest statistics are collected by Oregon Department of Revenue and reported by ODF, typically in August or September of the following year. As a result, it will be quite some time before the impact of the fires on total harvest will be known with any certainty.

9.5 Impacts at Wood Processing Mills

Operations at wood processing mills in western Oregon were immediately impacted by the Labor Day fires:

- At first, normal log deliveries were limited due to the disruptions to harvesting operations. Most mills reported low log inventory levels following the wildfires.
- Deliveries of burned logs to mills began soon after the fires were extinguished and have continued apace through mid-2021. Initially mills accepted the burned logs without issue, but mills have become more cautious as inventory levels in log yards were replenished.
- By spring 2021, some mills began limiting or ending purchases of burned logs. Mills reported an increase in the supply of smaller-diameter logs from salvage harvests of stands typically considered pre-merchantable. Some mills reported shifting some production to smaller-dimension lumber in order to utilize the smaller logs.

Mills reported the processing of burned logs tends to slow operations:

- At the log yard, for example, more intense scaling of burned logs to identify defects adds significant time to process log deliveries.

- Some mills report running log debarkers at a reduced rate to remove all burned material from the logs before further processing. This is necessary to prevent burned material entering the residual chip flow.
- Mills generally report that the damage to the burned logs is limited to the bark and are of an acceptable quality for processing. Any logs showing damage in the cambium layer, however, are typically rejected.

Nearly all the mills identified labor shortages as the primary factor limiting output in the short run. (One mill reported losing employees because their homes were destroyed by the fires, and they had to relocate.) Mills also report that widespread trucking shortages across the region have negatively affected operations.

In mid-2021, mills expect logs from restoration harvests will continue to represent a viable source of logs through spring of 2022. At least one log buyer expressed hope that logs from restoration harvests may bolster supply during the 2021 wildfire season if green log harvests are limited by wildfire logging restrictions.

Some mills anticipate receiving salvage logs from restoration harvests on public lands over the next two to three years. Past the salvage efforts, mills believed that available log supply will be a limiting factor to operations. At least one mill operator speculated that log shortages will result in running fewer shifts during stronger markets and shutdowns during market lulls.

9.6 Employment Impacts

In the near-term, fire salvage efforts are concentrating activity in the burned areas, but it is unclear whether the salvage activity will create new jobs in Oregon’s Forest Sector. Over the longer term, however, the loss of the timber on the burned acres is expected to affect about 1,200 to 3,000 direct jobs per year in Oregon’s Forest Sector, as shown in **Table 32**. To put that in context, OFRI’s *The 2019 Forest Report* indicates that there are about 36,000 direct jobs in Oregon’s Forest Sector.²⁵

Table 32: Employment impacts in terms of direct jobs in Oregon’s Forest Sector resulting from reduced future harvests.

| Years | Harvest Shortfall (MMbf) | Direct Jobs Impact |
|---------|--------------------------|--------------------|
| 2021-25 | 17 | 0 |
| 2026-30 | 113 | 1,229 |
| 2031-35 | 122 | 1,327 |
| 2036-40 | 129 | 1,404 |
| 2041-45 | 144 | 1,567 |
| 2046-50 | 172 | 1,871 |
| 2051-55 | 229 | 2,492 |
| 2056-60 | 267 | 2,905 |
| 2061-65 | 222 | 2,415 |

Near-term Employment Impacts: About 1.4 Bbf of timber is expected to be salvaged from the burned areas. Salvage operations started in late 2020 and will likely continue beyond 2023 (**Table 21**). Some of this work is performed by Oregon loggers from other regions who have been redirected to the burned areas. There are

²⁵ Oregon Forest Resources Institute, *The 2019 Forest Report*, (2020).

reports of logging crews from Washington and Idaho assisting with the salvage, suggesting that Oregon employment statistics might show an increase in logging employment during the salvage.

Whether the fire salvage ultimately increases employment in Oregon’s Forest Sector, however, depends on the extent to which the fire salvage volume adds to total harvest and total production of wood products. For some landowners, the salvage is offsetting the green timber they would have otherwise cut. And some landowners may be unable to get contractors to cut timber as previously planned (Section 9.4).

It is too early to determine how much of the salvage timber is in addition to planned harvest and how much offsets planned harvest. In Oregon, timber harvest statistics are derived from tax returns and reported by Oregon Department of Forestry, typically in August of the following year. It is therefore too early to determine how much of the salvage volume might be considered additional, and therefore providing new jobs.

Analysis of wood product production levels, furthermore, is complicated by the COVID pandemic recession. Through March, for example, 2021 lumber production in WWPA’s Coast Region (western Washington and Oregon) was up 9.2% over 2020 production. But only part of the harvest goes to sawmills, and the 2020 figures are reflecting the pandemic recession.

Long-term Employment Impacts: The fires destroyed timber on about 157,000 acres of merchantable timberland that would have otherwise been available for harvest (**Table 8**, Row 9) and another 231,500 acres of pre-merchantable timber that would have likewise been available for harvest when it matured. In total, therefore, the fires will effectively delay harvest on a total of 388,000 acres for at least 40 years.

Table 30 shows that the impact on future harvest ranges from about 115 MMbf to 265 MMbf per year.²⁶ Over the 40-year period, the lost harvest totals 7.1 Bbf.

Production of wood products by Oregon’s Forest Sector is generally thought to be limited by timber supply. An annual reduction of 115-265 MMbf of harvest, therefore, will likely reduce employment either through mill closures or through reduced hours at existing mills.

*The 2012 Forest Report*²⁷ estimates that in Oregon, a million board feet of logs support 10.88 direct jobs across Oregon’s Forest Sector. Table 32 applies that figure to the future harvest losses, showing annual job losses ranging from about 1,200 to nearly 3,000 direct jobs in Oregon’s Forest Sector, as a result of the loss of future harvest volume from the burned acres.

9.7 COVID Impacts

The Labor Day 2020 fires occurred during the COVID-19 pandemic. The pandemic affected the response of Oregon’s Forest Sector to disruptions caused by the Labor Day 2020 fires in several ways.

Prices for wood products set new highs during 4Q2020 and into 2Q2021. Across the country, mills initially limited production during the initial shutdown as the economy braced for what was projected to be a deep recession. Federal programs to boost the economy, however, had the unexpected impact of boosting the

²⁶ A typical Oregon sawmill uses about 80-100 MMbf of logs per year.

²⁷ Mark Rasmussen, Roger Lord, Brandon Vickery, Charles McKetta, Dan Green, MaryAnn Green, Tom Potiowsky, Darius Adamas, Greg Latta, Roy Anderson, Bill Mitchel, and Dan Mak, *The 2012 Forest Report: An Economic Assessment of Oregon’s Forest and Wood Products Manufacturing Sector*, Oregon Forest Resources Institute, (July 31, 2012).

demand for wood products, initially at the home centers. Stimulus checks coupled with stay-at-home orders allowed many people to take on repair and remodeling projects. Low interest rates had the effect of boosting demand for housing. In short, demand for wood products was greater than expected.

Meanwhile, COVID cases at the mills and throughout the production chain limited the ability of lumber and plywood mills to respond to increased demand. Federal unemployment benefits made it more advantageous for some potential forestry and manufacturing personnel to stay at home, rather than return to work. During the summer of 2020, it became clear that demand for wood products was exceeding the supply, and lumber and plywood prices were rising rapidly. By May 2020, the Random Lengths Framing Lumber Composite index exceeded \$1,500/Mbf, nearly four times the pre-COVID level.²⁸

The salvage harvest, therefore, began during a period of very favorable lumber prices, but limited mill capacity. Initially, this allowed favorable pricing for the smaller fire-killed timber. As the mill yards began to fill, however, the market for the smaller logs dropped off.

²⁸ For this study, the value of wood products that could be produced from the burned timber is based on the more conservative five-year average price – it does not reflect the 2020-2021 pricing.

10.0 SUMMARY OF ECONOMIC IMPACTS

The 12 fires analyzed in this study encompassed nearly 971,000 acres containing nearly 15 Bbf of green timber prior to the fires. Processing all of that timber through Oregon’s Forest Sector would’ve generated over \$30 billion of end-product value.

To estimate of the impact of the fires on Oregon’s Forest Product Sector, however, this analysis also recognizes other relevant factors:

- Not all the timber within the fire perimeters was destroyed.
- Some of the acres burned did not include merchantable timber – the loss on these acres, in terms of timber supply, will be realized in the future.
- Due to policies, regulations and landowner objectives, not all of the timber on the burned acres would have been available for harvest, prior to the fires.
- The value of some of the timber on the burned acres will be recovered through salvage harvest.
- Recovery and restoration of the burned acres will require additional costs.
- The fire disrupted forest operations and destroyed equipment.
- The loss of merchantable and pre-merchantable timber will create a harvest shortfall over the next 40 years.

Table 33 summarizes these factors and calculates that the total economic impact of the Labor Day 2020 fires on Oregon’s Forest Sector is about \$5.9 billion and will cost 1,200 to 3,000 jobs annually over the next 40 years.

Table 33: Summary of economic impacts of the Labor Day 2020 fires.

| Impact Description | Source | Amount (\$1000) |
|--|--------------------|----------------------|
| Value of timber on merchantable acres burned with medium or high severity, available for sustainable harvest | Table 16, Row 9 | \$ 7,513,000 |
| Net present value of timber on pre-merchantable acres burned with medium or high severity, available for sustainable harvest | | \$ 704,000 |
| Road reconstruction and maintenance costs | Section 8.5 | \$ 27,000 |
| Losses to forest contractors | Section 9.2 | \$ 100,000 |
| Reforestation costs | Section 8.3 | \$ 144,000 |
| Gross economic impacts | | \$ 8,488,000 |
| Offset - Value of timber likely to be salvaged | Table 16, Row 10 | \$ 2,604,000 |
| Net economic impact | | \$ 5,884,000 |
| Employment impacts, annual jobs 2026 - 2065 | Section 9.6 | 1,200 - 3,000 |

APPENDIX A: METHODS

Overview

Publicly available spatial datasets containing ownership and land management allocations, post-fire conditions, and pre-fire conditions were assembled. Publicly available forest inventory data were used to infer likely pre-fire timber volume for unique combinations of fire and landowner, while proprietary forest inventory data were used to train an image classification model to predict pre-fire forest age class. Pre-fire standing inventory within major wildfire perimeters was estimated for analysis units representing each combination of Oregon county, landowner group, wildfire, land management allocation, and pre-fire stand age class. Using a combination of burn severity data and pre-fire inventory, likelihood of forest restoration activity was estimated to infer probable timber recovery for each analysis unit. Public and proprietary economic data were leveraged to translate probable timber recovery into US dollar value reflecting the mix of timber products currently produced in Western Oregon, with prices informed by the most recent Oregon Mill Study data from the University of Montana Bureau of Business and Economic Research (BBER).²⁹

Table A 1: Compilation of publicly available data used in assessment of probable damage from the Oregon 2020 wildfires. Where specific contents were downloaded within a larger website, please refer to footnotes on the source URL.

| Ownership and Land Management | | |
|---------------------------------------|--|---|
| Landowner | Description | Source |
| USFS | Northwest Forest Plan (NWFP) Land Use Allocations | https://tinyurl.com/yufa4k7x ³⁰ |
| BLM | Western OR Resource Management Plan Land Use Allocations | https://tinyurl.com/2w92fxtz ³¹ |
| ODF | Land Management Layer (Public and Private) | https://tinyurl.com/nx2b5hzw |
| Wildfire Data | | |
| Agency | Content | Source |
| NIFC | Wildfire Perimeters (Oregon 20201113) | https://tinyurl.com/dtep3nu8 ³² |
| USFS | Rapid Assessment of Vegetation Condition (RAVG) 2020 Oregon | https://tinyurl.com/2kx6ez9r |
| Forest Inventory and Pre-Fire Imagery | | |
| Agency | Program | Source |
| USFS | Forest Inventory and Analysis (FIA – 2019) | https://tinyurl.com/tzdcyfsz ³³ |
| OSU | Landscape Ecology, Modeling, Mapping & Analysis (LEMMA-GNN) | https://tinyurl.com/cuxuk228 ³⁴ |
| ESA | European Space Agency / Copernicus Sentinel-2 2019-2020 | https://tinyurl.com/3fhaf92h |
| USGS | Landsat 8 Surface Reflectance Tier 2 (2019) | https://tinyurl.com/fnnbfwt2 |
| Economic Data | | |
| Agency | Department | Source |
| UM | Bureau of Business & Economic Research, Oregon Mill Study 2017 | https://tinyurl.com/49spsbu9 |

²⁹ University of Montana, Forest Industry Research Program, *Oregon forest products industry and timber harvest, 2017: Highlights and Summary Data Tables*, (December 12, 2019).

³⁰ https://www.fs.fed.us/r6/reo/library/downloads/maps/nwfp_lua_2013.zip

³¹ https://www.blm.gov/services/geospatial/GISData/oregon#quickset-services_geospatial_gis_data_ore_15

³² https://data-nifc.opendata.arcgis.com/search?tags=Category%2Chistoric_wildlandfire_opendata

³³ https://apps.fs.usda.gov/fia/datamart/datamart_sqlite.html

³⁴ <https://lemmdownload.forestry.oregonstate.edu/>

Ownership and Land Use Allocation

Polygon layers representing USFS, BLM and ODF land ownership were reconciled to minimize overlap artifacts using chiefly ArcGIS 10.3. Slivers less than 1/10th acre were removed, encompassing less than 500 acres overall. While ODF provides public access to a partial layer of private ownership, certain known Large Private ownerships were not accurately represented. Proprietary layers for some Large Private ownerships were used, but to maintain confidentiality, the identity and location of these owners and areas are not reported.

Each landowner follows a different forest plan with unique Land Use Allocations (LUA). While the “LUA” designation is formally used only by USFS and BLM, it is adopted here to refer to land use categories on the other ownerships as well. The ODF specifies a “Desired Future Condition” (DFC), but salvage harvest operations would potentially be permitted across any DFC, so the distinctions are not of further consequence to this analysis. The LUA potentially eligible for area salvage operations on USFS ownership are limited to those that are not Congressionally Withdrawn Areas, Riparian Reserves, or Late Successional Reserves (LSR). The specific LUA eligible for salvage treatments were the Adaptive Management Areas (AMA) or Other designations. The NWFP technically allows salvage harvest on LSR, for example, on the 2002 Biscuit Fire in the Rogue River-Siskiyou National Forest (Pers. Comm. Brian Spradlin, USFS). However, to minimize controversy and expedite hazard tree removal operations, USFS Region 6 has not proposed salvage in LSR areas in the 2020 wildfires. USFS has publicized a focus on hazard mitigation (roadside tree removal) and expects limited area salvage, if any.

The BLM expects a similar focus on hazard mitigation but is more open to area salvage. The BLM divides its ownership into the Harvest Land Base (HLB) and an array of reserve LUA. This report limits salvage-eligible acres to the HLB but acknowledges some fraction of BLM salvage may be roadside hazard reduction, which may occur on non-HLB if necessary. The BLM itself is currently assessing the total extent of area salvage, but area salvage will be constrained to HLB. The ODF conducts normal forest operations under a framework of LUA called Desired Future Condition (DFC). While DFC of Old Forest Structure (OFS) or Layered (LYR) are typically not prioritized for harvest, the ODF will pursue salvage harvest regardless of DFC if the burn severity and extent necessitate stand replacement or partial cut.

Private landowners are free to pursue salvage across their land base as long as it conforms to the Oregon Forest Practices Act. The ODF is allowing more extensive operations in riparian areas to facilitate canopy cover regeneration along streams. It is expected that most large private owners will salvage in riparian areas where consistent with ODF’s directive. Other private owners may pursue a similar salvage strategy.

Subsequent steps in this analysis focus on the eligible versus ineligible LUA groupings, and from this point forward, the sub-groups in each LUA class will be aggregated under either “Yes” or “No” eligibility classes (**Table A 2**).

Table A 2: Salvage eligibility was determined by the resource management plan or rules for each landowner: the NWFP for USFS; the BLM’s Resource Management Plan; and ODF’s 2020 Implementation Plan specific to wildfire recovery. Private landowners’ salvage harvest will conform to the Forest Practices Act.

| Owner | Salvage Eligibility Basis | Source | Eligibility | Classes |
|---------------|---------------------------|-----------------------------|-------------|---|
| USFS | Land Use Allocation | NWFP | Eligible | Adaptive Management Areas, Other |
| USFS | Land Use Allocation | NWFP | Ineligible | Late-Successional Reserve, Congressional Reserve, Administratively Withdrawn, Managed Late-Successional Area, Undefined, Riparian Reserve |
| BLM | Harvest Land Base | Resource Management Plan | Eligible | Harvest Land Base (Uneven-Aged Timber Area, Low Intensity Timber Area, Moderate Intensity Timber Area) |
| BLM | Harvest Land Base | Resource Management Plan | Ineligible | Congressionally Reserved Lands, District-Designated Reserve, Riparian Reserve, Eastside Management Area |
| ODF | Desired Future Condition | Implementation Plan | Eligible | General Use |
| ODF | Desired Future Condition | Implementation Plan | Ineligible | Non-Forest, Old Forest Structure, Layered |
| Large Private | All | Oregon Forest Practices Act | Eligible | Uplands; Most riparian can be salvaged |
| Other Private | All | Oregon Forest Practices Act | Eligible | Uplands; Likely reduced riparian salvage |

Table A 3: Acres within each ownership that are ineligible or eligible for salvage based on the relevant LUA. Note that while riparian areas are typically excluded from harvest units on private lands, the ODF is allowing salvage operations in riparian zones where it will facilitate regeneration, so riparian areas are at least partly allowed in these ownerships.

| Owner | Salvage Eligibility (Acres) by LUA | | Owner Total (Acres) |
|---------------|------------------------------------|----------------|---------------------|
| | No | Yes | |
| USFS | 189,131 | 175,174 | 364,304 |
| BLM | 90,128 | 39,189 | 129,317 |
| ODF | 6,740 | 18,440 | 25,180 |
| Large Private | - | 271,375 | 271,375 |
| Other Private | - | 180,676 | 180,676 |
| Total | 285,999 | 684,854 | 970,852 |

Pre-fire Forest Age Class

Proprietary forest inventory data were used to train a satellite image classifier to differentiate recently harvested areas, pre-merchantable (“premerch”) areas, and merchantable forest. Maintaining confidentiality, it is possible to report that these data derive from western Oregon and are representative of areas burned in the

2020 wildfires. Classifiers were built using a combination of LANDSAT 8 and Sentinel 2 imagery, ranging from acquisition dates in June 2019 through August 2020.

Known stand ages for more than 200 stands near the fire locations were classified using a Support Vector Machine procedure (Figure A 1), resulting in 80% classification accuracy (90% on recently cleared, 82% on premerch, and 76% on merchantable). Recent harvest ages were 0 through 8; premerch ages 9 through 34, and merchantable ages 35 and older.

Pre-fire cloud-free composite imagery from 2019 and 2020 was then classified using this method within the NIFC wildfire perimeters. Certain 2020 imagery was compromised by smoke and haze in the June-August composite due to other regional fires, so there is the potential for some confusion of recently harvested and premerch. The boundary between premerch and merchantable could also see up to one year of mis-characterization, particularly on the Riverside, Beachie Creek, and Holiday Farm fires where 2020 images were most extensively obscured. Classification applied at the 30' x 30' pixel level; all subsequent analysis (forest status, fire severity, timber volume) occurred at this resolution.

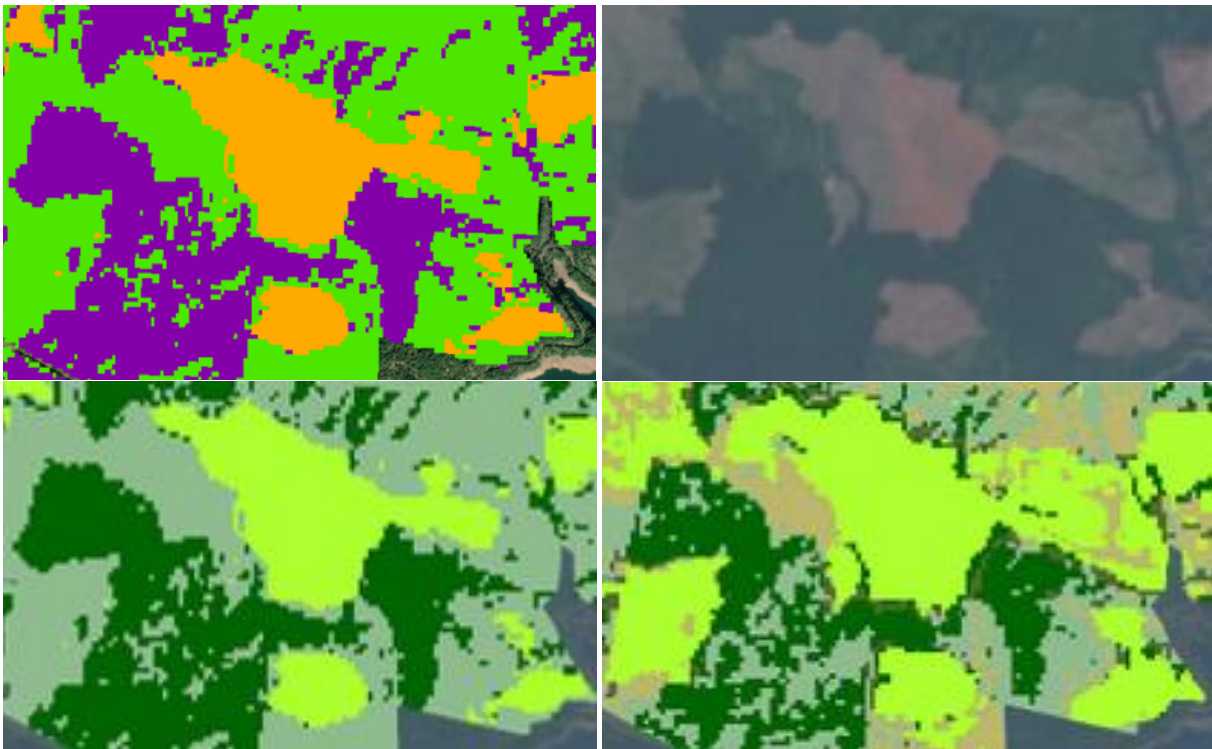


Figure A 1: Image classification of LANDSAT 8 pixels (aggregate cloud-free from 2019 and 2020) (top left), as compared to the raw aggregate image (top right). Input polygons averaging 18-22 acres (bottom left) produced the highest classification accuracy; a wider range of polygons (e.g., 15-25 acres, bottom right) reduced accuracy by several percentage points.

Area Reductions

Non-Forest Areas: Areas without trees, but which were not recent harvests, were excluded from analysis of pre-fire inventory and potential salvage volume. The NIFC wildfire perimeters partly exclude non-forest in some fires, but the perimeter polygons encompass significant areas without tree cover before the fire. The OSU-USFS LEMMA/GNN dataset was used to identify non-forest areas. This dataset is a raster product; GNN age raster was

clipped to each wildfire perimeter; null-value pixels from that layer were assigned a non-forest status and removed from ensuing acreage and volume calculations.

Roads: Based on analysis of several proprietary datasets, roads typically cover 3% of the forest area in western Oregon actively managed forests. Note that the removal of road area in, for example, USFS wilderness areas should not follow this same rationale since road density will be lower on those LUA, but that ultimately the economic calculations deriving from probable salvage volume do not depend on USFS wilderness, so an accurate roads classification for ineligible areas is not critical to the mission of this report.

In the merchantable age class, where pre-fire tree canopy cover mostly obscures roads, the satellite image classifier will not reliably identify roads, but in different ways for each age class. In merchantable age classes, a full 3% deduction should apply because roads are difficult to see beneath a tall canopy. In the premerch class, an approximate visual survey suggests roads are identified at perhaps a 50% rate, visible toward the younger end of the age range but obscured once stands approach 34 years old. For this age class, a 1.5% deduction for invisible roads should be applied; visible roads would be classified as recent harvest. In the recent harvest age class, the image classifier will confuse roads with recently cut forest area, partly from the 1.5% road area that should be premerch, and partly from legitimate roads within the recently cut areas. The classifier is incapable of differentiating road area from recent harvest, so the extent of invisible roads versus visible must be calculated. The invisible roads constituted:

$$\text{Invisible Roads} = 0.03 * \text{Merchantable Acreage} + 0.015 * \text{Pre-Merchantable Acreage} \quad (\text{Eq. 1})$$

All roads are visible in the recent harvest age class, but the classifier assigns recent harvest age class to some roads that are in premerch stands (skewed to younger ages). Again, the visual approximation suggests that 50% of the roads in premerch stands are classified as recent harvest. The amount of road area in the recent harvest classification is therefore not 3% but rather the total road area, excluding the invisible roads in the premerch and merchantable age classes. Expressed as an equation:

$$\text{Visible Roads} = (\text{Total Acres} * 0.03) - \text{Invisible Roads} \quad (\text{Eq. 2})$$

The acreage of visible roads and invisible roads was computed for each combination of owner and age class, such that total road area in each ownership summed to 3%.

Riparian Areas: On privately owned forestland in western Oregon, riparian areas (Riparian Management Zones – RMZ) typically cover around 4% of the forested land base. Within the forest age classification system adopted for this report, virtually all RMZ would be classified as merchantable age class, with limited area in the premerch class. It is unlikely, based on the classification confusion matrix, that RMZ would be mis-classified as recent harvest. This analysis assumes that 80% of RMZ will be classified as merchantable and 20% as premerch. Special circumstances permit salvage operation within RMZ where justified by burn severity; typical Oregon Forest Practices Act regulations may be temporarily relaxed to facilitate faster tree cover establishment near streams. It is assumed that RMZ salvage will not occur on public lands, but that 50% of RMZ will be salvaged on private lands with medium intensity and higher burn severity (>25% canopy cover loss).

Access to an RMZ layer for ODF was not straightforward, so the 4% RMZ assumption was applied to ODF land as well, although this reduction has no influence on calculation of ODF economic impacts because ODF's Implementation Plan states their salvage objectives. The riparian fraction has already been excluded from the BLM HLB, so no further reduction for RMZ is applied to BLM. USFS Region 6 reports approximately 19% RMZ (Pers. Comm. Carrie Spradlin. 2021).

Wildfire Severity

Wildfire perimeters (NIFC) were downloaded on terminal date November 13, 2020. Few fires were actively burning by that date over appreciable areas, and perimeters did not appear to change later for the major fires.

The USFS RAVG program³⁵ offers several schemes for classifying fire severity by basal area loss and canopy cover loss. For this report, canopy cover loss is used as a proxy for fire severity because canopy loss is a strong correlate of eventual fire-induced mortality.³⁶ The RAVG canopy cover loss product is a percent scale from 0 to 100. A likely threshold for area-based restoration treatments is around 25% canopy damage. Above that point, it makes more economic sense to replace the stand with a new cohort rather than to selectively operate (remove stems) around trees likely to survive. Below the 25% threshold, conversely, sufficiently few trees die that disturbing the stand is not economically necessary, so a partial treatment to remove dead trees is not pursued. For private land, the probability of restoration is assumed to be binary: either restoration will not occur (canopy cover loss <25%) or restoration will occur, and it will be a stand replacement (where canopy cover loss ≥25%). A similar binary approach is likely suitable for ODF land. On federal land, however, the threshold for treatment differs, with USFS focused on salvage where canopy cover loss exceeds 75%, and BLM where canopy cover loss exceeds 50%. Volume reduction percentage is calculated as an acre-weighted average by ownership of green tree retention for each severity class (midpoint of 50% to 75%, and midpoint of 75% to 100%). For USFS, this translates to 10% reduction in volume; for BLM, 15% reduction in volume, consistent with BLM reported leave tree levels. The RAVG assessment used for this report was based on satellite imagery collected October 9, 2020.

Volume Assignment and Reductions

Standing pre-fire forest inventory was assessed using USDA/USFS Forest Inventory and Analysis (FIA) and OSU-USFS LEMMA/GNN. Consultation with USFS Region 6 biometricians (Pers. Comm. J. Fried, 2018; Pers. Comm. M. Palmer, 2021) suggests that FIA data are best suited to application where the total area meets or exceeds the size of a single national forest or a single county. Where areas are smaller than this scale, or where the result must be dispersed among combinations of owners and ages classes – precisely the situation in the 2020 Oregon wildfires – uncertainty in the FIA data increases beyond target levels. For small-area applications, the USFS recommends using the OSU-USFS LEMMA/GNN data, and the in-place (spatially located) volume rather than the in-place forest age.

For each combination of ownership and wildfire perimeter, pre-fire standing inventory was calculated for the merchantable age class (35 years and older) as the average of LEMMA/GNN gross volume. This volume [raster] layer is provided in cubic foot units. The FIA volume data for western Oregon suggest a gross cubic foot to gross Board Feet (Scribner³⁷) conversion of 5.35 BdFt/CuFt. The board-cube ratio is essentially independent of age at the stand level. At the individual tree level, a smaller-diameter tree will contain fewer board-feet than a larger-diameter tree. At the stand level, however, the relative homogeneity of diameters in even-aged western Oregon forests translates to a nearly linear relationship between board-cube ratio and stand age. A second reason to use LEMMA/GNN is that the FIA sampling intensity on certain ownerships is relatively low. Fewer FIA plots are

³⁵ <https://tinyurl.com/2kx6ez9r>

³⁶ Thomas Whittier and Andrew Gray, “Tree mortality based fire severity classification for forest inventories; A Pacific Northwest national forests example,” <https://doi.org/10.1016/j.foreco.2015.10.015>; Sean Parks, Gregory Dillon, and Carol Miller, “A New Metric for Quantifying Burn Severity: The Relativized Burn Ratio,” (2014), https://www.fs.fed.us/rm/pubs_other/rmrs_2014_parks_s002.pdf

³⁷ FIA gross BdFt volume reported units are International 1/4 inch; a Scribner Decimal C conversion of FIA data was implemented using the MBGTools software platform, merchandising tree dimensions on a long (40') log scale.

located on private lands than on federal lands overall, and a majority of burned acreage was located on federal land. In most fire perimeters, the number of FIA plots per acre was lower on private land than on federal land, to the exclusion of important merchantable age classes. In contrast, the LEMMA/GNN volume is available for every forested acre (30' x 30' pixels). For the merchantable age classes (older than 35 years) the per-acre volume was calculated for each combination of owner by wildfire perimeter (**Table A 4**).

Table A 4: Gross volume (Scribner Decimal C Mbf) per acre for merchantable age classes by ownership for each of the focal 2020 Oregon wildfires. This volume is further reduced by a gross-net conversion factor of 0.925 (7.5% hidden defect) and assorted owner- and treatment-specific reductions.

| Fire | Merchantable Age Class Mbf/acre | | | | |
|-----------------|---------------------------------|------|------|---------------|---------------|
| | USFS | BLM | ODF | Large Private | Other Private |
| Riverside | 38.6 | 42.1 | - | 21.2 | 20.0 |
| Beachie Creek | 32.5 | 45.2 | 27.6 | 21.9 | 23.8 |
| Lionshead | 32.8 | - | 24.1 | 24.2 | 19.3 |
| Holiday Farm | 46.1 | 51.9 | 36.4 | 24.0 | 27.8 |
| Archie Creek | 43.5 | 43.8 | - | 22.6 | 22.1 |
| Thielsen | 31.1 | - | - | - | - |
| South Obenchain | - | 10.2 | - | 8.8 | 6.6 |
| 242 | 15.5 | - | - | 8.8 | 6.5 |
| Slater | 35.2 | 23.7 | 13.7 | 16.1 | 19.4 |
| White River | 25.9 | 24.8 | - | - | 6.4 |
| P515 | - | - | - | - | 8.6 |
| Green Ridge | 23.6 | - | - | - | 10.7 |

The age classification method using LANDSAT 8 and Sentinel 2 imagery does not enable finer resolution of age class distribution. Use of the LEMMA/GNN age class raster layer for in-place forest age assessment is not recommended (Pers. Comm. M. Palmer, 2021). For sufficiently large areas (entire national forests, counties), FIA age class distributions are often left-skewed relative to the corresponding LEMMA/GNN age class distribution for the same area. While the volume-per-acre on a LEMMA/GNN age class is trustworthy, the in-place age class distribution may not be as reliable. For example, whether a LEMMA/GNN pixel is classified as 120 years old or 150 years old has no impact on the aggregate volume per acre of the merchantable age class – both pixels are in the same age class. The relative proportion of 120-year-old or 150-year-old stands (pixels), however, would differ; the FIA and LEMMA/GNN ages appear to diverge more extensively at older ages. The premerch age class (or the boundary between premerch and merchantable) is similar in both datasets, but the extreme older ages in the merchantable class diverge. Subsequent volume and economic results depend primarily on the merchantable age class, however, so this divergence can be safely set aside.

Restoration Treatments Differ by Owner

The extent of restoration (salvage harvest) operations will vary by owner, including the areal extent of planned treatments, degree of overstory removal, and pace of operations. The USFS intends to focus on hazard mitigation, chiefly roadside hazard tree removal, with limited or zero focus on area salvage. As USFS staffing is inelastic, these operations would occur in place of typical area sales. The USFS road network within the fire areas is estimated at 1,200 miles, which with a 150-foot buffer on each side, translates to 43,000 acres of hazard

mitigation. The USFS also states an intention to focus on areas with greater than 75% burn severity, which is approximately 150,000 acres out of 350,000 acres. Collectively, this suggests around 18,500 acres of tree removal. Where burn severity exceeds 75% (canopy cover loss), a 10% green tree retention is expected. The Forest Service also expects operations to extend over three years, with volume loss to deterioration of 20%.

The BLM faces some similar constraints as USFS in terms of pace (litigation may delay BLM timber sales), but will focus to a greater extent on area sales, with roadside hazard tree removal as necessary for transportation safety. The BLM expects salvage harvests ranging from 8,000 to 14,000 acres, the uncertainty deriving from logistical issues like access and contractor availability. The midpoint of this range, 11,000 acres, was selected as the probable salvage acreage for the BLM. Salvage will focus on areas exceeding 50% burn severity and older than 50 years, which should result in 15% green tree retention. Pace and deterioration rate are assumed by the BLM to result in 20% volume loss.

Forests owned by the ODF were most heavily impacted by the Beachie Creek Fire on the Santiam State Forest (SSF). The ODF plans a range of stand-replacing salvage with a midpoint of 3,125 acres, and a range of partial salvage with a midpoint of 1,663 acres. Combined, the ODF likely plans to salvage 4,788 acres; it is assumed that 50% green tree retention would occur with partial salvage. The ODF has suggested a focus on any merchantable age class, consistent with our 35-year-old lower limit, with a likely green tree retention around 21% of volume (based on an acre-weighted average of green trees by burn severity group). While the ODF is moving as quickly as possible to salvage, the likely pace could translate to 12% volume loss to deterioration.

Salvage harvests on private lands will focus on volume recovery and forest cover restoration. Large private landowners expect to salvage 80% of their acreage, and it is surmised that other private owners may operate on 50% of the burned acreage. Any burn severity level above 25% canopy cover loss is assumed to be prioritized for salvage. Large private owners are moving quickly to complete salvage, with an estimated 60% complete in FY21 and the remainder in FY22. Deterioration should be minimal given the speed of operations, so volume loss to deterioration is set at 6%. With logging contractors focused on larger private land holdings, other private landowners will have to wait some time to begin operations, possibly completing 20% in FY21, 70% in FY22, and 10% in FY23. Volume losses on other private land from deterioration are set at 14%.

APPENDIX B: IMPACTS BY FIRE

Salvage Estimates by Wildfire

| Fire: Riverside | | | | | | | |
|-------------------------------------|-----------|-------------------|------------------|---------------|-------------------|-----------------|-------------------|
| Row | USFS | BLM | ODF | Large Private | Other Private | Total | |
| Acres | | | | | | | |
| Total Acres | 1 | 83,000 | 12,600 | - | 39,400 | 3,000 | 138,000 |
| Non-Forest and Roads | 2 | 3,300 | 700 | - | 1,900 | 300 | 6,200 |
| Forested Acres | 3 | 79,700 | 11,900 | - | 37,500 | 2,700 | 131,800 |
| Unburned and Low Severity | 4 | 30,500 | 7,100 | - | 16,100 | 1,700 | 55,400 |
| Medium and High Severity | 5 | 49,200 | 4,800 | - | 21,400 | 1,100 | 76,500 |
| Pre-merchantable | 6 | 15,400 | 2,000 | - | 16,600 | 900 | 34,900 |
| Merchantable | 7 | 33,800 | 2,800 | - | 4,800 | 200 | 41,600 |
| Unavailable for Sust. Harvest | 8 | 18,800 | 1,800 | - | 700 | - | 21,300 |
| Available for Sust. Harvest | 9 | 15,000 | 1,000 | - | 4,100 | 100 | 20,200 |
| Probable Salvage Acres | 10 | 5,300 | 700 | - | 3,600 | 100 | 9,700 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 1,940,000 | 268,000 | - | 258,000 | 13,000 | 2,479,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 1,940,000 | 268,000 | - | 258,000 | 13,000 | 2,479,000 |
| Unburned and Low Severity | 4 | 732,000 | 160,000 | - | 164,000 | 10,000 | 1,066,000 |
| Medium and High Severity | 5 | 1,208,000 | 107,000 | - | 94,000 | 3,000 | 1,412,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 1,208,000 | 107,000 | - | 94,000 | 3,000 | 1,412,000 |
| Unavailable for Sust. Harvest | 8 | 672,000 | 70,000 | - | 14,000 | 1,000 | 757,000 |
| Available for Sust. Harvest | 9 | 536,000 | 37,000 | - | 81,000 | 2,000 | 656,000 |
| Probable Salvage MBF | 10 | 61,000 | 13,000 | - | 66,000 | 1,000 | 141,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 3,858,000 | \$ 540,000 | \$ 1,000 | \$ 580,000 | \$ 33,000 | \$ 5,012,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 3,858,000 | \$ 540,000 | \$ 1,000 | \$ 580,000 | \$ 33,000 | \$ 5,012,000 |
| Unburned and Low Severity | 4 | \$ 1,459,000 | \$ 324,000 | \$ - | \$ 349,000 | \$ 24,000 | \$ 2,156,000 |
| Medium and High Severity | 5 | \$ 2,399,000 | \$ 216,000 | \$ - | \$ 231,000 | \$ 9,000 | \$ 2,855,000 |
| Pre-merchantable | 6 | \$ 69,000 | \$ 9,000 | \$ - | \$ 48,000 | \$ 3,000 | \$ 129,000 |
| Merchantable | 7 | \$ 2,330,000 | \$ 207,000 | \$ - | \$ 182,000 | \$ 6,000 | \$ 2,725,000 |
| Unavailable for Sust. Harvest | 8 | \$ 1,297,000 | \$ 136,000 | \$ - | \$ 27,000 | \$ 1,000 | \$ 1,461,000 |
| Available for Sust. Harvest | 9 | \$ 1,033,000 | \$ 71,000 | \$ - | \$ 156,000 | \$ 4,000 | \$ 1,264,000 |
| Probable Salvage \$ | 10 | \$ 117,000 | \$ 25,000 | \$ - | \$ 127,000 | \$ 2,000 | \$ 271,000 |

Fire: Beachie Creek

| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
|-------------------------------------|-----------|------------------|-------------------|-------------------|-------------------|------------------|-------------------|
| Acres | | | | | | | |
| Total Acres | 1 | 50,500 | 38,600 | 23,900 | 61,600 | 19,000 | 193,600 |
| Non-Forest and Roads | 2 | 2,000 | 1,900 | 1,000 | 2,800 | 3,100 | 10,800 |
| Forested Acres | 3 | 48,400 | 36,700 | 22,800 | 58,800 | 15,900 | 182,600 |
| Unburned and Low Severity | 4 | 8,500 | 15,300 | 11,600 | 17,700 | 6,800 | 59,900 |
| Medium and High Severity | 5 | 39,900 | 21,400 | 11,200 | 41,100 | 9,100 | 122,700 |
| Pre-merchantable | 6 | 6,700 | 6,300 | 5,000 | 31,400 | 6,500 | 55,900 |
| Merchantable | 7 | 33,200 | 15,000 | 6,200 | 9,700 | 2,600 | 66,700 |
| Unavailable for Sust. Harvest | 8 | 27,700 | 10,600 | 400 | 1,400 | 300 | 40,400 |
| Available for Sust. Harvest | 9 | 5,400 | 4,400 | 5,800 | 8,400 | 2,300 | 26,300 |
| Probable Salvage Acres | 10 | 1,900 | 3,300 | 4,800 | 7,200 | 1,200 | 18,400 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 1,207,000 | 1,070,000 | 363,000 | 315,000 | 114,000 | 3,069,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 1,207,000 | 1,070,000 | 363,000 | 315,000 | 114,000 | 3,069,000 |
| Unburned and Low Severity | 4 | 209,000 | 441,000 | 206,000 | 119,000 | 55,000 | 1,030,000 |
| Medium and High Severity | 5 | 997,000 | 629,000 | 158,000 | 197,000 | 59,000 | 2,040,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 997,000 | 629,000 | 158,000 | 197,000 | 59,000 | 2,040,000 |
| Unavailable for Sust. Harvest | 8 | 834,000 | 443,000 | 9,000 | 27,000 | 7,000 | 1,320,000 |
| Available for Sust. Harvest | 9 | 163,000 | 186,000 | 148,000 | 169,000 | 52,000 | 718,000 |
| Probable Salvage MBF | 10 | 19,000 | 65,000 | 71,000 | 137,000 | 22,000 | 314,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 2,364,000 | \$ 2,116,000 | \$ 737,000 | \$ 760,000 | \$ 262,000 | \$ 6,239,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 2,364,000 | \$ 2,116,000 | \$ 737,000 | \$ 760,000 | \$ 262,000 | \$ 6,239,000 |
| Unburned and Low Severity | 4 | \$ 410,000 | \$ 874,000 | \$ 413,000 | \$ 282,000 | \$ 123,000 | \$ 2,102,000 |
| Medium and High Severity | 5 | \$ 1,954,000 | \$ 1,243,000 | \$ 324,000 | \$ 478,000 | \$ 139,000 | \$ 4,138,000 |
| Pre-merchantable | 6 | \$ 30,000 | \$ 29,000 | \$ 20,000 | \$ 99,000 | \$ 25,000 | \$ 203,000 |
| Merchantable | 7 | \$ 1,924,000 | \$ 1,213,000 | \$ 304,000 | \$ 379,000 | \$ 114,000 | \$ 3,934,000 |
| Unavailable for Sust. Harvest | 8 | \$ 1,609,000 | \$ 855,000 | \$ 18,000 | \$ 53,000 | \$ 13,000 | \$ 2,548,000 |
| Available for Sust. Harvest | 9 | \$ 315,000 | \$ 358,000 | \$ 286,000 | \$ 326,000 | \$ 101,000 | \$ 1,386,000 |
| Probable Salvage \$ | 10 | \$ 36,000 | \$ 126,000 | \$ 136,000 | \$ 265,000 | \$ 42,000 | \$ 605,000 |

Fire: Lionshead

| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
|-------------------------------------|-----------|------------------|-------------|-------------|------------------|------------------|-------------------|
| Acres | | | | | | | |
| Total Acres | 1 | 104,800 | - | 500 | 6,200 | 93,100 | 204,600 |
| Non-Forest and Roads | 2 | 6,500 | - | - | 300 | 4,900 | 11,700 |
| Forested Acres | 3 | 98,300 | - | 500 | 5,900 | 88,200 | 192,900 |
| Unburned and Low Severity | 4 | 43,700 | - | 300 | 3,500 | 37,400 | 84,900 |
| Medium and High Severity | 5 | 54,600 | - | 200 | 2,400 | 50,700 | 107,900 |
| Pre-merchantable | 6 | 9,700 | - | 100 | 800 | 21,100 | 31,700 |
| Merchantable | 7 | 44,900 | - | 100 | 1,600 | 29,600 | 76,200 |
| Unavailable for Sust. Harvest | 8 | 32,600 | - | - | 100 | 1,700 | 34,400 |
| Available for Sust. Harvest | 9 | 12,300 | - | 100 | 1,500 | 27,900 | 41,800 |
| Probable Salvage Acres | 10 | 4,300 | - | - | 1,300 | 27,200 | 32,800 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 2,455,000 | - | 9,000 | 104,000 | 372,000 | 2,940,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 2,455,000 | - | 9,000 | 104,000 | 372,000 | 2,940,000 |
| Unburned and Low Severity | 4 | 1,091,000 | - | 6,000 | 67,000 | 155,000 | 1,319,000 |
| Medium and High Severity | 5 | 1,364,000 | - | 3,000 | 36,000 | 216,000 | 1,619,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 1,364,000 | - | 3,000 | 36,000 | 216,000 | 1,619,000 |
| Unavailable for Sust. Harvest | 8 | 990,000 | - | - | 2,000 | 12,000 | 1,004,000 |
| Available for Sust. Harvest | 9 | 374,000 | - | 3,000 | 35,000 | 204,000 | 616,000 |
| Probable Salvage MBF | 10 | 42,000 | - | - | 27,000 | 33,000 | 102,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 4,797,000 | \$ - | \$ 18,000 | \$ 204,000 | \$ 786,000 | \$ 5,805,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 4,797,000 | \$ - | \$ 18,000 | \$ 204,000 | \$ 786,000 | \$ 5,805,000 |
| Unburned and Low Severity | 4 | \$ 2,130,000 | \$ - | \$ 12,000 | \$ 132,000 | \$ 324,000 | \$ 2,598,000 |
| Medium and High Severity | 5 | \$ 2,667,000 | \$ - | \$ 6,000 | \$ 72,000 | \$ 463,000 | \$ 3,208,000 |
| Pre-merchantable | 6 | \$ 36,000 | \$ - | \$ - | \$ 2,000 | \$ 45,000 | \$ 83,000 |
| Merchantable | 7 | \$ 2,631,000 | \$ - | \$ 6,000 | \$ 70,000 | \$ 418,000 | \$ 3,125,000 |
| Unavailable for Sust. Harvest | 8 | \$ 1,910,000 | \$ - | \$ - | \$ 3,000 | \$ 24,000 | \$ 1,937,000 |
| Available for Sust. Harvest | 9 | \$ 721,000 | \$ - | \$ 6,000 | \$ 67,000 | \$ 394,000 | \$ 1,188,000 |
| Probable Salvage \$ | 10 | \$ 82,000 | \$ - | \$ - | \$ 51,000 | \$ 65,000 | \$ 198,000 |

Fire: Holiday Farm

| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
|-------------------------------------|-----------|------------------|------------------|-------------|-------------------|------------------|-------------------|
| Acres | | | | | | | |
| Total Acres | 1 | 31,200 | 18,500 | 100 | 110,800 | 13,300 | 173,900 |
| Non-Forest and Roads | 2 | 1,100 | 800 | - | 3,700 | 2,400 | 8,000 |
| Forested Acres | 3 | 30,000 | 17,800 | - | 107,100 | 10,900 | 165,800 |
| Unburned and Low Severity | 4 | 10,100 | 2,400 | - | 25,500 | 3,800 | 41,800 |
| Medium and High Severity | 5 | 20,000 | 15,400 | - | 81,600 | 7,000 | 124,000 |
| Pre-merchantable | 6 | 5,700 | 4,600 | - | 62,400 | 5,400 | 78,100 |
| Merchantable | 7 | 14,300 | 10,800 | - | 19,200 | 1,600 | 45,900 |
| Unavailable for Sust. Harvest | 8 | 7,900 | 8,400 | - | 2,700 | 200 | 19,200 |
| Available for Sust. Harvest | 9 | 6,400 | 2,400 | - | 16,500 | 1,400 | 26,700 |
| Probable Salvage Acres | 10 | 2,200 | 1,800 | - | 14,300 | 700 | 19,000 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 958,000 | 593,000 | 1,000 | 678,000 | 83,000 | 2,313,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 958,000 | 593,000 | 1,000 | 678,000 | 83,000 | 2,313,000 |
| Unburned and Low Severity | 4 | 351,000 | 75,000 | 1,000 | 251,000 | 39,000 | 717,000 |
| Medium and High Severity | 5 | 607,000 | 518,000 | - | 427,000 | 44,000 | 1,596,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 607,000 | 518,000 | - | 427,000 | 44,000 | 1,596,000 |
| Unavailable for Sust. Harvest | 8 | 336,000 | 403,000 | - | 60,000 | 6,000 | 805,000 |
| Available for Sust. Harvest | 9 | 271,000 | 115,000 | - | 367,000 | 38,000 | 791,000 |
| Probable Salvage MBF | 10 | 31,000 | 40,000 | - | 298,000 | 16,000 | 385,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 1,883,000 | \$ 1,169,000 | \$ 2,000 | \$ 1,578,000 | \$ 191,000 | \$ 4,823,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 1,883,000 | \$ 1,169,000 | \$ 2,000 | \$ 1,578,000 | \$ 191,000 | \$ 4,823,000 |
| Unburned and Low Severity | 4 | \$ 685,000 | \$ 149,000 | \$ 1,000 | \$ 547,000 | \$ 85,000 | \$ 1,467,000 |
| Medium and High Severity | 5 | \$ 1,197,000 | \$ 1,021,000 | \$ 1,000 | \$ 1,031,000 | \$ 106,000 | \$ 3,356,000 |
| Pre-merchantable | 6 | \$ 25,000 | \$ 21,000 | \$ - | \$ 208,000 | \$ 21,000 | \$ 275,000 |
| Merchantable | 7 | \$ 1,172,000 | \$ 999,000 | \$ - | \$ 823,000 | \$ 86,000 | \$ 3,080,000 |
| Unavailable for Sust. Harvest | 8 | \$ 649,000 | \$ 778,000 | \$ - | \$ 115,000 | \$ 12,000 | \$ 1,554,000 |
| Available for Sust. Harvest | 9 | \$ 523,000 | \$ 222,000 | \$ - | \$ 708,000 | \$ 74,000 | \$ 1,527,000 |
| Probable Salvage \$ | 10 | \$ 59,000 | \$ 78,000 | \$ - | \$ 576,000 | \$ 31,000 | \$ 744,000 |

Fire: Archie Creek

| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
|-------------------------------------|-----------|------------------|-------------------|-------------|-------------------|------------------|-------------------|
| Acres | | | | | | | |
| Total Acres | 1 | 26,400 | 40,400 | - | 46,400 | 18,400 | 131,600 |
| Non-Forest and Roads | 2 | 1,100 | 1,900 | - | 1,700 | 1,400 | 6,100 |
| Forested Acres | 3 | 25,300 | 38,500 | - | 44,700 | 16,900 | 125,400 |
| Unburned and Low Severity | 4 | 7,700 | 11,300 | - | 7,700 | 3,900 | 30,600 |
| Medium and High Severity | 5 | 17,700 | 27,200 | - | 37,000 | 13,100 | 95,000 |
| Pre-merchantable | 6 | 5,000 | 5,600 | - | 22,900 | 9,700 | 43,200 |
| Merchantable | 7 | 12,700 | 21,600 | - | 14,100 | 3,300 | 51,700 |
| Unavailable for Sust. Harvest | 8 | 7,800 | 14,900 | - | 1,200 | 400 | 24,300 |
| Available for Sust. Harvest | 9 | 4,900 | 6,800 | - | 12,900 | 2,900 | 27,500 |
| Probable Salvage Acres | 10 | 1,700 | 5,000 | - | 10,800 | 1,600 | 19,100 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 776,000 | 1,254,000 | 1,000 | 372,000 | 104,000 | 2,507,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 776,000 | 1,254,000 | 1,000 | 372,000 | 104,000 | 2,507,000 |
| Unburned and Low Severity | 4 | 265,000 | 376,000 | 1,000 | 78,000 | 35,000 | 755,000 |
| Medium and High Severity | 5 | 511,000 | 878,000 | - | 294,000 | 68,000 | 1,751,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 511,000 | 878,000 | - | 294,000 | 68,000 | 1,751,000 |
| Unavailable for Sust. Harvest | 8 | 315,000 | 603,000 | - | 25,000 | 9,000 | 952,000 |
| Available for Sust. Harvest | 9 | 196,000 | 275,000 | - | 268,000 | 60,000 | 799,000 |
| Probable Salvage MBF | 10 | 22,000 | 97,000 | - | 211,000 | 25,000 | 355,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 1,519,000 | \$ 2,452,000 | \$ 1,000 | \$ 794,000 | \$ 239,000 | \$ 5,005,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 1,519,000 | \$ 2,452,000 | \$ 1,000 | \$ 794,000 | \$ 239,000 | \$ 5,005,000 |
| Unburned and Low Severity | 4 | \$ 516,000 | \$ 735,000 | \$ 1,000 | \$ 165,000 | \$ 76,000 | \$ 1,493,000 |
| Medium and High Severity | 5 | \$ 1,003,000 | \$ 1,717,000 | \$ - | \$ 629,000 | \$ 162,000 | \$ 3,511,000 |
| Pre-merchantable | 6 | \$ 17,000 | \$ 24,000 | \$ - | \$ 62,000 | \$ 30,000 | \$ 133,000 |
| Merchantable | 7 | \$ 986,000 | \$ 1,693,000 | \$ - | \$ 567,000 | \$ 132,000 | \$ 3,378,000 |
| Unavailable for Sust. Harvest | 8 | \$ 608,000 | \$ 1,162,000 | \$ - | \$ 49,000 | \$ 17,000 | \$ 1,836,000 |
| Available for Sust. Harvest | 9 | \$ 378,000 | \$ 531,000 | \$ - | \$ 518,000 | \$ 115,000 | \$ 1,542,000 |
| Probable Salvage \$ | 10 | \$ 43,000 | \$ 186,000 | \$ - | \$ 408,000 | \$ 48,000 | \$ 685,000 |

Fire: Thielsen

| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
|-------------------------------------|-----------|-----------------|-------------|-------------|---------------|---------------|-----------------|
| Acres | | | | | | | |
| Total Acres | 1 | 9,900 | - | - | - | - | 9,900 |
| Non-Forest and Roads | 2 | 400 | - | - | - | - | 400 |
| Forested Acres | 3 | 9,500 | - | - | - | - | 9,500 |
| Unburned and Low Severity | 4 | 4,100 | - | - | - | - | 4,100 |
| Medium and High Severity | 5 | 5,400 | - | - | - | - | 5,400 |
| Pre-merchantable | 6 | 1,300 | - | - | - | - | 1,300 |
| Merchantable | 7 | 4,100 | - | - | - | - | 4,100 |
| Unavailable for Sust. Harvest | 8 | 2,700 | - | - | - | - | 2,700 |
| Available for Sust. Harvest | 9 | 1,400 | - | - | - | - | 1,400 |
| Probable Salvage Acres | 10 | 500 | - | - | - | - | 500 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 222,000 | - | - | - | - | 222,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 222,000 | - | - | - | - | 222,000 |
| Unburned and Low Severity | 4 | 103,000 | - | - | - | - | 103,000 |
| Medium and High Severity | 5 | 119,000 | - | - | - | - | 119,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 119,000 | - | - | - | - | 119,000 |
| Unavailable for Sust. Harvest | 8 | 78,000 | - | - | - | - | 78,000 |
| Available for Sust. Harvest | 9 | 41,000 | - | - | - | - | 41,000 |
| Probable Salvage MBF | 10 | 5,000 | - | - | - | - | 5,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 431,000 | \$ - | \$ - | \$ - | \$ - | \$ 431,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 431,000 | \$ - | \$ - | \$ - | \$ - | \$ 431,000 |
| Unburned and Low Severity | 4 | \$ 200,000 | \$ - | \$ - | \$ - | \$ - | \$ 200,000 |
| Medium and High Severity | 5 | \$ 231,000 | \$ - | \$ - | \$ - | \$ - | \$ 231,000 |
| Pre-merchantable | 6 | \$ 1,000 | \$ - | \$ - | \$ - | \$ - | \$ 1,000 |
| Merchantable | 7 | \$ 229,000 | \$ - | \$ - | \$ - | \$ - | \$ 229,000 |
| Unavailable for Sust. Harvest | 8 | \$ 151,000 | \$ - | \$ - | \$ - | \$ - | \$ 151,000 |
| Available for Sust. Harvest | 9 | \$ 79,000 | \$ - | \$ - | \$ - | \$ - | \$ 79,000 |
| Probable Salvage \$ | 10 | \$ 9,000 | \$ - | \$ - | \$ - | \$ - | \$ 9,000 |

Fire: South Obenchain

| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
|-------------------------------------|-----------|-------------|-----------------|-------------|------------------|-----------------|------------------|
| Acres | | | | | | | |
| Total Acres | 1 | - | 14,800 | - | 5,500 | 12,400 | 32,700 |
| Non-Forest and Roads | 2 | - | 700 | - | 200 | 900 | 1,800 |
| Forested Acres | 3 | - | 14,100 | - | 5,300 | 11,500 | 30,900 |
| Unburned and Low Severity | 4 | - | 4,300 | - | 1,800 | 3,400 | 9,500 |
| Medium and High Severity | 5 | - | 9,800 | - | 3,500 | 8,100 | 21,400 |
| Pre-merchantable | 6 | - | 7,800 | - | 2,500 | 6,900 | 17,200 |
| Merchantable | 7 | - | 2,100 | - | 900 | 1,200 | 4,200 |
| Unavailable for Sust. Harvest | 8 | - | 1,700 | - | 100 | 300 | 2,100 |
| Available for Sust. Harvest | 9 | - | 300 | - | 800 | 900 | 2,000 |
| Probable Salvage Acres | 10 | - | 200 | - | 700 | 500 | 1,400 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | - | 39,000 | - | 15,000 | 12,000 | 66,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | - | 39,000 | - | 15,000 | 12,000 | 66,000 |
| Unburned and Low Severity | 4 | - | 19,000 | - | 7,000 | 5,000 | 31,000 |
| Medium and High Severity | 5 | - | 20,000 | - | 7,000 | 7,000 | 34,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | - | 20,000 | - | 7,000 | 7,000 | 34,000 |
| Unavailable for Sust. Harvest | 8 | - | 17,000 | - | 1,000 | 2,000 | 20,000 |
| Available for Sust. Harvest | 9 | - | 3,000 | - | 7,000 | 6,000 | 16,000 |
| Probable Salvage MBF | 10 | - | 1,000 | - | 5,000 | 2,000 | 8,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ - | \$ 88,000 | \$ - | \$ 35,000 | \$ 35,000 | \$ 158,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ - | \$ 88,000 | \$ - | \$ 35,000 | \$ 35,000 | \$ 158,000 |
| Unburned and Low Severity | 4 | \$ - | \$ 41,000 | \$ - | \$ 17,000 | \$ 13,000 | \$ 71,000 |
| Medium and High Severity | 5 | \$ - | \$ 47,000 | \$ - | \$ 18,000 | \$ 22,000 | \$ 87,000 |
| Pre-merchantable | 6 | \$ - | \$ 9,000 | \$ - | \$ 4,000 | \$ 8,000 | \$ 21,000 |
| Merchantable | 7 | \$ - | \$ 38,000 | \$ - | \$ 14,000 | \$ 14,000 | \$ 66,000 |
| Unavailable for Sust. Harvest | 8 | \$ - | \$ 32,000 | \$ - | \$ 2,000 | \$ 3,000 | \$ 37,000 |
| Available for Sust. Harvest | 9 | \$ - | \$ 6,000 | \$ - | \$ 13,000 | \$ 11,000 | \$ 30,000 |
| Probable Salvage \$ | 10 | \$ - | \$ 2,000 | \$ - | \$ 10,000 | \$ 5,000 | \$ 17,000 |

Fire: 242

| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
|-------------------------------------|-----------|-----------------|-------------|-------------|---------------|-----------------|-----------------|
| Acres | | | | | | | |
| Total Acres | 1 | 9,200 | - | - | - | 5,200 | 14,400 |
| Non-Forest and Roads | 2 | 400 | - | - | - | 800 | 1,200 |
| Forested Acres | 3 | 8,800 | - | - | - | 4,400 | 13,200 |
| Unburned and Low Severity | 4 | 1,900 | - | - | - | 1,200 | 3,100 |
| Medium and High Severity | 5 | 7,000 | - | - | - | 3,200 | 10,200 |
| Pre-merchantable | 6 | 5,200 | - | - | - | 2,900 | 8,100 |
| Merchantable | 7 | 1,700 | - | - | - | 300 | 2,000 |
| Unavailable for Sust. Harvest | 8 | 1,100 | - | - | - | 100 | 1,200 |
| Available for Sust. Harvest | 9 | 600 | - | - | - | 200 | 800 |
| Probable Salvage Acres | 10 | 200 | - | - | - | 100 | 300 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 30,000 | - | - | - | 3,000 | 33,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 30,000 | - | - | - | 3,000 | 33,000 |
| Unburned and Low Severity | 4 | 5,000 | - | - | - | 1,000 | 6,000 |
| Medium and High Severity | 5 | 25,000 | - | - | - | 2,000 | 27,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 25,000 | - | - | - | 2,000 | 27,000 |
| Unavailable for Sust. Harvest | 8 | 16,000 | - | - | - | 1,000 | 17,000 |
| Available for Sust. Harvest | 9 | 9,000 | - | - | - | 1,000 | 10,000 |
| Probable Salvage MBF | 10 | 1,000 | - | - | - | 1,000 | 2,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 62,000 | \$ - | \$ - | \$ - | \$ 8,000 | \$ 70,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 62,000 | \$ - | \$ - | \$ - | \$ 8,000 | \$ 70,000 |
| Unburned and Low Severity | 4 | \$ 10,000 | \$ - | \$ - | \$ - | \$ 3,000 | \$ 13,000 |
| Medium and High Severity | 5 | \$ 52,000 | \$ - | \$ - | \$ - | \$ 6,000 | \$ 58,000 |
| Pre-merchantable | 6 | \$ 4,000 | \$ - | \$ - | \$ - | \$ 2,000 | \$ 6,000 |
| Merchantable | 7 | \$ 48,000 | \$ - | \$ - | \$ - | \$ 3,000 | \$ 51,000 |
| Unavailable for Sust. Harvest | 8 | \$ 32,000 | \$ - | \$ - | \$ - | \$ 1,000 | \$ 33,000 |
| Available for Sust. Harvest | 9 | \$ 17,000 | \$ - | \$ - | \$ - | \$ 2,000 | \$ 19,000 |
| Probable Salvage \$ | 10 | \$ 2,000 | \$ - | \$ - | \$ - | \$ 1,000 | \$ 3,000 |

| Fire: Slater | | | | | | | |
|-------------------------------|-----------|------------------|-------------|-------------|-----------------|-----------------|------------------|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
| Acres | | | | | | | |
| Total Acres | 1 | 39,300 | 2,700 | 600 | 1,500 | 1,600 | 45,700 |
| Non-Forest and Roads | 2 | 1,800 | 100 | - | 100 | 100 | 2,100 |
| Forested Acres | 3 | 37,500 | 2,600 | 600 | 1,400 | 1,500 | 43,600 |
| Unburned and Low Severity | 4 | 19,400 | 2,300 | 600 | 800 | 1,300 | 24,400 |
| Medium and High Severity | 5 | 18,100 | 300 | - | 700 | 200 | 19,300 |
| Pre-merchantable | 6 | 4,200 | 200 | - | 400 | 100 | 4,900 |
| Merchantable | 7 | 13,900 | 100 | - | 300 | 100 | 14,400 |
| Unavailable for Sust. Harvest | 8 | 8,000 | 100 | - | - | - | 8,100 |
| Available for Sust. Harvest | 9 | 5,900 | - | - | 300 | 100 | 6,300 |
| Probable Salvage Acres | 10 | 2,100 | - | - | 200 | - | 2,300 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 974,000 | 37,000 | 5,000 | 11,000 | 12,000 | 1,039,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 974,000 | 37,000 | 5,000 | 11,000 | 12,000 | 1,039,000 |
| Unburned and Low Severity | 4 | 521,000 | 34,000 | 5,000 | 7,000 | 10,000 | 577,000 |
| Medium and High Severity | 5 | 453,000 | 3,000 | - | 4,000 | 1,000 | 461,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 453,000 | 3,000 | - | 4,000 | 1,000 | 461,000 |
| Unavailable for Sust. Harvest | 8 | 262,000 | 2,000 | - | - | - | 264,000 |
| Available for Sust. Harvest | 9 | 192,000 | - | - | 4,000 | 1,000 | 197,000 |
| Probable Salvage MBF | 10 | 22,000 | - | - | 3,000 | 1,000 | 26,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 1,910,000 | \$ 73,000 | \$ 10,000 | \$ 23,000 | \$ 26,000 | \$ 2,042,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 1,910,000 | \$ 73,000 | \$ 10,000 | \$ 23,000 | \$ 26,000 | \$ 2,042,000 |
| Unburned and Low Severity | 4 | \$ 1,020,000 | \$ 68,000 | \$ 9,000 | \$ 14,000 | \$ 23,000 | \$ 1,134,000 |
| Medium and High Severity | 5 | \$ 891,000 | \$ 5,000 | \$ - | \$ 9,000 | \$ 3,000 | \$ 908,000 |
| Pre-merchantable | 6 | \$ 16,000 | \$ - | \$ - | \$ 1,000 | \$ 1,000 | \$ 18,000 |
| Merchantable | 7 | \$ 874,000 | \$ 5,000 | \$ - | \$ 8,000 | \$ 3,000 | \$ 890,000 |
| Unavailable for Sust. Harvest | 8 | \$ 505,000 | \$ 5,000 | \$ - | \$ 1,000 | \$ - | \$ 511,000 |
| Available for Sust. Harvest | 9 | \$ 370,000 | \$ - | \$ - | \$ 7,000 | \$ 3,000 | \$ 380,000 |
| Probable Salvage \$ | 10 | \$ 42,000 | \$ - | \$ - | \$ 6,000 | \$ 1,000 | \$ 49,000 |

Fire: White River

| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
|-------------------------------------|-----------|-----------------|-------------|-------------|---------------|-----------------|------------------|
| Acres | | | | | | | |
| Total Acres | 1 | 8,700 | 1,700 | - | - | 7,000 | 17,400 |
| Non-Forest and Roads | 2 | 300 | 300 | - | - | 1,900 | 2,500 |
| Forested Acres | 3 | 8,500 | 1,400 | - | - | 5,100 | 15,000 |
| Unburned and Low Severity | 4 | 5,900 | 600 | - | - | 900 | 7,400 |
| Medium and High Severity | 5 | 2,600 | 800 | - | - | 4,200 | 7,600 |
| Pre-merchantable | 6 | 400 | 600 | - | - | 3,000 | 4,000 |
| Merchantable | 7 | 2,200 | 200 | - | - | 1,200 | 3,600 |
| Unavailable for Sust. Harvest | 8 | 1,400 | 200 | - | - | 100 | 1,700 |
| Available for Sust. Harvest | 9 | 800 | - | - | - | 1,000 | 1,800 |
| Probable Salvage Acres | 10 | 300 | - | - | - | 500 | 800 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 174,000 | 15,000 | - | - | 13,000 | 202,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 174,000 | 15,000 | - | - | 13,000 | 202,000 |
| Unburned and Low Severity | 4 | 121,000 | 9,000 | - | - | 3,000 | 133,000 |
| Medium and High Severity | 5 | 53,000 | 6,000 | - | - | 10,000 | 69,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 53,000 | 6,000 | - | - | 10,000 | 69,000 |
| Unavailable for Sust. Harvest | 8 | 33,000 | 6,000 | - | - | 1,000 | 40,000 |
| Available for Sust. Harvest | 9 | 20,000 | - | - | - | 9,000 | 29,000 |
| Probable Salvage MBF | 10 | 2,000 | - | - | - | 4,000 | 6,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 340,000 | \$ 30,000 | \$ - | \$ - | \$ 32,000 | \$ 402,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 340,000 | \$ 30,000 | \$ - | \$ - | \$ 32,000 | \$ 402,000 |
| Unburned and Low Severity | 4 | \$ 237,000 | \$ 18,000 | \$ - | \$ - | \$ 7,000 | \$ 262,000 |
| Medium and High Severity | 5 | \$ 103,000 | \$ 12,000 | \$ - | \$ - | \$ 25,000 | \$ 140,000 |
| Pre-merchantable | 6 | \$ 1,000 | \$ 1,000 | \$ - | \$ - | \$ 6,000 | \$ 8,000 |
| Merchantable | 7 | \$ 101,000 | \$ 11,000 | \$ - | \$ - | \$ 19,000 | \$ 131,000 |
| Unavailable for Sust. Harvest | 8 | \$ 63,000 | \$ 11,000 | \$ - | \$ - | \$ 2,000 | \$ 76,000 |
| Available for Sust. Harvest | 9 | \$ 38,000 | \$ - | \$ - | \$ - | \$ 17,000 | \$ 55,000 |
| Probable Salvage \$ | 10 | \$ 4,000 | \$ - | \$ - | \$ - | \$ 7,000 | \$ 11,000 |

| Fire: P515 | | | | | | | | | | |
|-------------------------------|-----------|-------------|-------------|-------------|---------------|-----------------|-----------------|--|--|--|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total | | | |
| Acres | | | | | | | | | | |
| Total Acres | 1 | - | - | - | - | 4,600 | 4,600 | | | |
| Non-Forest and Roads | 2 | - | - | - | - | 100 | 100 | | | |
| Forested Acres | 3 | - | - | - | - | 4,500 | 4,500 | | | |
| Unburned and Low Severity | 4 | - | - | - | - | 1,900 | 1,900 | | | |
| Medium and High Severity | 5 | - | - | - | - | 2,600 | 2,600 | | | |
| Pre-merchantable | 6 | - | - | - | - | 1,400 | 1,400 | | | |
| Merchantable | 7 | - | - | - | - | 1,200 | 1,200 | | | |
| Unavailable for Sust. Harvest | 8 | - | - | - | - | 100 | 100 | | | |
| Available for Sust. Harvest | 9 | - | - | - | - | 1,100 | 1,100 | | | |
| Probable Salvage Acres | 10 | - | - | - | - | 1,100 | 1,100 | | | |
| Volume (MBF) | | | | | | | | | | |
| Total Volume | 1 | - | - | - | - | 24,000 | 24,000 | | | |
| Non-Forest and Roads | 2 | - | - | - | - | - | - | | | |
| From Forested Acres | 3 | - | - | - | - | 24,000 | 24,000 | | | |
| Unburned and Low Severity | 4 | - | - | - | - | 12,000 | 12,000 | | | |
| Medium and High Severity | 5 | - | - | - | - | 12,000 | 12,000 | | | |
| Pre-merchantable | 6 | - | - | - | - | - | - | | | |
| Merchantable | 7 | - | - | - | - | 12,000 | 12,000 | | | |
| Unavailable for Sust. Harvest | 8 | - | - | - | - | 1,000 | 1,000 | | | |
| Available for Sust. Harvest | 9 | - | - | - | - | 11,000 | 11,000 | | | |
| Probable Salvage MBF | 10 | - | - | - | - | 2,000 | 2,000 | | | |
| Value (2020 \$US, Thousands) | | | | | | | | | | |
| Total Value | 1 | \$ - | \$ - | \$ - | \$ - | \$ 49,000 | \$ 49,000 | | | |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - | | | |
| From Forested Acres | 3 | \$ - | \$ - | \$ - | \$ - | \$ 49,000 | \$ 49,000 | | | |
| Unburned and Low Severity | 4 | \$ - | \$ - | \$ - | \$ - | \$ 25,000 | \$ 25,000 | | | |
| Medium and High Severity | 5 | \$ - | \$ - | \$ - | \$ - | \$ 24,000 | \$ 24,000 | | | |
| Pre-merchantable | 6 | \$ - | \$ - | \$ - | \$ - | \$ 1,000 | \$ 1,000 | | | |
| Merchantable | 7 | \$ - | \$ - | \$ - | \$ - | \$ 23,000 | \$ 23,000 | | | |
| Unavailable for Sust. Harvest | 8 | \$ - | \$ - | \$ - | \$ - | \$ 2,000 | \$ 2,000 | | | |
| Available for Sust. Harvest | 9 | \$ - | \$ - | \$ - | \$ - | \$ 21,000 | \$ 21,000 | | | |
| Probable Salvage \$ | 10 | \$ - | \$ - | \$ - | \$ - | \$ 3,000 | \$ 3,000 | | | |

Fire: Green Ridge

| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
|-------------------------------------|-----------|-------------|-------------|-------------|---------------|-----------------|-----------------|
| Acres | | | | | | | |
| Total Acres | 1 | 1,200 | - | - | - | 3,100 | 4,300 |
| Non-Forest and Roads | 2 | - | - | - | - | 100 | 100 |
| Forested Acres | 3 | 1,200 | - | - | - | 3,000 | 4,200 |
| Unburned and Low Severity | 4 | 700 | - | - | - | 1,200 | 1,900 |
| Medium and High Severity | 5 | 500 | - | - | - | 1,800 | 2,300 |
| Pre-merchantable | 6 | - | - | - | - | 600 | 600 |
| Merchantable | 7 | 500 | - | - | - | 1,200 | 1,700 |
| Unavailable for Sust. Harvest | 8 | 500 | - | - | - | 100 | 600 |
| Available for Sust. Harvest | 9 | - | - | - | - | 1,100 | 1,100 |
| Probable Salvage Acres | 10 | - | - | - | - | 600 | 600 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 25,000 | - | - | - | 19,000 | 44,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 25,000 | - | - | - | 19,000 | 44,000 |
| Unburned and Low Severity | 4 | 14,000 | - | - | - | 7,000 | 21,000 |
| Medium and High Severity | 5 | 11,000 | - | - | - | 12,000 | 23,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 11,000 | - | - | - | 12,000 | 23,000 |
| Unavailable for Sust. Harvest | 8 | 11,000 | - | - | - | 1,000 | 12,000 |
| Available for Sust. Harvest | 9 | - | - | - | - | 11,000 | 11,000 |
| Probable Salvage MBF | 10 | - | - | - | - | 5,000 | 5,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 48,000 | \$ - | \$ - | \$ - | \$ 38,000 | \$ 86,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 48,000 | \$ - | \$ - | \$ - | \$ 38,000 | \$ 86,000 |
| Unburned and Low Severity | 4 | \$ 27,000 | \$ - | \$ - | \$ - | \$ 14,000 | \$ 41,000 |
| Medium and High Severity | 5 | \$ 20,000 | \$ - | \$ - | \$ - | \$ 24,000 | \$ 44,000 |
| Pre-merchantable | 6 | \$ - | \$ - | \$ - | \$ - | \$ 1,000 | \$ 1,000 |
| Merchantable | 7 | \$ 20,000 | \$ - | \$ - | \$ - | \$ 23,000 | \$ 43,000 |
| Unavailable for Sust. Harvest | 8 | \$ 20,000 | \$ - | \$ - | \$ - | \$ 1,000 | \$ 21,000 |
| Available for Sust. Harvest | 9 | \$ - | \$ - | \$ - | \$ - | \$ 22,000 | \$ 22,000 |
| Probable Salvage \$ | 10 | \$ - | \$ - | \$ - | \$ - | \$ 9,000 | \$ 9,000 |

APPENDIX C: IMPACTS BY COUNTY

Salvage Estimates by County

| Clackamas County | | | | | | | |
|-------------------------------|-----------|-------------------|------------------|------------------|-------------------|-----------------|-------------------|
| Row | USFS | BLM | ODF | Large Private | Other Private | Total | |
| Acres | | | | | | | |
| Total Acres | 1 | 84,700 | 31,700 | 5,200 | 55,800 | 7,100 | 184,500 |
| Non-Forest and Roads | 2 | 3,400 | 1,600 | 200 | 2,500 | 500 | 8,200 |
| Forested Acres | 3 | 81,400 | 30,100 | 5,000 | 53,300 | 6,600 | 176,400 |
| Unburned and Low Severity | 4 | 31,500 | 15,500 | 3,100 | 20,100 | 3,200 | 73,400 |
| Medium and High Severity | 5 | 49,800 | 14,600 | 1,900 | 33,200 | 3,400 | 102,900 |
| Pre-merchantable | 6 | 15,500 | 5,000 | 1,100 | 24,900 | 2,800 | 49,300 |
| Merchantable | 7 | 34,400 | 9,600 | 800 | 8,300 | 600 | 53,700 |
| Unavailable for Sust. Harvest | 8 | 19,300 | 6,400 | 100 | 1,100 | 100 | 27,000 |
| Available for Sust. Harvest | 9 | 15,000 | 3,200 | 800 | 7,200 | 500 | 26,700 |
| Probable Salvage Acres | 10 | 5,300 | 2,300 | 600 | 6,200 | 300 | 14,700 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 1,984,000 | 801,000 | 58,000 | 355,000 | 31,000 | 3,229,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 1,984,000 | 801,000 | 58,000 | 355,000 | 31,000 | 3,229,000 |
| Unburned and Low Severity | 4 | 760,000 | 409,000 | 36,000 | 191,000 | 18,000 | 1,414,000 |
| Medium and High Severity | 5 | 1,223,000 | 392,000 | 21,000 | 165,000 | 13,000 | 1,814,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 1,223,000 | 392,000 | 21,000 | 165,000 | 13,000 | 1,814,000 |
| Unavailable for Sust. Harvest | 8 | 688,000 | 262,000 | 2,000 | 22,000 | 2,000 | 976,000 |
| Available for Sust. Harvest | 9 | 536,000 | 130,000 | 20,000 | 143,000 | 11,000 | 840,000 |
| Probable Salvage MBF | 10 | 61,000 | 46,000 | 9,000 | 116,000 | 5,000 | 237,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 3,943,000 | \$ 1,593,000 | \$ 123,000 | \$ 806,000 | \$ 81,000 | \$ 6,546,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 3,943,000 | \$ 1,593,000 | \$ 123,000 | \$ 806,000 | \$ 81,000 | \$ 6,546,000 |
| Unburned and Low Severity | 4 | \$ 1,514,000 | \$ 814,000 | \$ 78,000 | \$ 413,000 | \$ 45,000 | \$ 2,864,000 |
| Medium and High Severity | 5 | \$ 2,429,000 | \$ 779,000 | \$ 45,000 | \$ 393,000 | \$ 36,000 | \$ 3,682,000 |
| Pre-merchantable | 6 | \$ 69,000 | \$ 23,000 | \$ 4,000 | \$ 76,000 | \$ 10,000 | \$ 182,000 |
| Merchantable | 7 | \$ 2,360,000 | \$ 756,000 | \$ 41,000 | \$ 318,000 | \$ 25,000 | \$ 3,500,000 |
| Unavailable for Sust. Harvest | 8 | \$ 1,326,000 | \$ 506,000 | \$ 3,000 | \$ 42,000 | \$ 5,000 | \$ 1,882,000 |
| Available for Sust. Harvest | 9 | \$ 1,034,000 | \$ 250,000 | \$ 38,000 | \$ 276,000 | \$ 21,000 | \$ 1,619,000 |
| Probable Salvage \$ | 10 | \$ 117,000 | \$ 88,000 | \$ 18,000 | \$ 223,000 | \$ 9,000 | \$ 455,000 |

| Douglas County | | | | | | | |
|-------------------------------------|------------|------------------|-------------------|-------------|----------------------|----------------------|-------------------|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
| Acres | | | | | | | |
| Total Acres | 1 | 36,400 | 40,400 | - | 46,400 | 18,400 | 141,600 |
| Non-Forest and Roads | 2 | 1,500 | 1,900 | - | 1,700 | 1,400 | 6,500 |
| Forested Acres | 3 | 34,900 | 38,500 | - | 44,700 | 16,900 | 135,000 |
| Unburned and Low Severity | 4 | 11,800 | 11,300 | - | 7,700 | 3,900 | 34,700 |
| Medium and High Severity | 5 | 23,100 | 27,200 | - | 37,000 | 13,100 | 100,400 |
| Pre-merchantable | 6 | 6,300 | 5,600 | - | 22,900 | 9,700 | 44,500 |
| Merchantable | 7 | 16,800 | 21,600 | - | 14,100 | 3,300 | 55,800 |
| Unavailable for Sust. Harvest | 8 | 10,600 | 14,900 | - | 1,200 | 400 | 27,100 |
| Available for Sust. Harvest | 9 | 6,300 | 6,800 | - | 12,900 | 2,900 | 28,900 |
| Probable Salvage Acres | 10 | 2,200 | 5,000 | - | 10,800 | 1,600 | 19,600 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 998,000 | 1,254,000 | 1,000 | 372,000 | 104,000 | 2,729,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 998,000 | 1,254,000 | 1,000 | 372,000 | 104,000 | 2,729,000 |
| Unburned and Low Severity | 4 | 368,000 | 376,000 | 1,000 | 78,000 | 35,000 | 858,000 |
| Medium and High Severity | 5 | 630,000 | 878,000 | - | 294,000 | 68,000 | 1,870,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 630,000 | 878,000 | - | 294,000 | 68,000 | 1,870,000 |
| Unavailable for Sust. Harvest | 8 | 393,000 | 603,000 | - | 25,000 | 9,000 | 1,030,000 |
| Available for Sust. Harvest | 9 | 237,000 | 275,000 | - | 268,000 | 60,000 | 840,000 |
| Probable Salvage MBF | 10 | 27,000 | 97,000 | - | 211,000 | 25,000 | 360,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 1,950,000 | \$ 2,452,000 | \$ 1,000 | \$ 794,000 | \$ 239,000 | \$ 5,436,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 1,950,000 | \$ 2,452,000 | \$ 1,000 | \$ 794,000 | \$ 239,000 | \$ 5,436,000 |
| Unburned and Low Severity | 4 | \$ 716,000 | \$ 735,000 | \$ 1,000 | \$ 165,000 | \$ 76,000 | \$ 1,693,000 |
| Medium and High Severity | 5 | \$ 1,234,000 | \$ 1,717,000 | \$ - | \$ 629,000 | \$ 162,000 | \$ 3,742,000 |
| Pre-merchantable | 6 | \$ 19,000 | \$ 24,000 | \$ - | \$ 62,000 | \$ 30,000 | \$ 135,000 |
| Merchantable | 7 | \$ 1,216,000 | \$ 1,693,000 | \$ - | \$ 567,000 | \$ 132,000 | \$ 3,608,000 |
| Unavailable for Sust. Harvest | 8 | \$ 759,000 | \$ 1,162,000 | \$ - | \$ 49,000 | \$ 17,000 | \$ 1,987,000 |
| Available for Sust. Harvest | 9 | \$ 456,000 | \$ 531,000 | \$ - | \$ 518,000 | \$ 115,000 | \$ 1,620,000 |
| Probable Salvage \$ | 10 | \$ 52,000 | \$ 186,000 | \$ - | \$ 408,000 | \$ 48,000 | \$ 694,000 |

| Jackson County | | | | | | | |
|-------------------------------|-----------|-------------|-----------------|-------------|------------------|-----------------|------------------|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
| Acres | | | | | | | |
| Total Acres | 1 | - | 14,800 | - | 5,500 | 12,400 | 32,700 |
| Non-Forest and Roads | 2 | - | 700 | - | 200 | 900 | 1,800 |
| Forested Acres | 3 | - | 14,100 | - | 5,300 | 11,500 | 30,900 |
| Unburned and Low Severity | 4 | - | 4,300 | - | 1,800 | 3,400 | 9,500 |
| Medium and High Severity | 5 | - | 9,800 | - | 3,500 | 8,100 | 21,400 |
| Pre-merchantable | 6 | - | 7,800 | - | 2,500 | 6,900 | 17,200 |
| Merchantable | 7 | - | 2,100 | - | 900 | 1,200 | 4,200 |
| Unavailable for Sust. Harvest | 8 | - | 1,700 | - | 100 | 300 | 2,100 |
| Available for Sust. Harvest | 9 | - | 300 | - | 800 | 900 | 2,000 |
| Probable Salvage Acres | 10 | - | 200 | - | 700 | 500 | 1,400 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | - | 39,000 | - | 15,000 | 12,000 | 66,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | - | 39,000 | - | 15,000 | 12,000 | 66,000 |
| Unburned and Low Severity | 4 | - | 19,000 | - | 7,000 | 5,000 | 31,000 |
| Medium and High Severity | 5 | - | 20,000 | - | 7,000 | 7,000 | 34,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | - | 20,000 | - | 7,000 | 7,000 | 34,000 |
| Unavailable for Sust. Harvest | 8 | - | 17,000 | - | 1,000 | 2,000 | 20,000 |
| Available for Sust. Harvest | 9 | - | 3,000 | - | 7,000 | 6,000 | 16,000 |
| Probable Salvage MBF | 10 | - | 1,000 | - | 5,000 | 2,000 | 8,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ - | \$ 88,000 | \$ - | \$ 35,000 | \$ 35,000 | \$ 158,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ - | \$ 88,000 | \$ - | \$ 35,000 | \$ 35,000 | \$ 158,000 |
| Unburned and Low Severity | 4 | \$ - | \$ 41,000 | \$ - | \$ 17,000 | \$ 13,000 | \$ 71,000 |
| Medium and High Severity | 5 | \$ - | \$ 47,000 | \$ - | \$ 18,000 | \$ 22,000 | \$ 87,000 |
| Pre-merchantable | 6 | \$ - | \$ 9,000 | \$ - | \$ 4,000 | \$ 8,000 | \$ 21,000 |
| Merchantable | 7 | \$ - | \$ 38,000 | \$ - | \$ 14,000 | \$ 14,000 | \$ 66,000 |
| Unavailable for Sust. Harvest | 8 | \$ - | \$ 32,000 | \$ - | \$ 2,000 | \$ 3,000 | \$ 37,000 |
| Available for Sust. Harvest | 9 | \$ - | \$ 6,000 | \$ - | \$ 13,000 | \$ 11,000 | \$ 30,000 |
| Probable Salvage \$ | 10 | \$ - | \$ 2,000 | \$ - | \$ 10,000 | \$ 5,000 | \$ 17,000 |

| Jefferson County | | | | | | | | | |
|-------------------------------|-----------|------------|------|------|---------------|---------------|---------------|--|--|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total | | |
| Acres | | | | | | | | | |
| Total Acres | 1 | 7,200 | - | - | - | 70,400 | 77,600 | | |
| Non-Forest and Roads | 2 | 700 | - | - | - | 3,800 | 4,500 | | |
| Forested Acres | 3 | 6,500 | - | - | - | 66,600 | 73,100 | | |
| Unburned and Low Severity | 4 | 2,300 | - | - | - | 29,200 | 31,500 | | |
| Medium and High Severity | 5 | 4,300 | - | - | - | 37,400 | 41,700 | | |
| Pre-merchantable | 6 | 1,700 | - | - | - | 16,700 | 18,400 | | |
| Merchantable | 7 | 2,600 | - | - | - | 20,700 | 23,300 | | |
| Unavailable for Sust. Harvest | 8 | 2,600 | - | - | - | 1,200 | 3,800 | | |
| Available for Sust. Harvest | 9 | - | - | - | - | 19,500 | 19,500 | | |
| Probable Salvage Acres | 10 | - | - | - | - | 18,600 | 18,600 | | |
| Volume (MBF) | | | | | | | | | |
| Total Volume | 1 | 117,000 | - | - | - | 280,000 | 397,000 | | |
| Non-Forest and Roads | 2 | - | - | - | - | - | - | | |
| From Forested Acres | 3 | 117,000 | - | - | - | 280,000 | 397,000 | | |
| Unburned and Low Severity | 4 | 43,000 | - | - | - | 125,000 | 168,000 | | |
| Medium and High Severity | 5 | 75,000 | - | - | - | 155,000 | 230,000 | | |
| Pre-merchantable | 6 | - | - | - | - | - | - | | |
| Merchantable | 7 | 75,000 | - | - | - | 155,000 | 230,000 | | |
| Unavailable for Sust. Harvest | 8 | 75,000 | - | - | - | 9,000 | 84,000 | | |
| Available for Sust. Harvest | 9 | - | - | - | - | 146,000 | 146,000 | | |
| Probable Salvage MBF | 10 | - | - | - | - | 25,000 | 25,000 | | |
| Value (2020 \$US, Thousands) | | | | | | | | | |
| Total Value | 1 | \$ 232,000 | \$ - | \$ - | \$ - | \$ 590,000 | \$ 822,000 | | |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - | | |
| From Forested Acres | 3 | \$ 232,000 | \$ - | \$ - | \$ - | \$ 590,000 | \$ 822,000 | | |
| Unburned and Low Severity | 4 | \$ 83,000 | \$ - | \$ - | \$ - | \$ 259,000 | \$ 342,000 | | |
| Medium and High Severity | 5 | \$ 149,000 | \$ - | \$ - | \$ - | \$ 331,000 | \$ 480,000 | | |
| Pre-merchantable | 6 | \$ 5,000 | \$ - | \$ - | \$ - | \$ 32,000 | \$ 37,000 | | |
| Merchantable | 7 | \$ 144,000 | \$ - | \$ - | \$ - | \$ 299,000 | \$ 443,000 | | |
| Unavailable for Sust. Harvest | 8 | \$ 144,000 | \$ - | \$ - | \$ - | \$ 18,000 | \$ 162,000 | | |
| Available for Sust. Harvest | 9 | \$ - | \$ - | \$ - | \$ - | \$ 281,000 | \$ 281,000 | | |
| Probable Salvage \$ | 10 | \$ - | \$ - | \$ - | \$ - | \$ 49,000 | \$ 49,000 | | |

| Josephine County | | | | | | | |
|-------------------------------------|-----------|------------------|-------------|-------------|-----------------|-----------------|------------------|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
| Acres | | | | | | | |
| Total Acres | 1 | 39,300 | 2,700 | 600 | 1,500 | 1,600 | 45,700 |
| Non-Forest and Roads | 2 | 1,800 | 100 | - | 100 | 100 | 2,100 |
| Forested Acres | 3 | 37,500 | 2,600 | 600 | 1,400 | 1,500 | 43,600 |
| Unburned and Low Severity | 4 | 19,400 | 2,300 | 600 | 800 | 1,300 | 24,400 |
| Medium and High Severity | 5 | 18,100 | 300 | - | 700 | 200 | 19,300 |
| Pre-merchantable | 6 | 4,200 | 200 | - | 400 | 100 | 4,900 |
| Merchantable | 7 | 13,900 | 100 | - | 300 | 100 | 14,400 |
| Unavailable for Sust. Harvest | 8 | 8,000 | 100 | - | - | - | 8,100 |
| Available for Sust. Harvest | 9 | 5,900 | - | - | 300 | 100 | 6,300 |
| Probable Salvage Acres | 10 | 2,100 | - | - | 200 | - | 2,300 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 974,000 | 37,000 | 5,000 | 11,000 | 12,000 | 1,039,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 974,000 | 37,000 | 5,000 | 11,000 | 12,000 | 1,039,000 |
| Unburned and Low Severity | 4 | 521,000 | 34,000 | 5,000 | 7,000 | 10,000 | 577,000 |
| Medium and High Severity | 5 | 453,000 | 3,000 | - | 4,000 | 1,000 | 461,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 453,000 | 3,000 | - | 4,000 | 1,000 | 461,000 |
| Unavailable for Sust. Harvest | 8 | 262,000 | 2,000 | - | - | - | 264,000 |
| Available for Sust. Harvest | 9 | 192,000 | - | - | 4,000 | 1,000 | 197,000 |
| Probable Salvage MBF | 10 | 22,000 | - | - | 3,000 | 1,000 | 26,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 1,910,000 | \$ 73,000 | \$ 10,000 | \$ 23,000 | \$ 26,000 | \$ 2,042,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 1,910,000 | \$ 73,000 | \$ 10,000 | \$ 23,000 | \$ 26,000 | \$ 2,042,000 |
| Unburned and Low Severity | 4 | \$ 1,020,000 | \$ 68,000 | \$ 9,000 | \$ 14,000 | \$ 23,000 | \$ 1,134,000 |
| Medium and High Severity | 5 | \$ 891,000 | \$ 5,000 | \$ - | \$ 9,000 | \$ 3,000 | \$ 908,000 |
| Pre-merchantable | 6 | \$ 16,000 | \$ - | \$ - | \$ 1,000 | \$ 1,000 | \$ 18,000 |
| Merchantable | 7 | \$ 874,000 | \$ 5,000 | \$ - | \$ 8,000 | \$ 3,000 | \$ 890,000 |
| Unavailable for Sust. Harvest | 8 | \$ 505,000 | \$ 5,000 | \$ - | \$ 1,000 | \$ - | \$ 511,000 |
| Available for Sust. Harvest | 9 | \$ 370,000 | \$ - | \$ - | \$ 7,000 | \$ 3,000 | \$ 380,000 |
| Probable Salvage \$ | 10 | \$ 42,000 | \$ - | \$ - | \$ 6,000 | \$ 1,000 | \$ 49,000 |

| Klamath County | | | | | | | | | |
|-------------------------------|-----------|-----------------|-------------|-------------|---------------|-----------------|-----------------|--|--|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total | | |
| Acres | | | | | | | | | |
| Total Acres | 1 | 9,200 | - | - | - | 5,200 | 14,400 | | |
| Non-Forest and Roads | 2 | 400 | - | - | - | 800 | 1,200 | | |
| Forested Acres | 3 | 8,800 | - | - | - | 4,400 | 13,200 | | |
| Unburned and Low Severity | 4 | 1,900 | - | - | - | 1,200 | 3,100 | | |
| Medium and High Severity | 5 | 7,000 | - | - | - | 3,200 | 10,200 | | |
| Pre-merchantable | 6 | 5,200 | - | - | - | 2,900 | 8,100 | | |
| Merchantable | 7 | 1,700 | - | - | - | 300 | 2,000 | | |
| Unavailable for Sust. Harvest | 8 | 1,100 | - | - | - | 100 | 1,200 | | |
| Available for Sust. Harvest | 9 | 600 | - | - | - | 200 | 800 | | |
| Probable Salvage Acres | 10 | 200 | - | - | - | 100 | 300 | | |
| Volume (MBF) | | | | | | | | | |
| Total Volume | 1 | 30,000 | - | - | - | 3,000 | 33,000 | | |
| Non-Forest and Roads | 2 | - | - | - | - | - | - | | |
| From Forested Acres | 3 | 30,000 | - | - | - | 3,000 | 33,000 | | |
| Unburned and Low Severity | 4 | 5,000 | - | - | - | 1,000 | 6,000 | | |
| Medium and High Severity | 5 | 25,000 | - | - | - | 2,000 | 27,000 | | |
| Pre-merchantable | 6 | - | - | - | - | - | - | | |
| Merchantable | 7 | 25,000 | - | - | - | 2,000 | 27,000 | | |
| Unavailable for Sust. Harvest | 8 | 16,000 | - | - | - | 1,000 | 17,000 | | |
| Available for Sust. Harvest | 9 | 9,000 | - | - | - | 1,000 | 10,000 | | |
| Probable Salvage MBF | 10 | 1,000 | - | - | - | 1,000 | 2,000 | | |
| Value (2020 \$US, Thousands) | | | | | | | | | |
| Total Value | 1 | \$ 62,000 | \$ - | \$ - | \$ - | \$ 8,000 | \$ 70,000 | | |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - | | |
| From Forested Acres | 3 | \$ 62,000 | \$ - | \$ - | \$ - | \$ 8,000 | \$ 70,000 | | |
| Unburned and Low Severity | 4 | \$ 10,000 | \$ - | \$ - | \$ - | \$ 3,000 | \$ 13,000 | | |
| Medium and High Severity | 5 | \$ 52,000 | \$ - | \$ - | \$ - | \$ 6,000 | \$ 58,000 | | |
| Pre-merchantable | 6 | \$ 4,000 | \$ - | \$ - | \$ - | \$ 2,000 | \$ 6,000 | | |
| Merchantable | 7 | \$ 48,000 | \$ - | \$ - | \$ - | \$ 3,000 | \$ 51,000 | | |
| Unavailable for Sust. Harvest | 8 | \$ 32,000 | \$ - | \$ - | \$ - | \$ 1,000 | \$ 33,000 | | |
| Available for Sust. Harvest | 9 | \$ 17,000 | \$ - | \$ - | \$ - | \$ 2,000 | \$ 19,000 | | |
| Probable Salvage \$ | 10 | \$ 2,000 | \$ - | \$ - | \$ - | \$ 1,000 | \$ 3,000 | | |

| Lane County | | | | | | | |
|-------------------------------------|-----------|------------------|------------------|-------------|-------------------|------------------|-------------------|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
| Acres | | | | | | | |
| Total Acres | 1 | 29,700 | 18,500 | 100 | 99,000 | 13,100 | 160,400 |
| Non-Forest and Roads | 2 | 1,100 | 800 | - | 3,300 | 2,400 | 7,600 |
| Forested Acres | 3 | 28,600 | 17,800 | - | 95,700 | 10,700 | 152,800 |
| Unburned and Low Severity | 4 | 9,300 | 2,400 | - | 20,200 | 3,800 | 35,700 |
| Medium and High Severity | 5 | 19,300 | 15,400 | - | 75,500 | 7,000 | 117,200 |
| Pre-merchantable | 6 | 5,600 | 4,600 | - | 58,300 | 5,400 | 73,900 |
| Merchantable | 7 | 13,700 | 10,800 | - | 17,200 | 1,600 | 43,300 |
| Unavailable for Sust. Harvest | 8 | 7,800 | 8,400 | - | 2,500 | 200 | 18,900 |
| Available for Sust. Harvest | 9 | 5,900 | 2,400 | - | 14,700 | 1,300 | 24,300 |
| Probable Salvage Acres | 10 | 2,100 | 1,800 | - | 12,800 | 700 | 17,400 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 905,000 | 593,000 | 1,000 | 563,000 | 81,000 | 2,143,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 905,000 | 593,000 | 1,000 | 563,000 | 81,000 | 2,143,000 |
| Unburned and Low Severity | 4 | 322,000 | 75,000 | 1,000 | 180,000 | 37,000 | 615,000 |
| Medium and High Severity | 5 | 583,000 | 518,000 | - | 383,000 | 43,000 | 1,527,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 583,000 | 518,000 | - | 383,000 | 43,000 | 1,527,000 |
| Unavailable for Sust. Harvest | 8 | 332,000 | 403,000 | - | 55,000 | 6,000 | 796,000 |
| Available for Sust. Harvest | 9 | 251,000 | 115,000 | - | 328,000 | 37,000 | 731,000 |
| Probable Salvage MBF | 10 | 29,000 | 40,000 | - | 267,000 | 16,000 | 352,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 1,779,000 | \$ 1,168,000 | \$ 2,000 | \$ 1,337,000 | \$ 187,000 | \$ 4,473,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 1,779,000 | \$ 1,168,000 | \$ 2,000 | \$ 1,337,000 | \$ 187,000 | \$ 4,473,000 |
| Unburned and Low Severity | 4 | \$ 629,000 | \$ 148,000 | \$ 1,000 | \$ 401,000 | \$ 82,000 | \$ 1,261,000 |
| Medium and High Severity | 5 | \$ 1,150,000 | \$ 1,020,000 | \$ 1,000 | \$ 936,000 | \$ 104,000 | \$ 3,211,000 |
| Pre-merchantable | 6 | \$ 25,000 | \$ 21,000 | \$ - | \$ 197,000 | \$ 21,000 | \$ 264,000 |
| Merchantable | 7 | \$ 1,125,000 | \$ 999,000 | \$ - | \$ 739,000 | \$ 84,000 | \$ 2,947,000 |
| Unavailable for Sust. Harvest | 8 | \$ 640,000 | \$ 778,000 | \$ - | \$ 107,000 | \$ 12,000 | \$ 1,537,000 |
| Available for Sust. Harvest | 9 | \$ 485,000 | \$ 221,000 | \$ - | \$ 632,000 | \$ 72,000 | \$ 1,410,000 |
| Probable Salvage \$ | 10 | \$ 55,000 | \$ 78,000 | \$ - | \$ 515,000 | \$ 30,000 | \$ 678,000 |

| Linn County | | | | | | | |
|-------------------------------------|-----------|------------------|-----------------|------------------|-------------------|-----------------|-------------------|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
| Acres | | | | | | | |
| Total Acres | 1 | 12,800 | 900 | 4,800 | 20,300 | 4,700 | 43,500 |
| Non-Forest and Roads | 2 | 400 | 100 | 200 | 1,000 | 1,000 | 2,700 |
| Forested Acres | 3 | 12,400 | 900 | 4,600 | 19,300 | 3,700 | 40,900 |
| Unburned and Low Severity | 4 | 6,500 | 600 | 3,000 | 7,700 | 2,400 | 20,200 |
| Medium and High Severity | 5 | 5,900 | 300 | 1,600 | 11,600 | 1,300 | 20,700 |
| Pre-merchantable | 6 | 600 | - | 700 | 7,300 | 900 | 9,500 |
| Merchantable | 7 | 5,200 | 200 | 900 | 4,300 | 400 | 11,000 |
| Unavailable for Sust. Harvest | 8 | 2,400 | 100 | 100 | 400 | - | 3,000 |
| Available for Sust. Harvest | 9 | 2,800 | 100 | 900 | 3,900 | 400 | 8,100 |
| Probable Salvage Acres | 10 | 1,000 | 100 | 700 | 3,300 | 200 | 5,300 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 344,000 | 32,000 | 88,000 | 194,000 | 34,000 | 692,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 344,000 | 32,000 | 88,000 | 194,000 | 34,000 | 692,000 |
| Unburned and Low Severity | 4 | 178,000 | 23,000 | 64,000 | 101,000 | 24,000 | 390,000 |
| Medium and High Severity | 5 | 166,000 | 9,000 | 23,000 | 92,000 | 10,000 | 300,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 166,000 | 9,000 | 23,000 | 92,000 | 10,000 | 300,000 |
| Unavailable for Sust. Harvest | 8 | 75,000 | 5,000 | 1,000 | 8,000 | 1,000 | 90,000 |
| Available for Sust. Harvest | 9 | 91,000 | 4,000 | 22,000 | 84,000 | 9,000 | 210,000 |
| Probable Salvage MBF | 10 | 10,000 | 2,000 | 10,000 | 66,000 | 4,000 | 92,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 669,000 | \$ 62,000 | \$ 174,000 | \$ 406,000 | \$ 74,000 | \$ 1,385,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 669,000 | \$ 62,000 | \$ 174,000 | \$ 406,000 | \$ 74,000 | \$ 1,385,000 |
| Unburned and Low Severity | 4 | \$ 347,000 | \$ 44,000 | \$ 126,000 | \$ 208,000 | \$ 52,000 | \$ 777,000 |
| Medium and High Severity | 5 | \$ 322,000 | \$ 18,000 | \$ 47,000 | \$ 197,000 | \$ 22,000 | \$ 606,000 |
| Pre-merchantable | 6 | \$ 3,000 | \$ - | \$ 3,000 | \$ 19,000 | \$ 3,000 | \$ 28,000 |
| Merchantable | 7 | \$ 319,000 | \$ 18,000 | \$ 45,000 | \$ 178,000 | \$ 19,000 | \$ 579,000 |
| Unavailable for Sust. Harvest | 8 | \$ 145,000 | \$ 9,000 | \$ 3,000 | \$ 16,000 | \$ 2,000 | \$ 175,000 |
| Available for Sust. Harvest | 9 | \$ 175,000 | \$ 9,000 | \$ 42,000 | \$ 163,000 | \$ 17,000 | \$ 406,000 |
| Probable Salvage \$ | 10 | \$ 20,000 | \$ 3,000 | \$ 20,000 | \$ 128,000 | \$ 7,000 | \$ 178,000 |

| Marion County | | | | | | | |
|-------------------------------|-----------|-------------------|------------------|------------------|-------------------|------------------|-------------------|
| Row | USFS | BLM | ODF | Large Private | Other Private | Total | |
| Acres | | | | | | | |
| Total Acres | 1 | 136,100 | 18,600 | 14,400 | 42,900 | 13,000 | 225,000 |
| Non-Forest and Roads | 2 | 7,400 | 900 | 700 | 1,900 | 2,400 | 13,300 |
| Forested Acres | 3 | 128,700 | 17,700 | 13,700 | 41,000 | 10,700 | 211,800 |
| Unburned and Low Severity | 4 | 43,800 | 6,400 | 5,800 | 14,700 | 4,100 | 74,800 |
| Medium and High Severity | 5 | 84,900 | 11,300 | 7,900 | 26,200 | 6,600 | 136,900 |
| Pre-merchantable | 6 | 14,100 | 3,300 | 3,300 | 20,700 | 4,100 | 45,500 |
| Merchantable | 7 | 70,800 | 8,000 | 4,600 | 5,500 | 2,500 | 91,400 |
| Unavailable for Sust. Harvest | 8 | 55,400 | 5,900 | 300 | 900 | 200 | 62,700 |
| Available for Sust. Harvest | 9 | 15,400 | 2,100 | 4,300 | 4,700 | 2,300 | 28,800 |
| Probable Salvage Acres | 10 | 5,400 | 1,600 | 3,400 | 4,100 | 1,300 | 15,800 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 3,235,000 | 506,000 | 227,000 | 243,000 | 85,000 | 4,296,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 3,235,000 | 506,000 | 227,000 | 243,000 | 85,000 | 4,296,000 |
| Unburned and Low Severity | 4 | 1,095,000 | 171,000 | 111,000 | 129,000 | 35,000 | 1,541,000 |
| Medium and High Severity | 5 | 2,140,000 | 335,000 | 117,000 | 114,000 | 50,000 | 2,756,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 2,140,000 | 335,000 | 117,000 | 114,000 | 50,000 | 2,756,000 |
| Unavailable for Sust. Harvest | 8 | 1,674,000 | 247,000 | 7,000 | 18,000 | 5,000 | 1,951,000 |
| Available for Sust. Harvest | 9 | 466,000 | 89,000 | 110,000 | 96,000 | 46,000 | 807,000 |
| Probable Salvage MBF | 10 | 53,000 | 31,000 | 51,000 | 79,000 | 18,000 | 232,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 6,326,000 | \$ 1,002,000 | \$ 459,000 | \$ 574,000 | \$ 188,000 | \$ 8,549,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 6,326,000 | \$ 1,002,000 | \$ 459,000 | \$ 574,000 | \$ 188,000 | \$ 8,549,000 |
| Unburned and Low Severity | 4 | \$ 2,139,000 | \$ 340,000 | \$ 221,000 | \$ 288,000 | \$ 75,000 | \$ 3,063,000 |
| Medium and High Severity | 5 | \$ 4,187,000 | \$ 662,000 | \$ 238,000 | \$ 286,000 | \$ 113,000 | \$ 5,486,000 |
| Pre-merchantable | 6 | \$ 58,000 | \$ 15,000 | \$ 13,000 | \$ 66,000 | \$ 16,000 | \$ 168,000 |
| Merchantable | 7 | \$ 4,128,000 | \$ 647,000 | \$ 225,000 | \$ 220,000 | \$ 97,000 | \$ 5,317,000 |
| Unavailable for Sust. Harvest | 8 | \$ 3,230,000 | \$ 476,000 | \$ 13,000 | \$ 34,000 | \$ 9,000 | \$ 3,762,000 |
| Available for Sust. Harvest | 9 | \$ 899,000 | \$ 171,000 | \$ 212,000 | \$ 186,000 | \$ 88,000 | \$ 1,556,000 |
| Probable Salvage \$ | 10 | \$ 102,000 | \$ 60,000 | \$ 98,000 | \$ 153,000 | \$ 35,000 | \$ 448,000 |

| Wasco County | | | | | | | | | |
|-------------------------------|-----------|-----------------|-------------|-------------|---------------|------------------|------------------|--|--|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total | | |
| Acres | | | | | | | | | |
| Total Acres | 1 | 8,700 | 1,700 | - | - | 34,800 | 45,200 | | |
| Non-Forest and Roads | 2 | 300 | 300 | - | - | 2,800 | 3,400 | | |
| Forested Acres | 3 | 8,500 | 1,400 | - | - | 31,900 | 41,800 | | |
| Unburned and Low Severity | 4 | 5,900 | 600 | - | - | 11,000 | 17,500 | | |
| Medium and High Severity | 5 | 2,600 | 800 | - | - | 20,900 | 24,300 | | |
| Pre-merchantable | 6 | 400 | 600 | - | - | 9,200 | 10,200 | | |
| Merchantable | 7 | 2,200 | 200 | - | - | 11,700 | 14,100 | | |
| Unavailable for Sust. Harvest | 8 | 1,400 | 200 | - | - | 700 | 2,300 | | |
| Available for Sust. Harvest | 9 | 800 | - | - | - | 11,000 | 11,800 | | |
| Probable Salvage Acres | 10 | 300 | - | - | - | 10,300 | 10,600 | | |
| Volume (MBF) | | | | | | | | | |
| Total Volume | 1 | 174,000 | 15,000 | - | - | 127,000 | 316,000 | | |
| Non-Forest and Roads | 2 | - | - | - | - | - | - | | |
| From Forested Acres | 3 | 174,000 | 15,000 | - | - | 127,000 | 316,000 | | |
| Unburned and Low Severity | 4 | 121,000 | 9,000 | - | - | 42,000 | 172,000 | | |
| Medium and High Severity | 5 | 53,000 | 6,000 | - | - | 85,000 | 144,000 | | |
| Pre-merchantable | 6 | - | - | - | - | - | - | | |
| Merchantable | 7 | 53,000 | 6,000 | - | - | 85,000 | 144,000 | | |
| Unavailable for Sust. Harvest | 8 | 33,000 | 6,000 | - | - | 5,000 | 44,000 | | |
| Available for Sust. Harvest | 9 | 20,000 | - | - | - | 80,000 | 100,000 | | |
| Probable Salvage MBF | 10 | 2,000 | - | - | - | 15,000 | 17,000 | | |
| Value (2020 \$US, Thousands) | | | | | | | | | |
| Total Value | 1 | \$ 340,000 | \$ 30,000 | \$ - | \$ - | \$ 271,000 | \$ 641,000 | | |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - | | |
| From Forested Acres | 3 | \$ 340,000 | \$ 30,000 | \$ - | \$ - | \$ 271,000 | \$ 641,000 | | |
| Unburned and Low Severity | 4 | \$ 237,000 | \$ 18,000 | \$ - | \$ - | \$ 87,000 | \$ 342,000 | | |
| Medium and High Severity | 5 | \$ 103,000 | \$ 12,000 | \$ - | \$ - | \$ 183,000 | \$ 298,000 | | |
| Pre-merchantable | 6 | \$ 1,000 | \$ 1,000 | \$ - | \$ - | \$ 20,000 | \$ 22,000 | | |
| Merchantable | 7 | \$ 101,000 | \$ 11,000 | \$ - | \$ - | \$ 164,000 | \$ 276,000 | | |
| Unavailable for Sust. Harvest | 8 | \$ 63,000 | \$ 11,000 | \$ - | \$ - | \$ 10,000 | \$ 84,000 | | |
| Available for Sust. Harvest | 9 | \$ 38,000 | \$ - | \$ - | \$ - | \$ 154,000 | \$ 192,000 | | |
| Probable Salvage \$ | 10 | \$ 4,000 | \$ - | \$ - | \$ - | \$ 28,000 | \$ 32,000 | | |

APPENDIX D: IMPACTS BY MARKET AREA

Salvage Estimates by Market Area

Figure A 2: Labor Day 2020 fires included in this report, and market areas.

| Market Area: East | | | | | | | |
|-------------------------------------|-----------|-----------------|-------------|---------------|---------------|------------------|------------------|
| Row | USFS | BLM | ODF | Large Private | Other Private | Total | |
| Acres | | | | | | | |
| Total Acres | 1 | 25,200 | 1,700 | - | - | 110,400 | 137,300 |
| Non-Forest and Roads | 2 | 1,400 | 300 | - | - | 7,400 | 9,100 |
| Forested Acres | 3 | 23,800 | 1,400 | - | - | 102,900 | 128,100 |
| Unburned and Low Severity | 4 | 10,000 | 600 | - | - | 41,500 | 52,100 |
| Medium and High Severity | 5 | 13,800 | 800 | - | - | 61,500 | 76,100 |
| Pre-merchantable | 6 | 7,300 | 600 | - | - | 28,800 | 36,700 |
| Merchantable | 7 | 6,500 | 200 | - | - | 32,700 | 39,400 |
| Unavailable for Sust. Harvest | 8 | 5,100 | 200 | - | - | 2,000 | 7,300 |
| Available for Sust. Harvest | 9 | 1,400 | - | - | - | 30,700 | 32,100 |
| Probable Salvage Acres | 10 | 500 | - | - | - | 29,000 | 29,500 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 321,000 | 15,000 | - | - | 409,000 | 745,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 321,000 | 15,000 | - | - | 409,000 | 745,000 |
| Unburned and Low Severity | 4 | 168,000 | 9,000 | - | - | 168,000 | 345,000 |
| Medium and High Severity | 5 | 152,000 | 6,000 | - | - | 242,000 | 400,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 152,000 | 6,000 | - | - | 242,000 | 400,000 |
| Unavailable for Sust. Harvest | 8 | 124,000 | 6,000 | - | - | 15,000 | 145,000 |
| Available for Sust. Harvest | 9 | 28,000 | - | - | - | 227,000 | 255,000 |
| Probable Salvage MBF | 10 | 3,000 | - | - | - | 41,000 | 44,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 634,000 | \$ 30,000 | \$ - | \$ - | \$ 869,000 | \$ 1,533,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 634,000 | \$ 30,000 | \$ - | \$ - | \$ 869,000 | \$ 1,533,000 |
| Unburned and Low Severity | 4 | \$ 330,000 | \$ 18,000 | \$ - | \$ - | \$ 349,000 | \$ 697,000 |
| Medium and High Severity | 5 | \$ 304,000 | \$ 12,000 | \$ - | \$ - | \$ 520,000 | \$ 836,000 |
| Pre-merchantable | 6 | \$ 10,000 | \$ 1,000 | \$ - | \$ - | \$ 54,000 | \$ 65,000 |
| Merchantable | 7 | \$ 294,000 | \$ 11,000 | \$ - | \$ - | \$ 466,000 | \$ 771,000 |
| Unavailable for Sust. Harvest | 8 | \$ 239,000 | \$ 11,000 | \$ - | \$ - | \$ 29,000 | \$ 279,000 |
| Available for Sust. Harvest | 9 | \$ 55,000 | \$ - | \$ - | \$ - | \$ 437,000 | \$ 492,000 |
| Probable Salvage \$ | 10 | \$ 6,000 | \$ - | \$ - | \$ - | \$ 78,000 | \$ 84,000 |

Market Area: M1

| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
|-------------------------------------|-----------|-------------------|------------------|------------------|-------------------|-----------------|-------------------|
| Acres | | | | | | | |
| Total Acres | 1 | 84,700 | 31,700 | 5,200 | 55,800 | 7,100 | 184,500 |
| Non-Forest and Roads | 2 | 3,400 | 1,600 | 200 | 2,500 | 500 | 8,200 |
| Forested Acres | 3 | 81,400 | 30,100 | 5,000 | 53,300 | 6,600 | 176,400 |
| Unburned and Low Severity | 4 | 31,500 | 15,500 | 3,100 | 20,100 | 3,200 | 73,400 |
| Medium and High Severity | 5 | 49,800 | 14,600 | 1,900 | 33,200 | 3,400 | 102,900 |
| Pre-merchantable | 6 | 15,500 | 5,000 | 1,100 | 24,900 | 2,800 | 49,300 |
| Merchantable | 7 | 34,400 | 9,600 | 800 | 8,300 | 600 | 53,700 |
| Unavailable for Sust. Harvest | 8 | 19,300 | 6,400 | 100 | 1,100 | 100 | 27,000 |
| Available for Sust. Harvest | 9 | 15,000 | 3,200 | 800 | 7,200 | 500 | 26,700 |
| Probable Salvage Acres | 10 | 5,300 | 2,300 | 600 | 6,200 | 300 | 14,700 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 1,984,000 | 801,000 | 58,000 | 355,000 | 31,000 | 3,229,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 1,984,000 | 801,000 | 58,000 | 355,000 | 31,000 | 3,229,000 |
| Unburned and Low Severity | 4 | 760,000 | 409,000 | 36,000 | 191,000 | 18,000 | 1,414,000 |
| Medium and High Severity | 5 | 1,223,000 | 392,000 | 21,000 | 165,000 | 13,000 | 1,814,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 1,223,000 | 392,000 | 21,000 | 165,000 | 13,000 | 1,814,000 |
| Unavailable for Sust. Harvest | 8 | 688,000 | 262,000 | 2,000 | 22,000 | 2,000 | 976,000 |
| Available for Sust. Harvest | 9 | 536,000 | 130,000 | 20,000 | 143,000 | 11,000 | 840,000 |
| Probable Salvage MBF | 10 | 61,000 | 46,000 | 9,000 | 116,000 | 5,000 | 237,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 3,943,000 | \$ 1,593,000 | \$ 123,000 | \$ 806,000 | \$ 81,000 | \$ 6,546,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 3,943,000 | \$ 1,593,000 | \$ 123,000 | \$ 806,000 | \$ 81,000 | \$ 6,546,000 |
| Unburned and Low Severity | 4 | \$ 1,514,000 | \$ 814,000 | \$ 78,000 | \$ 413,000 | \$ 45,000 | \$ 2,864,000 |
| Medium and High Severity | 5 | \$ 2,429,000 | \$ 779,000 | \$ 45,000 | \$ 393,000 | \$ 36,000 | \$ 3,682,000 |
| Pre-merchantable | 6 | \$ 69,000 | \$ 23,000 | \$ 4,000 | \$ 76,000 | \$ 10,000 | \$ 182,000 |
| Merchantable | 7 | \$ 2,360,000 | \$ 756,000 | \$ 41,000 | \$ 318,000 | \$ 25,000 | \$ 3,500,000 |
| Unavailable for Sust. Harvest | 8 | \$ 1,326,000 | \$ 506,000 | \$ 3,000 | \$ 42,000 | \$ 5,000 | \$ 1,882,000 |
| Available for Sust. Harvest | 9 | \$ 1,034,000 | \$ 250,000 | \$ 38,000 | \$ 276,000 | \$ 21,000 | \$ 1,619,000 |
| Probable Salvage \$ | 10 | \$ 117,000 | \$ 88,000 | \$ 18,000 | \$ 223,000 | \$ 9,000 | \$ 455,000 |

| Market Area: M2 | | | | | | | |
|-------------------------------------|-----------|-------------------|-------------------|-------------------|-------------------|------------------|---------------------|
| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
| Acres | | | | | | | |
| Total Acres | 1 | 178,700 | 38,100 | 19,300 | 162,200 | 30,900 | 429,200 |
| Non-Forest and Roads | 2 | 8,900 | 1,800 | 900 | 6,300 | 5,800 | 23,700 |
| Forested Acres | 3 | 169,800 | 36,300 | 18,400 | 156,000 | 25,000 | 405,500 |
| Unburned and Low Severity | 4 | 59,700 | 9,400 | 8,800 | 42,600 | 10,200 | 130,700 |
| Medium and High Severity | 5 | 110,100 | 27,000 | 9,500 | 113,300 | 14,800 | 274,700 |
| Pre-merchantable | 6 | 20,400 | 7,900 | 4,100 | 86,300 | 10,300 | 129,000 |
| Merchantable | 7 | 89,700 | 19,000 | 5,500 | 27,100 | 4,500 | 145,800 |
| Unavailable for Sust. Harvest | 8 | 65,600 | 14,400 | 300 | 3,700 | 500 | 84,500 |
| Available for Sust. Harvest | 9 | 24,100 | 4,600 | 5,200 | 23,300 | 4,000 | 61,200 |
| Probable Salvage Acres | 10 | 8,400 | 3,400 | 4,200 | 20,100 | 2,300 | 38,400 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 4,484,000 | 1,130,000 | 316,000 | 1,000,000 | 200,000 | 7,130,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 4,484,000 | 1,130,000 | 316,000 | 1,000,000 | 200,000 | 7,130,000 |
| Unburned and Low Severity | 4 | 1,595,000 | 268,000 | 176,000 | 411,000 | 96,000 | 2,546,000 |
| Medium and High Severity | 5 | 2,889,000 | 862,000 | 140,000 | 589,000 | 104,000 | 4,584,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 2,889,000 | 862,000 | 140,000 | 589,000 | 104,000 | 4,584,000 |
| Unavailable for Sust. Harvest | 8 | 2,081,000 | 654,000 | 8,000 | 81,000 | 12,000 | 2,836,000 |
| Available for Sust. Harvest | 9 | 808,000 | 208,000 | 132,000 | 508,000 | 92,000 | 1,748,000 |
| Probable Salvage MBF | 10 | 92,000 | 73,000 | 61,000 | 413,000 | 37,000 | 676,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 8,774,000 | \$ 2,232,000 | \$ 634,000 | \$ 2,316,000 | \$ 449,000 | \$ 14,405,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 8,774,000 | \$ 2,232,000 | \$ 634,000 | \$ 2,316,000 | \$ 449,000 | \$ 14,405,000 |
| Unburned and Low Severity | 4 | \$ 3,115,000 | \$ 532,000 | \$ 348,000 | \$ 897,000 | \$ 209,000 | \$ 5,101,000 |
| Medium and High Severity | 5 | \$ 5,659,000 | \$ 1,700,000 | \$ 286,000 | \$ 1,419,000 | \$ 239,000 | \$ 9,303,000 |
| Pre-merchantable | 6 | \$ 86,000 | \$ 37,000 | \$ 16,000 | \$ 282,000 | \$ 39,000 | \$ 460,000 |
| Merchantable | 7 | \$ 5,573,000 | \$ 1,664,000 | \$ 270,000 | \$ 1,137,000 | \$ 200,000 | \$ 8,844,000 |
| Unavailable for Sust. Harvest | 8 | \$ 4,015,000 | \$ 1,262,000 | \$ 16,000 | \$ 157,000 | \$ 23,000 | \$ 5,473,000 |
| Available for Sust. Harvest | 9 | \$ 1,558,000 | \$ 401,000 | \$ 255,000 | \$ 980,000 | \$ 178,000 | \$ 3,372,000 |
| Probable Salvage \$ | 10 | \$ 177,000 | \$ 141,000 | \$ 118,000 | \$ 796,000 | \$ 72,000 | \$ 1,304,000 |

Market Area: M3

| | Row | USFS | BLM | ODF | Large Private | Other Private | Total |
|-------------------------------------|-----------|------------------|-------------------|-------------|-------------------|------------------|-------------------|
| Acres | | | | | | | |
| Total Acres | 1 | 75,700 | 57,900 | 700 | 53,400 | 32,300 | 220,000 |
| Non-Forest and Roads | 2 | 3,300 | 2,700 | - | 1,900 | 2,400 | 10,300 |
| Forested Acres | 3 | 72,400 | 55,200 | 700 | 51,400 | 29,900 | 209,600 |
| Unburned and Low Severity | 4 | 31,200 | 17,900 | 600 | 10,400 | 8,600 | 68,700 |
| Medium and High Severity | 5 | 41,200 | 37,300 | - | 41,100 | 21,300 | 140,900 |
| Pre-merchantable | 6 | 10,500 | 13,500 | - | 25,800 | 16,700 | 66,500 |
| Merchantable | 7 | 30,800 | 23,800 | - | 15,300 | 4,600 | 74,500 |
| Unavailable for Sust. Harvest | 8 | 18,600 | 16,700 | - | 1,400 | 700 | 37,400 |
| Available for Sust. Harvest | 9 | 12,200 | 7,100 | - | 13,900 | 3,900 | 37,100 |
| Probable Salvage Acres | 10 | 4,300 | 5,300 | - | 11,700 | 2,100 | 23,400 |
| Volume (MBF) | | | | | | | |
| Total Volume | 1 | 1,972,000 | 1,330,000 | 5,000 | 397,000 | 128,000 | 3,832,000 |
| Non-Forest and Roads | 2 | - | - | - | - | - | - |
| From Forested Acres | 3 | 1,972,000 | 1,330,000 | 5,000 | 397,000 | 128,000 | 3,832,000 |
| Unburned and Low Severity | 4 | 889,000 | 430,000 | 5,000 | 92,000 | 51,000 | 1,467,000 |
| Medium and High Severity | 5 | 1,083,000 | 900,000 | - | 305,000 | 77,000 | 2,365,000 |
| Pre-merchantable | 6 | - | - | - | - | - | - |
| Merchantable | 7 | 1,083,000 | 900,000 | - | 305,000 | 77,000 | 2,365,000 |
| Unavailable for Sust. Harvest | 8 | 655,000 | 621,000 | - | 27,000 | 11,000 | 1,314,000 |
| Available for Sust. Harvest | 9 | 428,000 | 279,000 | - | 279,000 | 67,000 | 1,053,000 |
| Probable Salvage MBF | 10 | 49,000 | 98,000 | - | 220,000 | 28,000 | 395,000 |
| Value (2020 \$US, Thousands) | | | | | | | |
| Total Value | 1 | \$ 3,860,000 | \$ 2,614,000 | \$ 11,000 | \$ 852,000 | \$ 300,000 | \$ 7,637,000 |
| Non-Forest and Roads | 2 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - |
| From Forested Acres | 3 | \$ 3,860,000 | \$ 2,614,000 | \$ 11,000 | \$ 852,000 | \$ 300,000 | \$ 7,637,000 |
| Unburned and Low Severity | 4 | \$ 1,735,000 | \$ 844,000 | \$ 11,000 | \$ 195,000 | \$ 112,000 | \$ 2,897,000 |
| Medium and High Severity | 5 | \$ 2,125,000 | \$ 1,770,000 | \$ 1,000 | \$ 657,000 | \$ 188,000 | \$ 4,741,000 |
| Pre-merchantable | 6 | \$ 35,000 | \$ 34,000 | \$ - | \$ 68,000 | \$ 39,000 | \$ 176,000 |
| Merchantable | 7 | \$ 2,090,000 | \$ 1,736,000 | \$ 1,000 | \$ 589,000 | \$ 149,000 | \$ 4,565,000 |
| Unavailable for Sust. Harvest | 8 | \$ 1,264,000 | \$ 1,199,000 | \$ - | \$ 51,000 | \$ 20,000 | \$ 2,534,000 |
| Available for Sust. Harvest | 9 | \$ 826,000 | \$ 537,000 | \$ 1,000 | \$ 538,000 | \$ 128,000 | \$ 2,030,000 |
| Probable Salvage \$ | 10 | \$ 94,000 | \$ 188,000 | \$ - | \$ 424,000 | \$ 54,000 | \$ 760,000 |

APPENDIX E: DETERIORATION

Ambrosia Beetles Reduce the Shelf-life of Salvage Timber

Ecology and Life History

Several decay mechanisms are set in motion when trees are damaged by wildfire. One of the most destructive and rapid processes is the infestation of weakened, dying or dead trees by ambrosia beetles.³⁸ Unlike mountain pine beetles or spruce bark beetles, ambrosia beetles in the Pacific Northwest do not attack healthy live trees, so they are not the cause of large-scale tree mortality. The ambrosia beetle designation refers to genera in the Scolytinae and Platypodinae subfamilies, which are true weevils, despite not having the typical extended snout of most weevils (Jordal 2007). The most common ambrosia beetle in Oregon and the Pacific Northwest is *Trypodendron lineatum* (Wood 1982).

Ambrosia beetles have a symbiotic relationship with the ambrosia fungus (Endoh et al., 2011). Adult beetles are small, a few millimeters long, and carry fungal spores in specialized structures called mycangia. The adults bore through tree bark and into the sapwood, constructing a network of tunnels or galleries, the walls of which are colonized by the symbiotic fungi. Adults then lay eggs that hatch into larvae, which feed on the fungus rather than on the wood. The fungus extends mycelial structures into the surrounding wood to extract nutrients, causing extensive dark staining and further weakening the physical structure of the tree. North American ambrosia beetle species mostly tunnel through sapwood, while some Asian species also extend galleries into the heartwood, inflicting greater damage.

In the Pacific Northwest, several ambrosia beetle species are native and exist at stable population levels most of the time (Dyer and Chapman 1965). When large-scale forest damage events occur, however, the population of ambrosia beetles can rise rapidly. Beetle activity, and therefore the capacity of populations to spread and multiply, is governed strongly by temperature. When daytime temperatures exceed 70° F for two or three consecutive days, the probability of beetle dispersal is effectively 100%. Ambrosia beetles chiefly attack tree trunks, but 10% of attacks may occur on branches; large diameter slash may harbor the beetles, so slash burning also controls ambrosia beetle populations.

Implications for Timber Salvage

Damage caused by ambrosia beetles includes “pin-holes” in finished lumber and blue or dark stains from fungal growth. As the saw cuts through beetle galleries, lumber surfaces appear to have many small holes; this impacts high-grade logs the most, incurring value losses up to 57% (Orbay et al., 1993). Pin-holes structurally weaken the lumber and are often accompanied by blue stain or other dark stain, which usually reduces the lumber grade. Logs for export may be rejected; for example, Japan rejects any logs with more than 5% ambrosia beetle defect and may even cancel entire shipments. In typical years, ambrosia beetle attack can be mitigated by scheduling logging during months with low attack rates. Attack rates typically drop February through June but resume again in July through January (Dyer and Chapman 1965). At the mill, ambrosia beetles can be controlled by sprinkler systems and pheromone traps. Keeping decked logs wet using sprinklers or in ponds physically prevents beetle attack and may cause anaerobic conditions that inhibit symbiotic fungal growth if attack does occur.³⁹

³⁸ “Ambrosia beetle” refers to a wide range of species. Many ambrosia beetle species, particularly in the tropics and subtropics, attack healthy, live trees, e.g., the redbay ambrosia beetle (*Xyleborus glabratus*) native to Southeast Asia, invasive in the US Southeast. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5349704.pdf

³⁹ https://www.oregon.gov/ODF/Documents/ForestBenefits/Ambrosia_beetle_2017.pdf



Figure A 3: Ambrosia beetle life stages and damage symptoms.

Adult beetles (top left) are only a few millimeters long. The adult bores into wood to lay eggs, creating an initial infestation site. Beetles have evolved special structures to carry spores of the ambrosia fungus (genera *Ambrosiella* or *Rafaellea*) that germinate and grow along the galleries as the beetle mines through the tree. After constructing galleries, adults lay eggs that hatch into larvae (top right), which feed on the symbiotic fungal tissues growing in the galleries rather than directly on the wood. The most obvious outward sign of ambrosia

beetle infestation is the presence of fine dust on the bark or at the base of the tree (middle). Extensive galleries physically weaken wood (bottom right), and also introduce fungal staining (bottom left), both of which cause defect, reduce grade and, after sufficient time, render logs unsuitable for processing. Image source: <https://www.fs.fed.us/r3/resources/health/field-guide/wb/ambrosia.shtml>

Our ability to control ambrosia beetle attack in the forest is limited to luck and timing; the only reliable method is to conduct logging operations during months when attack rates are low. The 2020 Oregon wildfires occurred in September and into October, fortunately after dispersal flights would have ended for the season. With October daytime temperatures after the fires likely below 60° F most days, further ambrosia beetle dispersal onto dying or dead burned trees is unlikely to have occurred. The pre-fire population of *T. lineatum* would have continued its background attack rates where beetles were already present and, at lower elevations, continued attacks through November and into January.

Limited winter dispersal of ambrosia beetles gives forest managers and logging contractors a head start to complete some salvage before temperatures warm back up in spring and summer 2021. Given the large area damaged by fires, however, some portion – possibly large – of the standing timber will not get extracted in time to avoid ambrosia beetle infestation. Once ambrosia beetles start flying again in 2021, sometime in May or June, the beetles' life cycle rate will govern how fast the population can multiply. One generation of *T. lineatum* requires 8 to 10 weeks (Lindgren 1990). At least one and probably two generations will be able to grow and disperse in 2021, with 50-70 offspring per adult (Kirkendall 1983); three generations could likely grow to maturity before adults decamp from trees to hibernate in duff.

Populations of ambrosia beetles could spike to thousands of times higher than normal during 2021 and 2022, as each female beetle produces approximately 60 offspring. Sex ratios in ambrosia beetle species are variable (Kirkendall 1983), but if roughly half of the next generation is female, and with limited ability of predators to ramp up populations in synchrony, a single female beetle could multiply into 27,000 over this growing season, of which 900 will likely disperse. Sometime in 2021 and certainly by 2022, the regional ambrosia beetle population will be ubiquitous in the areas damaged by the 2020 fires. Standing dead or damaged timber is virtually certain to sustain ambrosia beetle damage by the middle to end of 2021, and populations will begin the 2022 dispersal season at highly elevated levels.

The window of opportunity to salvage timber with negligible beetle damage may end around June or July 2021, as the first generation of 2021 completes its life cycle. Damage from the first cycle will be constrained to background levels but will accelerate exponentially after the second 2021 cycle. The precise rate of beetle-induced wood quality reduction is difficult to predict, but salvage operations later in 2021 and through 2022 will find decreasing wood quality as the ambrosia beetle population acclimates to the high resource availability in wildfire-affected areas.

Deterioration

The amount of post-fire timber volume that can be recovered is affected by the delay between the time of the fire and the time of harvest. Timber volume that can be made into solid wood products is lost due to deterioration of the sapwood, weather checking and insect damage. These problems are scaled out as defect, reducing the merchantable volume scaled from the logs. Volume loss is a function of species, log diameter and time since the fire. Lowell and Cahill (1996) provide a comprehensive summary of a number of fire deterioration studies for

timber in Southern Oregon and Northern California.⁴⁰ **Figure A 4** summarizes the deterioration rates reported in the study.

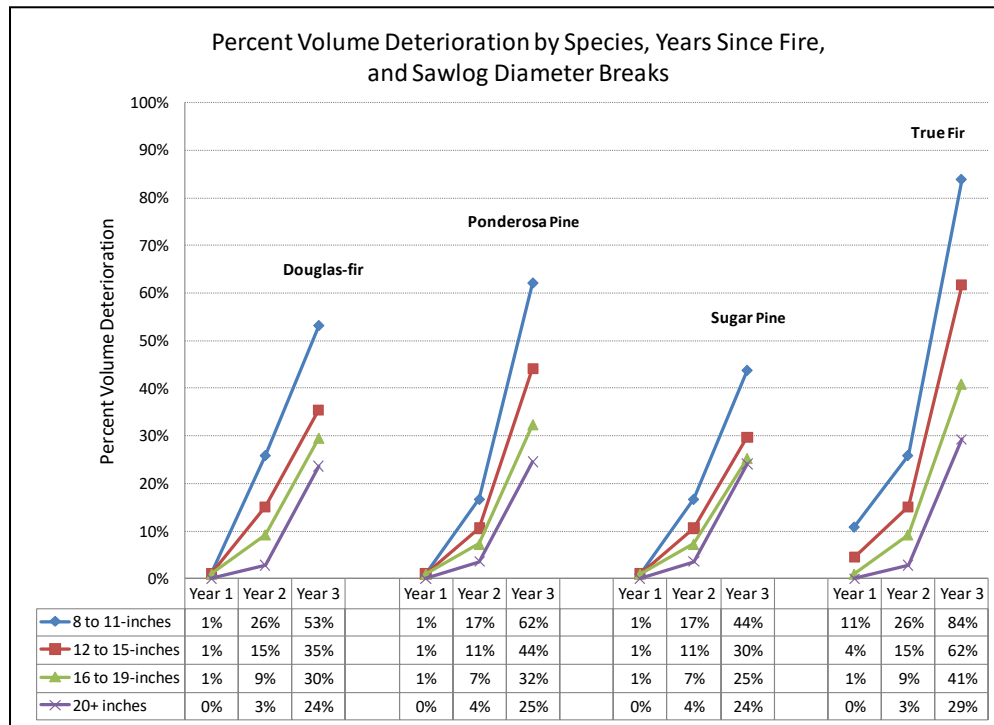


Figure A 4: Percent volume deterioration by species, years since fire, and sawlog diameter breaks.

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