MARKET CAPACITY ASSESSMENT

Southern Cascade and Northeastern Sierra Nevada OPR Pilot Project

Prepared for :
Fall River Resource Conservation District

Prepared by :
CLERE Inc.

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EXECUTIVE SUMMARY

Overview

A century of intensive single-species harvest practices and the suppression of wildfire and cultural burning has led to a landscape with significantly higher stand densities of smaller, more fire-sensitive trees (Hagmann 2021; Cabiyo 2021; Knight 2020). Furthermore, climate-induced events like the 2012-2017 CA drought and the subsequent bark beetle infestation have led to wide-spread tree mortality and an increase in wildfire occurrence, acres burned, and fire severity (Crockett 2018). Over the next century, climate change will further exacerbate natural disturbances and impact the structure and composition of California forests (Stevens-Rumann 2017).

The Southern Cascades and Northern Sierra, as illustrated in Figure 1, has a mature timber market with mixed landowner types who manage the surrounding forests for varying management objectives. In the coming decades, regional strategies to influence wildfire behavior will need to expand fuel reduction and forest restoration treatments, which will produce large quantities of unmerchantable forest-based biomass and sawmill residue. More research is needed to understand market capacity to handle biomass, regional biomass availability based on current market conditions, and the ability for biomass markets to remove barriers to treating additional acres that would have otherwise not been treated.

In 2020, the Governor's Office of Planning and Research (OPR) was provided $3 million from the Wildfire and Forest Resilience Early Action Package to address economic development opportunities. $2.5 million was allocated to support new long-term wood feedstock pilot projects which OPR used to pilot 5 projects throughout the State. The pilots will develop plans to improve feedstock supply chain logistics within each target region through an institutional arrangement with the structure, authority, and resources to aggregate and initiate long-term feedstock contracts. Each project will explore and assess market opportunities of potential woody biomass businesses in their region and commit to increasing feedstock aggregation on all relevant land types, including private and noncommercial land, especially where opportunity exists to produce community fire resilience benefits.

Market Capacity Assessment – Northern Sierra Southern Cascade

The Southern Cascade and Northeastern Sierra Nevada—including Shasta, Lassen, Modoc, and Siskiyou Counties (Figure 1)—has a mature timber market with mixed landowner types who manage the surrounding forests for varying management objectives. In the coming decades, regional strategies to develop community and ecological resilience to high-intensity wildfires will need to expand fuel reduction and forest restoration treatments, which will produce large quantities of unmerchantable sawlog biomass and sawmill residue. Currently, some of the unmerchantable biomass is either pile burned or left in-woods to decay due to a variety of reasons including complicated market dynamics and the high costs of biomass removal. Adding new infrastructure and/or expanding existing infrastructure to handle the expected increases of residue from fuel reduction treatments is a widely supported solution to address these issues (FMTF 2021, Sanchez 2022, Cabiyo 2022).

Led by the Fall River and Pit Resource Conservation Districts (RCD), this Market Capacity Assessment aims to understand and quantify (1) long term average market capacity for forest harvests, (2) how much biomass is currently being generated from those harvests, and (3) how

much biomass is being utilized by existing businesses today. This report focuses exclusively on forest-based biomass. Furthermore, due to the lack of a centralized point to anchor haul distances, this report does not analyze how much biomass *could be* removed with improved economics. Rather this report looks at market capacity under current market conditions.

1. Regional Resource Supply Area (RSA)

The Resource Supply Area (RSA) was selected based on natural features on the landscape including: ecoregions, public land boundaries, major highways, county boundaries, and likely areas for continued forest management by the Fall River RCD. The RSA contains over 7.6 million acres. Analysis found that this region contains 1.7 million acres of forested land that is suitable for biomass operations. Of this acreage, 90% can be considered productive timberland which includes mixed conifer and conifer dominant stands. Over 50% of all forested lands are managed by the US Forest Service, while 44% is managed by both large industrial and small private forest landowners.

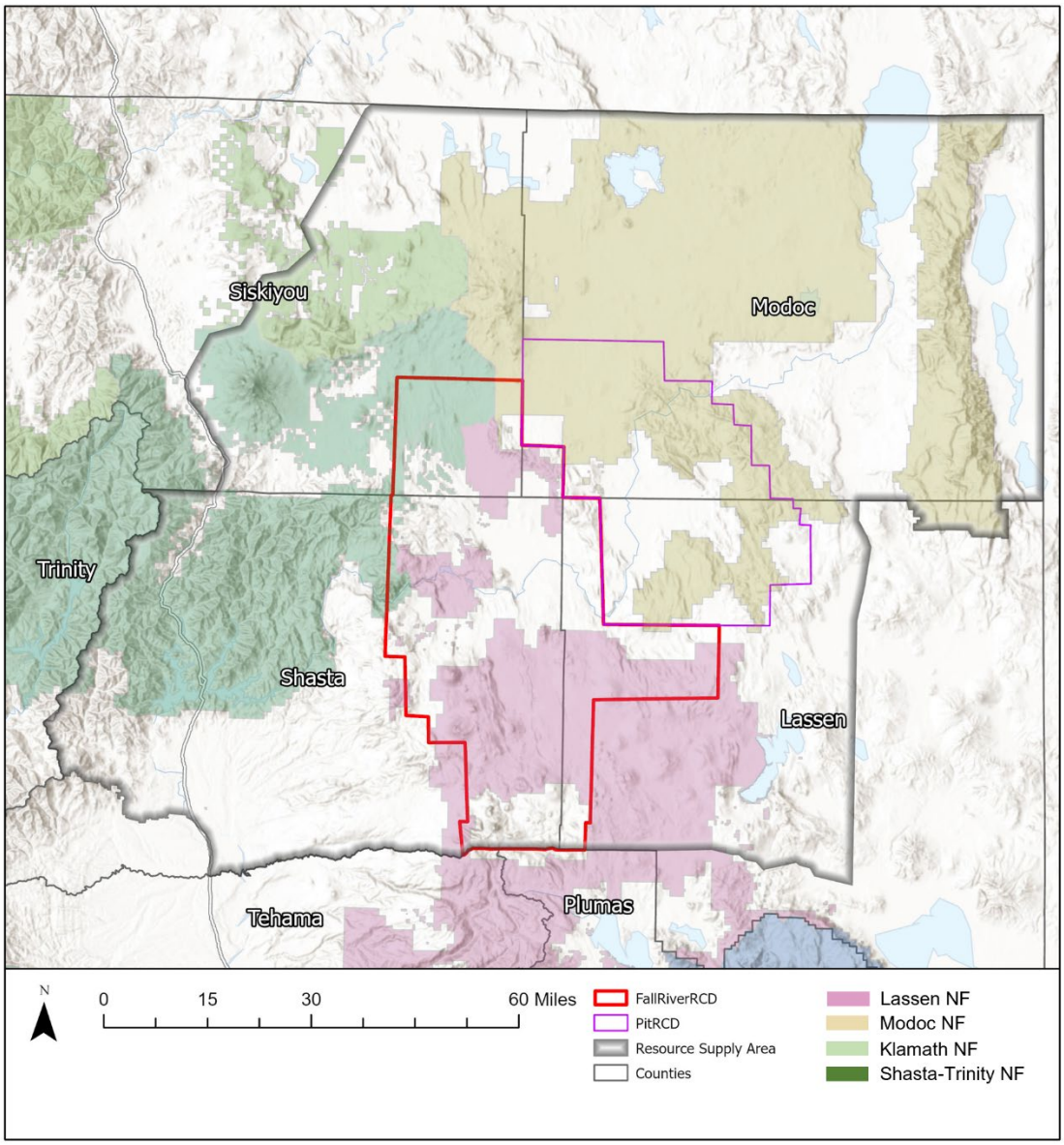

Figure 1: Resource Supply Area (RSA) boundary

In the last decade 1,477,993 acres of land have burned within the RSA due to wildfire. 71% of the acres burned (1,056,046 ac) occurred after 2018. Areas that burned at high severity are still common in a fire prone ecosystem (McIntyre, 2015). However, with increasing amounts of acres burning at higher fire severities than historically present, there is a general concern about future landscape conditions to regenerate as forest (Stephens, 2022). Over 68% of the wildfires in the last decade within the RSA can be considered beneficial. Only 12% of wildfires over the last decade were burned at high-severity. Yet, 99% of high-severity acres burned occurred in 2021. While a ten-year timespan is shorter than the expected historic fire return interval for the region, it is also illustrative of findings on the increasing amount of high severity acres burned across the Western US (Hagmann et al, 2021).

2. How much biomass is being generated in the RSA?

Potentially Available

In this report, potentially available biomass refers to the amount of biomass that is generated within various harvest operations but not necessarily available for the market to utilize. This should not be confused with gross biomass availability which may look at spatially explicit information to estimate the total amount of biomass that could be harvested from the forest. Several different categories of forest biomass exist to estimate potentially available biomass for new market development. These biomass estimates can be categorized as coming from private, public, or "other" lands. The "other" category is to represent fuel reduction projects funded by CAL FIRE and led by RCDs, Fire Safe Councils (FSC), and other non-profits not occurring on public land, or do not always require a Timber Harvest Plan. The following categories analyzed include:

- **Timber harvest residuals:** generated as a byproduct of commercial timber harvests and recorded through the Board of Equalizations (BOE) Timber Yield Tax. This category estimates biomass produced from any operations which cuts and sells trees as sawlogs.
- **Pre-commercial thinning:** timberland owners often use this silvicultural technique to improve stand conditions years before a timber harvest. However, rarely is there a viable market to pay for biomass removal of this material. Therefore, this category is not always recorded.
- **Fuel reduction and forest health:** CAL FIRE separately tracks fuel break and fuel reduction projects funded through their grant projects through their Cal MAPPER portal. These projects are not associated with private or public harvest databases, nor are represented appropriately through the BOE timber harvest records. These projects are growing in funding support and are expected to increase moving into the future.
- **Standing dead and fire killed trees:** Utilizing as many dead trees as ecologically and economically possible is a high priority due to the public safety concerns posed by dead trees to priority infrastructure like powerlines, roads, and buildings, as well as the implications for wildfire risk, and the ability to reestablish productive forests after a disturbance event (The Beck Group, 2017).
    - Concurrent with commercial harvests: Commercial harvest operations will remove some standing dead trees which can be sent to a biomass end-user in some situations.
    - Fire salvage within 100ft from roads: this report focuses on the amount of biomass that can be potentially salvaged within fire footprints from 2018-2021 based on burn severity data. Using a 100ft buffer around roads addresses the need to prioritize hazardous tree removal along ingress and egress routes.
    - Fire salvage within 101-1000ft from roads and above 20in DBH: a larger buffer around roads is applied to estimate additional biomass recovery, where trees above 20in in diameter at breast height (BDH) are considered economically viable.

In addition to estimating the volume removed, market capacity can also be estimated through acres completed per year. Over the last 10 years, the region has completed approximately 40,000 acres per year of forest treatments on private and public land. It is expected to complete at least 44,000 acres per year moving into the future when including CAL FIRE administered fuel reductions projects.

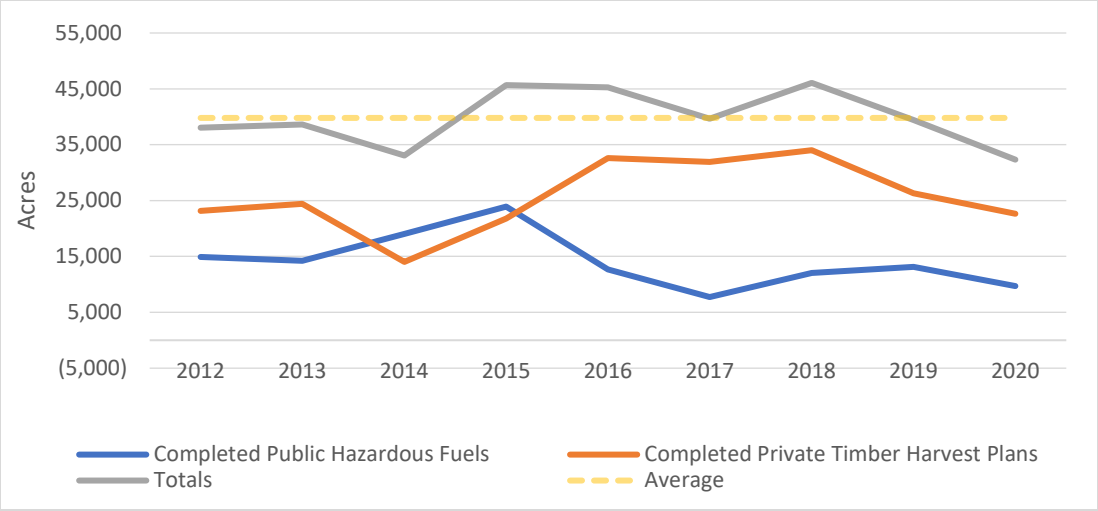

Figure 2: Acres completed within RSA over the last decade

Practically Available

Potentially available biomass estimates are the maximum estimate that could be procured within the RSA based on treated acres. However, the forest sector in general is prone to a variety of economic and environmental constraints which can impact the overall recovery of potential estimates, including: breakage and defects in logs, chip van accessibility, project size, NEPA delays, timber harvest plan costs, contractor availability, and unwillingness or inability for landowners to fund biomass removal (MBG 2019, CT Bioenergy 2018). Practically available biomass estimates are estimated by applying a conversion factor to the Potentially available estimates. This report assumes that 60% of the Potentially available biomass is available to the market for biomass utilization. However, conversion factors were customized for "pre-commercial thinning" and public land's "standing dead concurrently removed with commercial harvests". Very rarely are these feedstock sources made available to or prioritized for market utilization. Therefore, they were given a 0% conversion factor. However, given the presence of more outlets for this type of material, precommercial or mortality removed with harvests on public land may eventually become practically available given more favorable economics. As a reminder, economics is not taken into account in this analysis, but rather is looking at recorded market capacity for biomass over the last decade.

Practically available estimates also include utility vegetation management and sawmill residues into the final estimates. These were found through analysis and interviews with facilities within the region. Vegetation management from Caltrans was not included due to some limitations in reporting and analysis but may be included at a later date.

Our estimates show that there is over 1.1 million BDT practically available to the market within the RSA on an annual basis. 73% of this material is from private lands, while 15% and 12% are from fuel reduction projects funded by CALFIRE and public lands, respectively. These categories were further separated based on how reliable the biomass is made available on an annual basis. Over 938,000 BDT is produced on a sustainable basis. However, 202,000 BDT are opportunistic estimates for biomass procurement and should not be relied on as a recurring annual amount.

Annual Forest-based Biomass Practically Available	Public	Private	other	Totals
	avg BDT	avg BDT	avg BDT	
Harvest residue	21,377	184,787	-	206,164
Pre-commercial harvests	-	-	-	-
Fuels reductions and forest health	23,061	64,019	125,678	212,758
Standing dead				
Concurrent with harvests	-	42,982	-	42,982
Fire salvage - 100ft of roads	17,392	29,716	-	47,108
Fire salvage - 101-1000ft of roads	21,355	48,209	30,383	99,947
Practically Available	**83,186**	**369,713**	**156,061**	**608,960**
Utility vegetation management	-	-	12,000	12,000
Sawmill residues	53,834	465,342	-	519,175
GRAND TOTALS	**137,020**	**835,054**	**168,061**	**1,140,135**
Reliable basis	**98,272** (±5,000)	**714,147** (±14,000)	**125,678** (±27,000)	**938,098**
Inflated due to mortality and utilities	**38,748** (±18,000)	**120,907** (±37,000)	**42,383** (±14,000)	**202,037**

3. How much biomass is being utilized in the RSA?

There are currently six (6) major biomass utilization facilities and seven (7) sawmills operating within or around the RSA. While sawmill and biomass facilities are reliant upon each other in many ways when creating an efficient and effective supply chain, this report mainly focuses on biomass utilization facilities. Furthermore, forest-derived feedstock is only a part of the feedstock mix that a biomass utilization facility can procure from. Agricultural and urban wood waste are also both procurement sources but are not estimated here. There is approximately 783,505 BDT currently being utilized within the RSA.

Name	Type	MW nameplate	procurement within RSA	
Burney Forest Power	Bioenergy	31	100%	
Honey Lake Power	Bioenergy	31	14%	
Roseburg Forest Products Biomass Power	Bioenergy	15	43%	
Shasta Sustainable Resource Management	Bioenergy	55	70%	
Sierra Pacific Anderson Biomass Power II	Bioenergy	30	100%	
Sierra Pacific Burney Biomass Power	Bioenergy	20	100%	
Total		**182**	**783,505 BDT**	
Procured from sawmill residuals			402,529 BDT	51%
Procured from in-woods			381,497 BDT	49%

Net availability was calculated by subtracting the total practically available biomass estimates from the amount currently being utilized. The remainder will be forest based biomass under little competition from existing facilities in the region and can support a new business opportunity for utilization. There is a grand total of 409,646 BDT available for new wood utilization markets based on current and existing capacity within the region to operate. It is important to note that the amount

of utilized "in-woods" biomass is less than the "sustainable procurement" estimate. However, the reality of providing an outlet to inflated sources on an ad-hoc basis suggests that there is varying availability in both the sustainable and inflated sources. Furthermore, due to sawmill residues being the lowest cost procurement source for many biomass utilization facilities, the estimated 144,282 BDT net availability may be a high estimate. As such, caution is advised when interpreting these results.

Procurement Source	Practically available feedstock Totals	Biomass Utilized	Net available
In-woods	620,960	356,117	264,843
Reliable	418,922		
Inflated	159,055		
Sawmill residue	519,175	374,893	144,282
GRAND TOTALS	**1,140,135**	**730,489**	**409,646**

4. How much biomass will be generated based on desired treatment levels in the RSA?

This section of the report has been delayed. The California Resources Agency, Department of Conservation (DOC), and USGS 3DEP recently invested in a large, comprehensive acquisition of quality L1 lidar data in the region, which was collected in 2022. Together with existing QL2 lidar data, the region has a unique opportunity to conduct a precise inventory of biomass and meaningfully inform forest-level project bid packages as well as the Market Capacity Assessment. The 2022 lidar data are currently being processed and quality controlled, and the RCD's partnership with University of Washington and 34 North will continue to coordinate with public agencies for permission to conduct the forest structure and biomass estimation. As the DOC and USGS release the final lidar data, the RCD will immediately process these products to produce a forest structure condition assessment and update the biomass assessment, as needed. This analysis will be sure to include tree growth when projecting treatments into the future. The estimated timeframe to complete the terrestrial condition assessment is slated for the end of 2023.

5. Limitations and Considerations

It is expected that this document will help inform and support ongoing efforts to expand market availability for biomass utilization in order to address the region's community and ecological resilience goals. However, this report may not be suitable as a substitute for feedstock availability assessments required by new biomass utilization business plans. There are a number of aspects that this report fails to address that would be important for a new facility to understand. Rather, this report is most useful to inform efforts to initiate a quasi-public institutional arrangement to aggregate feedstock and lower risk for feedstock procurement contracts. The following are a few limitations to consider:

- **No economic considerations**. This report's goal is to look at the current fiber flow within the region given the current market conditions. As such it does not take into account the amount of biomass that could be available given more favorable economics. There is a reasonable assumption that siting new biomass outlets would provide an increase in biomass availability due to the reduction of haul distances and subsequent haul costs. However, this type of analysis requires a different methodology that was not within the

scope of the project and is more appropriate on a case-by-case basis. Additionally, economic considerations to biomass availability have already been completed for all BioRAM facilities through the High Hazard Fuels Availability Study (MB&G, The Beck Group, 2019). Some economic considerations will be included in Tasks 4, 5, and 6 of the OPR project.

- **Market competition for biomass.** Competing demand for biomass was not fully analyzed in this report. Many reports (including this one) have shown that there is little concern regarding the total quantity of biomass supply throughout the state. Nevertheless, the location of the end-user, economics of removal, and access to the material are aspects of market competition that are particularly difficult to quantify for a region as a whole. The dynamics of an ever-changing landscape coupled with the strong relationships between various actors along the supply chain create forecasting competitive prices difficult. Instead, this report uses a simple "net-availability" approach to define how much biomass is produced on an annual basis but not utilized by end-users. However, while this number is quantifiable, the location of the excess biomass is much more difficult to identify and not within the scope of this report.
- **Estimates on how much will be procured in the future has not been completed.** With the exception of standing dead salvage estimates, research focused mostly on the 10-year recorded history of harvest activity. The numbers contained in the report identify the expected availability per year, but there may be more made available over the next decade due to political and funding support. Similarly, this report does not included biomass from PGE distribution lines, Caltrans roadside vegetation clearing, or improved access to small private landowners. With the acquisition of QL2 Lidar data, the team will be better equipped to estimate future biomass and support better forecasting.
- **Workforce capacity and housing availability.** Anecdotally, workforce capacity (especially hauling) is regarded as one of the largest constraints to reach state and regional goals for community and ecological resilience. While economics is also regarded as a critical lever to biomass utilization, the results found in this report may be inferred as a workforce constraint as much as it is an economic constraint. In other words, if the economics were more favorable, there would be more people willing to work in the sector. However, as stakeholder meetings revealed, housing availability and associated city amenities are limited in these rural regions. This discourages a potentially willing workforce from accepting positions in regions with a strong promise for biomass utilization opportunities, thus linking market capacity back to workforce constraints rather than economics.
- **BioRAM program may end in 2025.** Over the next few years BioRAM—one of the most effective programs to support forest-based biomass utilization—may end. Unless the legislature approves an extension, the loss of this program may redirect a considerable amount of demand for forest-based biomass from participating facilities. This could simultaneously reduce competition demand for forest-based biomass resources as well as potentially strand more biomass out in the woods due to the loss of a subsidized program which targets high hazard fuels. It is hard to know how this will impact the market, but if the program is not continued it will certainly have some impact.