

FEASIBILITY STUDY FOR A VALUE-ADDED WOOD PRODUCTS CAMPUS WITHIN THE CENTRAL SIERRA REGION OF CALIFORNIA

Prepared for:

MARIPOSA COUNTY



RESOURCE
CONSERVATION DISTRICT

Prepared by:



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INTRODUCTION

The Mariposa County Resource Conservation District (RCD) is working closely with the Governor's Office of Planning and Research to implement the Woody Feedstock Aggregation Pilot Program within the Central Sierra Region of California. The pilot program will be an opportunity for significant innovation in the natural resources manufacturing industry and forestry management sector in California by spearheading a regional approach with a Joint Powers Authority (JPA) between Alpine, Amador, Tuolumne, Calaveras and Mariposa counties. The project will encourage development of small enterprises where innovative forestry businesses focused on forest fuels reduction and forest restoration can develop and thrive.

The project and associated deliverables address how forest restoration, climate adaptation, and stakeholder engagement can arise from delivering forest biomass to businesses, all while promoting community stability, fire resilience and enhancement of public safety.

The Mariposa RCD has retained TSS Consultants (TSS) to conduct several tasks in support of this project. In March 2023, TSS delivered a feedstock supply availability and cost analysis report and in June 2023, delivered a workforce and feedstock supply chain review. This current investigation is focused on delivering results of a feasibility study for a value-added wood products campus within the five-county pilot area and provides recommendations regarding next steps.

ANALYSIS OBJECTIVES

Summarized below is the task that TSS implemented in support of this analysis.

- Task 5a.** Utilize findings from the feedstock supply availability and cost analysis to conduct a feasibility study for a value-added product yard located within the CSSA. First step is site review to create a short list of production yard candidate sites.
- Task 5b.** Working with local stakeholders, conduct a value-added opportunity analysis that aligns with feedstock type and volume to optimize value-added use. A matrix of value-added opportunities will be created and vetted by stakeholders.
- Task 5c.** Up to four value-added opportunities (as selected by stakeholders) will be analyzed with a focus on near-term (two to five year) enterprise deployment.

Key metrics to be addressed in the analysis include:

- Minimum volume and type of woody biomass feedstock(s) required for an appropriately scaled (sustainable) value-added activity.
- Delivered cost (at candidate site) for each feedstock by type.

- Processing and support equipment required and onsite infrastructure required to support it.
- Capital cost of equipment.
- Permits required for a value-added activity at the candidate site.
- Onsite resources required (e.g., energy, water) and projected cost of these resources.
- All-in cost forecast for value-added products at the candidate site delivered to local, regional and external markets.
- Local, regional, and external market pricing for value-added product, including potential revenue estimates.
- Local market competition for production of similar products.
- Direct employment (by type) created in the local market area.
- Potential partnering opportunities with strategic firms (equity partners).
- Potential grant funding opportunities to support start-up expenses for value-added product yard enterprises.

Task 5d. Utilizing findings from tasks 5a through 5c, prepare a feasibility study report for a value-added wood yard. TSS will work closely with the RCD and partners to coordinate financial analysis.

CENTRAL SIERRA NEVADA REGION

As noted above, the study area for this analysis is the Central Sierra Nevada region including Alpine, Amador, Tuolumne, Calaveras, and Mariposa counties. This is a large region that includes just over 3.9 million acres and approximately 161,672 residents.¹ In order to characterize the forest restoration workforce, there needs to be a clear understanding of the Central Sierra Study Area (SA), including vegetation/land cover, wildfire history and land ownership/objectives.

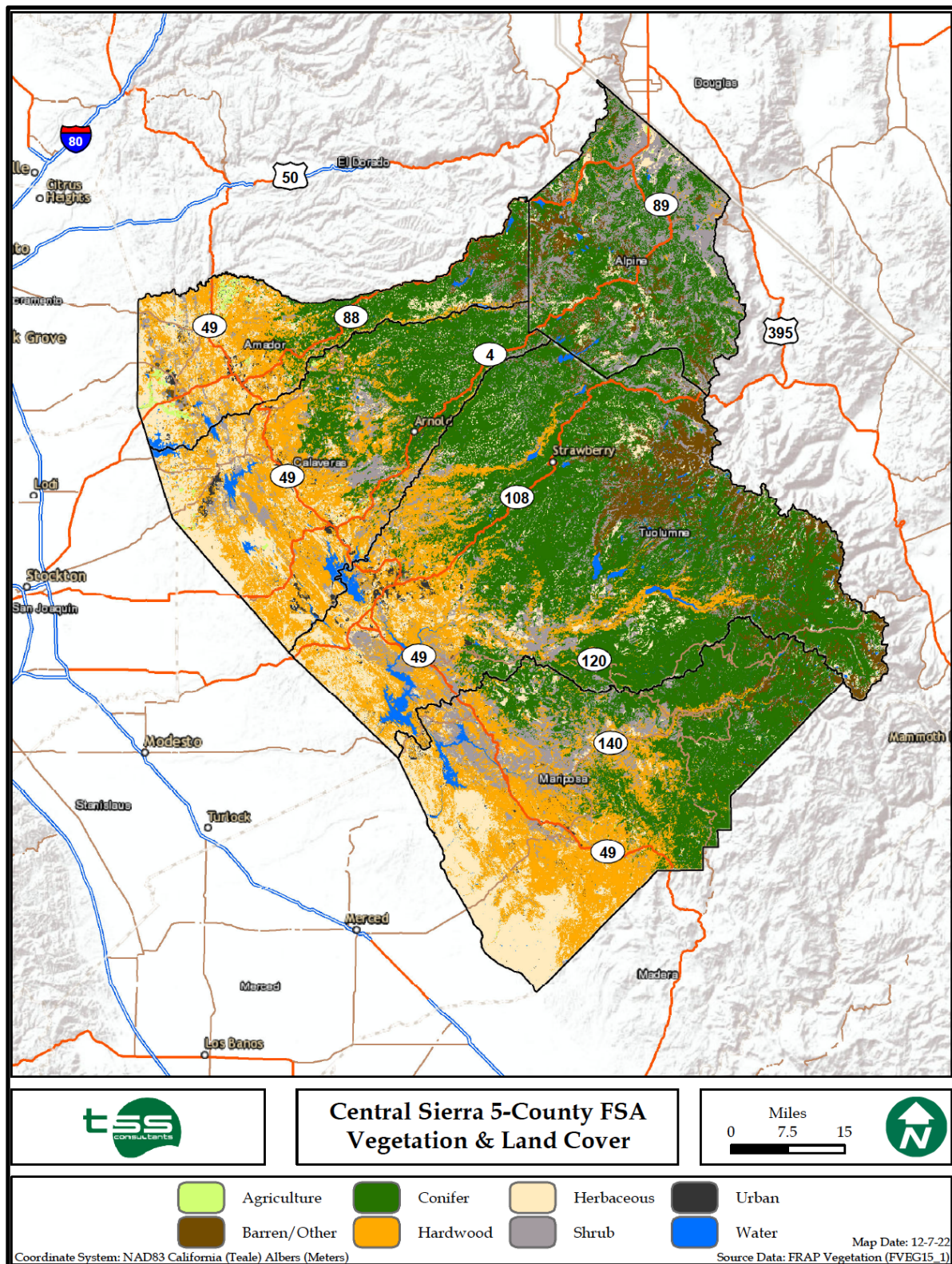
Vegetation and Land Cover

Using geographic information system (GIS) data maintained by Cal Fire,² TSS conducted an analysis of vegetation cover and land use within the SA. Figure 1 is a map highlighting vegetation and land cover by type within the SA.

¹ US Census Bureau, 2021 data.

² Cal Fire, Fire and Resource Assessment Program.

Figure 1. Vegetation and Land Cover Types Within the SA



Outlined in Table 1 is a summary of vegetation and cover acreage by type.

Table 1. Vegetation and Land Cover Acreage Within the SA

| Vegetation and Land Cover | Five-County SA | |
|---------------------------|------------------|-------------|
| | Acres | Percent |
| Agriculture | 14,027 | <1% |
| Barren/Other | 231,877 | 6% |
| Conifer (forestland) | 1,558,803 | 40% |
| Hardwood (woodland) | 908,590 | 23% |
| Herbaceous | 576,211 | 15% |
| Shrub | 514,268 | 13% |
| Urban | 39,425 | 1% |
| Water | 74,395 | 2% |
| Total | 3,917,596 | 100% |

Forestland

Note that the SA includes approximately 3,917,596 acres total, of which the most significant vegetation cover type is conifer dominated forestland at 1,558,803 acres (making up about 40% of the SA). Historically, forestland has provided sustainable volumes of sawtimber and woody biomass for commercial enterprises located within and tributary to the SA.

Woodland

The second most significant vegetation cover type is hardwood dominated woodland. At 908,590 acres, woodland makes up 23% of the SA. Relatively little of the vegetation cover found on woodland acreage is actively managed. TSS experience in the region confirms that some woodland acreage is managed as rangeland for commercial cattle operations. In addition, some hardwood firewood is harvested, but there are no sustained commercial removal operations.

Agriculture

The commercial agriculture sector is very well developed in the San Joaquin Valley. Orchards, row crops, and livestock operations are active in this region. Ready access to commercial orchard removals was a primary reason for development of several biomass power plants³ within this region.

Wildfire

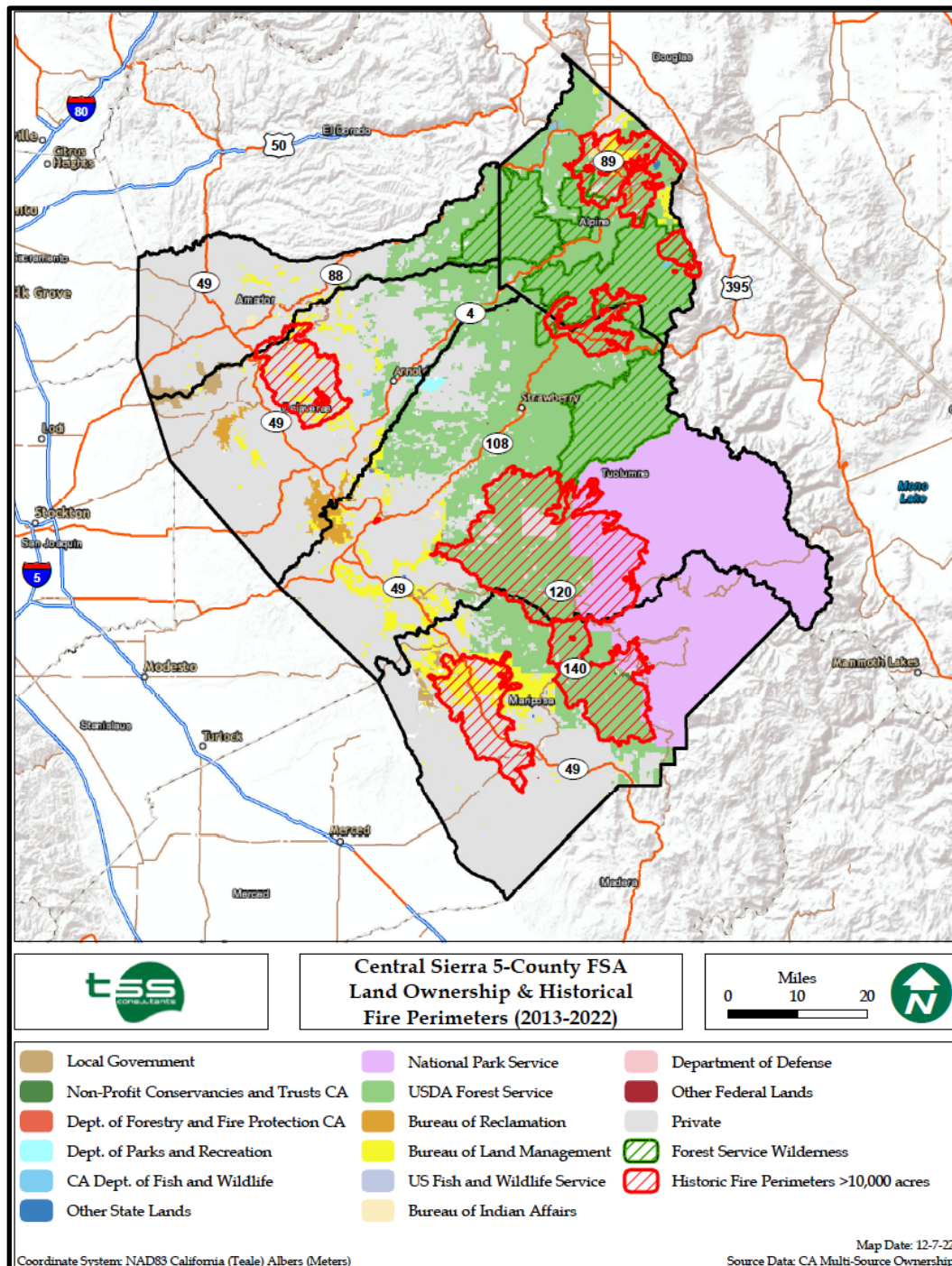
Wildfire activity in the last decade has been extreme, with over 625,000 acres within the SA impacted (see Table 2). The response from state and federal policy makers has been to significantly increase targeted funding⁴ to support more proactive vegetation management in the coming years, which should increase acres treated and the volume of forest material removed.

³ DTE Stockton, Tracy Biomass, Pacific Ultrapower Chinese Station.

⁴ Federal: Bipartisan Infrastructure Law, Inflation Reduction Act, Replant Act. State: Climate Change Initiative.

Figure 2 is a map highlighting recent wildfire events within the SA.

Figure 2. 2013 to 2022 Wildfire History Within the SA



Summarized in Table 2 are the wildfires shown in Figure 2. Note that only fires over 10,000 acres are shown.

Table 2. Historic Wildfires Within the SA 2013-2022

| Wildfire | Year | Acres Impacted |
|-----------------|---------------------------|-----------------------|
| Rim | 2013 | 256,176 |
| Butte | 2015 | 70,847 |
| Washington | 2015 | 17,915 |
| Detwiler | 2017 | 81,826 |
| Donnell | 2018 | 36,461 |
| Ferguson | 2018 | 96,831 |
| Slink | 2020 | 12,783 |
| Tamarack | 2021 | 52,269 |
| | Total | 625,108 |
| | Average Acres/Year | 62,511 |

Clearly, there is significant wildfire activity within the SA. While there will likely be an opportunity to conduct post-fire restoration activities (as a result of ongoing wildfire events), there is also the risk of these wildfire events damaging the productive capacity of forestland (e.g., impacts to soil) to grow wood fiber within the SA.

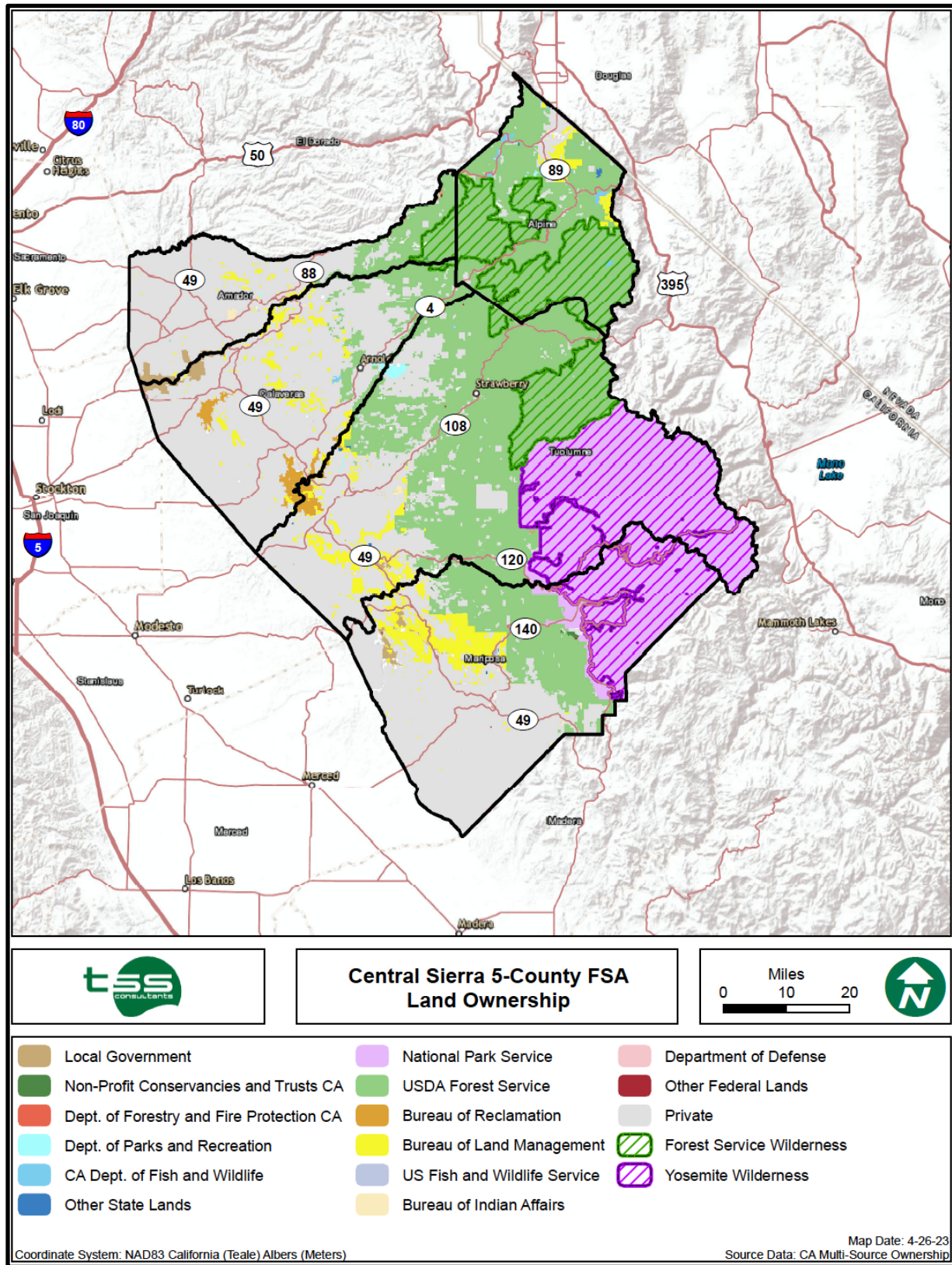
Land Ownership

Land ownership within the SA includes forestland managed by various public agencies (e.g., USDA Forest Service, Bureau of Land Management, National Park Service) as well as private landowners (industrial and non-industrial).

Small non-industrial ownership (typically family owned) and industrial (e.g., Sierra Pacific Industries) make up most of the private forestland ownership within the SA. Non-industrial forest owners are typically families managing for various resources, including the production of sawlogs as a long-term revenue source. Industrial forest owners are focused on active forestland management, including sawtimber output and fuels reduction activities (to protect timber assets).

TSS utilized GIS shape files from the State of California database to conduct land ownership analysis. Figure 3 incorporates this data to highlight land ownership within the SA.

Figure 3. Land Ownership within the SA



WOOD PRODUCTS CAMPUS FEASIBILITY

In the geographical center of the SA is Tuolumne County, the site of several existing or planned wood utilization facilities. Sierra Pacific Industries' two sawmills are here, as are Pacific Ultrapower (electric generation facility) and other facilities⁵ currently under construction that intend to utilize small diameter material and timber harvest residuals from the surrounding forestlands. In order to optimize facility location relative to available forest feedstocks, TSS looked toward the northern and southern end of the SA.

Wood Yard Campus Candidate Site Location

TSS utilized a number of key siting attributes when considering the range of siting location candidate sites within the SA including:

- Ready access to forest feedstock supply. Preferably a blend of forestland ownerships (public, private) located within a 75-mile radius.
- Transportation system access.
- Community support.
- Existing and potential feedstock competition.
- Current land use zoning and property ownership.

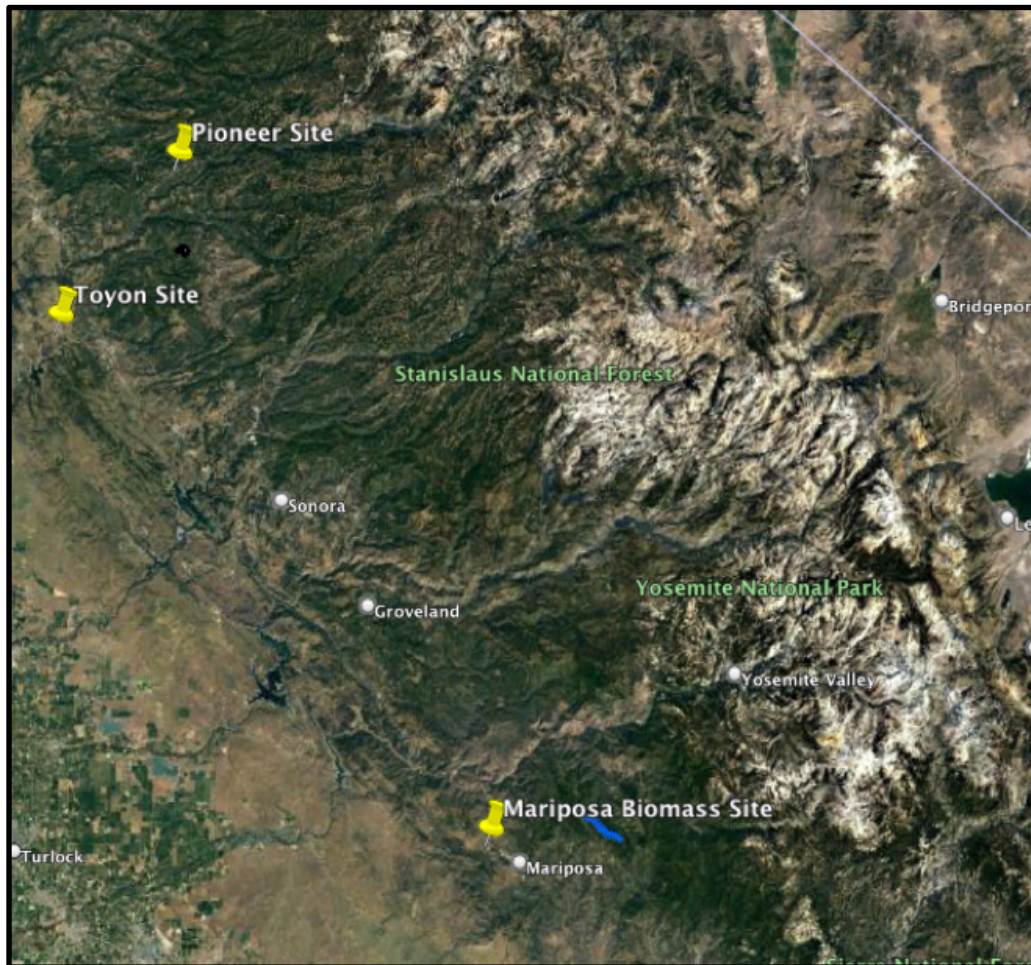
TSS settled on three candidate sites, listed in ranked (optimal to less optimal) order:

- Toyon Industrial Site near Valley Springs. Former sawmill site.
- Former P&M Cedar sawmill site in Pioneer.
- Mariposa Biomass site in Mariposa.

Figure 4 shows the locations of the three sites within the SA. On the southern end of the SA, a facility in Mariposa would be well situated to receive woody material from the Sierra National Forest, Yosemite National Park, and the Central Valley agricultural sector. The northern options in the SA are well placed to be supplied by the Stanislaus, Eldorado and Humboldt-Toiyabe National Forests, as well as the extensive private forestland in the region.

⁵ Heartwood Biomass, Tuolumne Wood Pellet Facility.

Figure 4. Candidate Site Locations



VALUE-ADDED UTILIZATION OPPORTUNITIES CONSIDERED

A range of value-added utilization options for typically under-utilized forest biomass from forest thinning and/or restoration activities are potentially viable within the Central Sierra region. Table 3 is a value-added utilization matrix that was developed jointly by TSS and the University of California Cooperative Extension.⁶

⁶Gareth Mayhead, Academic Coordinator, Forest Products, provided assistance in the development of the value-added matrix.

Table 3. Value-Added Opportunities Matrix

| Process or Product | Development Status | Feedstock Specifications | Jobs (FTE) Low High | | Main Equipment | Market Potential | Comments |
|--------------------------|-----------------------|---|------------------------|----|---|--|---|
| Wood fuel pellets | Commercially deployed | Clean, dry (<10% mc) chip, needs to be <1% ash. | 8 | 40 | Pellet mill, dryer, cooler, hammermill, packaging. | Residential and commercial users, animal bedding, potential for thermal heating and niche barbeque pellets. | Use of biomass from forest possible (e.g., small logs or chips low in bark) - key issue and expense is drying system for the feedstock. Gaining market share for domestic stoves is dependent upon propane and natural gas pricing. |
| Fuel bricks | Commercially deployed | Chip, dry (<15% mc), needles, bark okay. | 3 | 6 | Brick machine, dryer, cooler, hammermill, packaging. | Substitute as firewood for residential or commercial facilities. | Use of biomass from forest possible (e.g., small logs or chips low in bark) - key issue and expense is feedstock drying system. |
| Fire logs | Commercially deployed | Clean, dry (<10% mc) chip, needs to be <1% ash. | 3 | 9 | Log machine, dryer, cooler, hammermill, packaging. | Substitute as firewood for residential or commercial facilities. | Use of biomass from forest possible (e.g., small logs or chips low in bark) - key issue and expense is feedstock drying system. |
| Decorative bark | Commercially deployed | Small roundwood that is easily debarked. Raw bark from sawmills is common feedstock source. | 2 | 6 | Typically sourced as byproduct from sawmill operation. Screening equipment. | High value in urban areas. Deco bark market can be seasonal. Spring and summer is typically peak demand period. Sold bulk and/or bagged. | As sawmill residuals become scarce, value of bark for landscape cover increases. Alternative use is hog fuel. |
| Decorative chip | Commercially deployed | Bark free and sized (no fines) wood chip. | 2 | 6 | Debarker (flail, ring or rosser head), screen (trommel or flat). | Colorized landscape cover sold in bulk and/or bagged. | Colored landscape cover requires additional equipment (colorizer). Feedstock is bark free chip |

Table 3. continued

| Process or Product | Development Status | Feedstock Specifications | Jobs (FTE) Low High | | Main Equipment | Market Potential | Comments |
|---------------------------------|-----------------------|--|------------------------|----|--|--|--|
| Hog Fuel | Commercially deployed | Woody biomass chipped to 3"minus, 50% mc, 3% ash. | 2 | 3 | Log loader and chipper. Walking floor trailer or chip van to deliver hog fuel to market. | Biomass power generation facilities. | Biomass power markets are mature and likely to continue considering current power purchase agreements. |
| Firewood | Commercially deployed | Roundwood (hardwood is preferred) logs that can be processed using automated firewood processor. | 2 | 8 | Log splitter or firewood processor. | Could be marketed to urban centers or campgrounds in boxes or bundles. Hardwood worth more. Higher prices for firewood near to affluent urban areas. | Numerous firewood contractors already in place. Some large contractors have significant market share. |
| Post and pole | Commercially deployed | Straight, low taper softwood (lodgepole, ponderosa, white fir) is preferred. | 5 | 15 | Rosser head peeler and/or doweller. Sorting line. Bucking saw. | Sold to treating facilities. Market treated posts for landscape timbers, vineyards (used to suspend vine wires) fences, furniture. | Need to treat - nearest facility is in Riverbank, CA. |
| Small-scale sawmill | Commercially deployed | Medium to large size roundwood. | 2 | 10 | Debarker, head rig, resaw, edger. | May need to target specialty markets to secure optimal value for products. | Tough to compete with large-scale sawmills for logs and lumber sales. Niche markets for lumber is important. Most lumber is low-value commodity product. |
| Lumber kiln | Commercially deployed | Lumber products or firewood. | 1 | 2 | Kiln (steam or dehumidifier). | Kiln dried lumber has added value in the market place. Transport of dried lumber products is more cost effective (due to lower weight). | Could also dry firewood or heat treat lumber and packaging to meet ISPM15. Could use waste wood as a fuel source. |
| Biochar (Slow pyrolysis) | Commercially deployed | Wood pieces (flexible spec). | 2 | 4 | Biochar kiln. | Soil amendment, activated carbon (water filtration). | Very few biochar production facilities deployed. Most biochar is currently sourced from existing biomass power plants. |

Table 3. continued

| Process or Product | Development Status | Feedstock Specifications | Jobs (FTE) Low High | | Main Equipment | Market Potential | Comments |
|---|-----------------------|---|------------------------|---|---|---|---|
| Mild pyrolysis (torrefaction) | Pilot projects/R&D | Wood pieces (spec is vendor specific). | 0 | 0 | Reaction unit. | Co-firing in coal power plants (no modifications required to coal handling systems) or as fuel supplement for biomass power plants. | Torrefied fuel could be highly marketable due to BTU/pound and impervious to water. Coal is a key solid fuel in the marketplace and tends to set the price point. |
| Compost | Commercially deployed | Green waste (tree trimmings/grass clippings) is optimal. | 2 | 6 | Grinder, screen and windrow turner. | Soil amendment market is seasonal. Compost and mulch operations work best on same site. Typically sold in bulk or bagged. | There may be opportunities to source green waste from transfer stations and landfills. Operation could take in biochar as a compost blend. |
| Mulch | Commercially deployed | Green waste (tree trimmings/grass clippings) are optimal. | 2 | 6 | Grinder and screen. | Soil amendment market is seasonal. Compost and mulch operations work best on same site. | Very similar to compost operation. In fact, compost/mulch operations typically share the same site. |
| Chip for pulp/paper or composite panel furnish | Commercially deployed | Woody biomass chipped to 3"minus, 50% mc, bark free with few fines. | 3 | 6 | Debarking equipment (e.g., chain flail) chipper and screen. | No pulp/paper or composite panel facilities currently operating in CA. One composite panel is in development at Marysville (West Forest, LLC) | Currently very limited markets (no pulp mills or composite panel operations) in CA. Chip export market is volatile. |
| Animal bedding (shavings) | Commercially deployed | Small roundwood (ponderosa pine preferred). | 2 | 6 | Shaver, screens, drying, packaging. | Can be sold in bulk and/or in bales or bags. | One commercial operation within the region (American Wood Fiber at Keystone). |

TSS utilized the Value-Added Opportunities Matrix to conduct outreach to SA stakeholders for a discussion regarding which of the opportunities best aligned with the local community. When querying local contractors involved in forestry services (including loggers and tree service businesses), a clear thread emerged: these businesses handle steady volumes of timber, some of which they sell to the local sawmill, but inevitably they end up with decks of logs sitting in their

own yards. Without fail, every owner either expressed desire to add a sawmill operation or a firewood processor to utilize excess roundwood.⁷

VALUE-ADDED OPPORTUNITIES SELECTION

As a result of TSS and stakeholder analysis, four value-added opportunities were selected for more detailed investigation. These included:

- Post and pole processing
- Firewood processing
- Small-scale sawmill
- Biomass fiber to local markets

VALUE-ADDED OPPORTUNITIES ANALYSIS

Post and Pole Processing

The production of small diameter posts and poles, used extensively in the agricultural industry for products such as fence posts and vineyard stakes, appeared to be an attractive, value-added opportunity. However, conversations with major suppliers of these products to agricultural clients revealed some potential downside.

The preferred species for posts and poles is currently lodgepole pine (*pinus contorta*), a species of the Pacific Northwest and interior mountain states and a major commercial timber type. In the Central Sierra Nevada region, lodgepole pine is a high elevation species and as such its availability throughout the year is significantly limited due to seasonal access. While there is evidence to suggest that large tracts of higher elevation forest (particularly within the Stanislaus and Eldorado National Forests) will be targeted for thinning treatments over the coming decade, there is not a reliable commercial supply of lodgepole pine in the SA at this time. Further discussions with the USDA's Wood Products Innovation and Business Development team⁸ confirmed there have been attempts to create post and pole businesses utilizing available softwood species in Central California. These enterprises proved to be financially unsustainable for a variety of reasons, including the fact that there is a well-established and competitive supply from commercial producers within the Pacific Northwest.

Despite the above information, at the time of this report there is a facility being built in Jamestown (Tuolumne County) by Heartwood Biomass (an Oregon-based company) that plans to develop Tuolumne Biomass LLC as an enterprise producing post and poles for the agricultural market. We hope that Heartwood Biomass is successful; however, our findings have determined the post/pole market to be too competitive to recommend another post and pole facility in the Central Sierra region.

⁷ See Appendix A for list of contractors contacted.

⁸ Per Larry Swan, USDA Wood Innovations and Business Development team.

Firewood Processing

There are well-developed local and regional firewood markets that a commercial-scale firewood processing facility within the SA could cost effectively serve. The capital cost associated with a firewood processing operation is manageable and return on equity calculations are favorable. Key drivers for success include raw material expense (cost of firewood logs) and the market value for firewood sold into local and regional markets. There may be an opportunity to sell packaged firewood (bundled and palletized) into regional and external markets. This will require a well-defined and targeted marketing plan and additional packaging equipment.

Firewood production enterprises interviewed for this study indicated that hardwood species logs including live oak, black oak, and madrone are removed on a regular basis during commercial sawlog harvest activities and during forest restoration/timber stand improvement activities. If a local market for hardwood logs were available and priced competitively to address the costs of removal and transport and provide a reasonable return to the landowner, then a ready supply of hardwood logs could be available.

Softwood logs that could be available for firewood production are prevalent within the SA. Diseased or insect-impacted softwood species logs including ponderosa pine, white fir, red fir, Douglas fir, and incense cedar that do not meet sawlog specifications (due to blue stain, rot) could be available for firewood. In addition, traditionally non-commercial softwood species such as foothill pine and higher elevation lodgepole pine could also be available.

Current commercial markets for firewood logs are located some distance from the SA (e.g., Placerville, Oroville). Prices offered for firewood logs delivered to these locations range from \$900 per truckload for softwood logs and from \$1100 to \$1200 per truckload for hardwood logs. Figure 6 is the Model M1820 Cord King firewood processor.

Figure 5. Cord King Model M1820 Firewood Processor



Base Case Scenario Financial Analysis

TSS conducted a financial feasibility analysis to determine the viability of a commercial-scale firewood processing operation using the Cord King processor. Delivered firewood log prices were based on locally available logs priced competitively (hardwood logs at \$900/truckload and softwood logs at \$720/truckload). Firewood sales assumed hardwood firewood at \$350/cord and softwood firewood at \$250/cord picked up at the wood yard. In order to maintain year-round cash flow (firewood sales typically peak during fall and winter months), sales to a large regional commercial firewood retailer are optional and were not built into the analysis. Assumptions built into this analysis included an industry-standard internal rate of return (IRR) of at least 17% (after taxes).

Summarized below are base case scenario assumptions used when conducting the financial analysis for a small commercial-scale firewood processing operation.

- Minimum 17% IRR (after taxes).
- \$71,694 for Cord King Processor M1820, producing 2.5 cords/hour.
- \$110,000 Rolling stock (log loader, skid steer, flatbed truck) to be shared 50/50 with sawmill operation.
- \$60,000 self-loading box truck (facilitate delivery of firewood logs and sawlogs) to be shared 50/50 with sawmill operation.
- \$25,000 for dry kiln to be shared 50/50 with sawmill operation.
- \$247,262/year labor cost (approximately five full-time equivalent employees, 2 @ \$40/hr, 2 @ \$35/hr, 1 @ \$55/hr) for 120 days/year at 40 hours per week.
- \$19,300/year (insurance, legal, utilities) to be shared 50/50 with sawmill operation.
- \$1,200/year land lease cost to be shared 50/50 with sawmill operation.
- \$4,380/year portable office and restroom rental to be shared 50/50 with sawmill operation; \$13,522/year other operating costs (miscellaneous supplies).
- \$20,538/year propane and diesel.
- 10-year accelerated tax depreciation schedule.
- 20-year debt service (amortization period).
- 5% interest rate on debt.
- 50% debt/50% equity in year one.
- 1%/year escalation for firewood logs, labor costs and firewood sales.
- \$900/truckload for hardwood logs.
- 9 cords processed per truckload of hardwood logs.
- \$720/truckload for softwood logs.
- 9 cords processed per truckload of softwood logs.
- 16 cords processed per eight-hour day.
- 1,920 cords processed annually (120 processing days).
- 15% shrinkage of firewood (lost in the drying process).
- 1,632 cords sold into local markets (288 cords lost to shrinkage).
- Product output is approximately 66% softwood, 34% hardwood firewood.
- Product sales is 97% bulk and 3% packaged.
- Average hardwood firewood sales realization is \$350/cord bulk.

- Average softwood firewood sales realization is \$250/cord bulk and \$660/cord packaged.

Using these assumptions results in a first-year positive cash flow (after expenses) of \$35,225. This scenario represents the “Base Case.”

Variables such as the cost of firewood logs will affect the rate of return on processed firewood. As noted earlier, log buyers at commercial firewood facilities outside the SA are paying \$900 per log truck load of softwood logs delivered. However, these facilities are too far to the north of the SA to be competitive with trucking costs. Additionally, the other local market for softwood logs (e.g., American Wood Fibers at Jamestown) that do not meet specifications for sawtimber currently pays within close to the same range, \$800-\$960 for delivered logs. This facility is located in Tuolumne County and therefore a wood yard sited on the north or south end of the SA could successfully acquire softwood log deliveries at a lower price point based on a more strategic location to the upland forests from which the logs are sourced, thus mitigating transport costs. A price point of \$700-\$800 per truckload would be considered competitive for softwood logs into a firewood production yard located in the northern part of the SA.

For base-case analysis, TSS assumes a delivered cost of \$720 per truckload for softwood logs and \$900 per truckload for hardwood logs. It is anticipated that local logging contractors will deliver logs to the wood yard at these competitive rates. Note that deliveries of softwood logs using the box truck are forecast (base case) to provide an additional 320 cords of delivered firewood logs annually. Due to regional tree mortality trends and continued powerline hazard tree removals, there is significant opportunity to use the box truck to pick up logs (as a service) that are not marketable to larger sawmills (e.g., SPI Standard) in the area.

Financial Sensitivity Analysis

TSS conducted a financial sensitivity analysis with firewood log pricing and grant funding as key variables. Table 4 summarizes findings.

Table 4. Sensitivity Analysis – Firewood Log Pricing and Grant Funding

| Cash Grant for Capital Expenses | <u>Log Expense (\$/Load)</u> | | Year One Cash Flow After Expenses | Internal Rate of Return (IRR) |
|--|-------------------------------------|----------------------|--|--|
| | Hardwood Logs | Softwood Logs | | |
| \$0 (Base Case) | \$900 | \$720 | \$35,225 | 25% |
| \$0 | \$800 | \$650 | \$43,234 | 31% |
| \$0 | \$1,000 | \$850 | \$23,241 | 14% |
| \$100,000 | \$900 | \$720 | \$38,141 | 43% |
| \$250,000 | \$900 | \$720 | \$42,516 | 224% |

TSS also conducted financial sensitivity analysis with firewood sales pricing and grant funding as key variables. Table 5 summarizes findings.

Table 5. Sensitivity Analysis – Firewood Sales Pricing and Grant Funding

| Cash Grant for Capital Expenses | Bulk Firewood Sales Softwood (\$/Cord) | Packaged Firewood Sales Softwood (\$/Cord) | Bulk Firewood Sales Hardwood (\$/Cord) | Year One Cash Flow After Expenses | Internal Rate of Return (IRR) |
|--|---|---|---|--|--------------------------------------|
| \$0 (Base Case) | \$250 | \$660 | \$350 | \$35,225 | 25% |
| \$0 | \$300 | \$1,000 | \$400 | \$108,548 | 79% |
| \$0 | \$200 | \$850 | \$300 | \$22,623 | 13% |
| \$100,000 | \$250 | \$943 | \$350 | \$70,564 | 79% |
| \$250,000 | \$250 | \$943 | \$350 | \$74,938 | 383% |

Firewood Sales – Bulk

Revenue generated from firewood sales fall into two categories:

- Local bulk sales.
- Regional bundled sales.

Local sales of hardwood and softwood firewood are focused on sales to customers within a 60-mile radius of the wood yard, and it is common practice in the area to offer delivery service as an added value. Rural homeowners are a primary customer for firewood delivered by the cord. Demand from this customer base is very price sensitive, so it will be imperative that the market price is set at a competitive rate that will attract (and hopefully keep) customers long term. Demand from the rural homeowners is also dependent upon weather conditions. The colder the winter, the more demand there will be for home heating and thus for firewood. Softwood firewood currently sells for \$250/cord delivered and hardwood for \$375/cord delivered to the customer.

The cabin rental market is also an important potential customer base, as the SA's proximity to winter recreation destinations (Kirkwood, Bear Valley, Dodge Ridge) ensures a robust winter tourism economy. TSS spoke with real estate management companies within the SA whose common practice is to require that at a minimum, the rental houses they manage stock a cord of firewood for each location. The average price for this service is \$450 per delivered cord.

Firewood Sales – Bundled

Bundled firewood throughout the region is offered at retail outlets by the packaged cubic foot for an average of \$8/cubic foot. Assuming a 30% mark-up at retail, bundles wholesale for \$5.50 delivered to the retail outlet (e.g., local grocery store, campground). Regional bundled firewood sales are targeting retail firewood customers (typically small to medium-sized retailers) located 61 to 150 miles from the wood yard.

There are large-scale firewood retailers (e.g., California Hot Wood, Inc., Cal Oak, Inc.) in northern California that have packaging facilities which supply processed and cured firewood to large retailers such as Home Depot, Walmart, and Lowes. It is possible to compete with these economies

of scale with a clever marketing plan and value proposition but for the purposes of this report, it's recommended the focus be on small to medium size retailers in the region where it might be easier to establish personal relationships.

There will be opportunities to market bundled firewood (one cubic foot package) into the regional and external markets in locations like Yosemite Park, state parks in the Lake Tahoe area, and local grocery stores. Significant investment in targeted marketing and outreach would have to occur for local and regional packaged firewood sales to be successful. Capital investment in bundling equipment and pallets (all bundled firewood is sold on pallets) would be required. Once the enterprise is operating efficiently and the bulk local and regional markets are served, a concerted effort to craft a marketing plan for sales of bundled firewood should be considered.

Access to drying kilns will be helpful, as commercial firewood is required to have less than 20% moisture. The financial analysis for the firewood processing facility includes the capital cost as well as operating and maintenance costs of a propane-fired kiln for drying firewood.

Outdoor storage of firewood inventory is important so that a ready supply of dry, market-ready firewood is constantly in inventory. If packaged firewood is considered, then covered storage of the palletized packaged firewood will be necessary.

Small-Scale Sawmill

The product yard will have ready access to sawlogs generated within the SA. Strategically located between large-scale commercial sawmills, the wood yard has a transport cost advantage that will allow the facility to source sawlogs at cost effective prices. Sawmill operations revenue is a function of local lumber sales. Lumber sales will depend on competitive pricing of finished product, both rough green lumber and dry finished lumber. There may be an opportunity to develop a secondary manufacturing product line, though secondary manufacturing will require additional processing equipment (and capital investment). A marketing plan should be considered to address lumber sales and secondary manufacturing sales opportunities. Due to the highly competitive regional lumber markets, the sawmill product marketing plan should target local sales and specialty products for the regional market.

A small sawmill collocated at the product yard would be a strategic addition to the firewood operation, as some of the firewood logs will no doubt meet sawlog specifications. The sawmill and firewood operation will be able to share rolling stock, such as a log loader and forklift. A log loader will be needed to off-load logs delivered to the yard, store the logs, and remove the logs from storage for processing into firewood or lumber. The forklift will facilitate movement of firewood baskets (metal boxes capable of holding 1/2 cord firewood), firewood pallets (if producing firewood bundles), and units of lumber. Personnel can also be cross-trained and shared in the production of firewood or lumber, thus assisting with increased production should either operation require additional hours of production or if employees are sick.

As noted earlier in this report, the SA is a region with an active forest management sector, one that has produced around 109,000 MBF of sawlogs annually for the last five years.⁹ Discussions with a local sawmill operator confirmed that about 5 MBF per day of sawlogs are required to sustain a small-scale mill. This equates to about one to one and one-half truckloads of sawlogs per day. Forecast over a one-year operation (assuming 120 days milling per year), the sawmill would require about 500 MBF.

With the product yard site located strategically between the commercial-scale forest products sawmills located in Lincoln (to the north) and Standard (to the south), the product yard should be able to cost effectively source sawlogs to support a small sawmill.

Lumber Dry Kiln

The sale of dry lumber allows sawmill operators to provide a blend of finished lumber products to their customers. Some sawmills are strategically located in relatively dry, windy climates that facilitate air drying of lumber. Air drying also requires large expanses of flat land to store the finished lumber as it dries. The SA region's climate will accommodate the air drying of lumber, and this will require a large flat area of several acres.

A lumber kiln will be needed to produce dry lumber. Once dried, the lumber can be sold dry rough or planed and sold as a dry finished product. For the purposes of this analysis, a propane fired lumber kiln capable of drying up to 8 MBF per charge was assumed to be installed at the wood yard. Propane (liquid petroleum gas) is a preferred fuel due to its predictable and easily managed heating properties. In addition, a lumber planer was included in the capital cost assumptions. The planer will facilitate surfacing of dried lumber for value-added products such as interior paneling, exterior siding or for use in custom wood boxes.

Base Case Scenario Financial Analysis

TSS conducted a financial feasibility analysis to determine the viability of a small-scale sawmill operation using a model LT40 Super Hydraulic Wood-Mizer.¹⁰ Delivered sawlog prices were based on locally available logs priced competitively (pine and fir sawlogs at \$400 and incense cedar logs at \$500/MBF) delivered to the product yard. Lumber sales realization assumed pine and fir boards at an average sale price of \$1,000 per MBF (lumber tally) for a blend of rough green and dry finished lumber (sold at the yard). Incense cedar boards are more valued in the marketplace and are forecast to have an average lumber sales realization of \$2,000 per MBF (lumber tally) for a blend of rough green and dry finished lumber (also sold at the yard).

In order to maintain year-round cash flow, it will be important to maintain lumber inventory and operate the sawmill 120 days per year (about 5.5 months/year). The dry kiln will also need to operate at least on a 10 months/year basis in coordination with the sawmill and firewood operations. About half of the lumber produced and sold will be dried and planed. Assumptions built into this

⁹ California Department of Tax and Fee Administration.

¹⁰ As suggested by local sawmill operator.

analysis included an industry standard IRR of at least 17%. Figure 7 is an image of the Wood-Mizer Model LT40.

Figure 6. Wood-Mizer Sawmill Model LT40



Summarized below are base case assumptions used when conducting the financial analysis for a small commercial scale sawmill operation.

- Minimum 17% IRR (after taxes).
- \$68,145 Sawmill (Wood-Mizer LT40 Super Hydraulic diesel powered).
- \$110,000 Rolling stock (log loader, skid steer, flatbed truck) to be shared 50/50 with firewood operation.
- \$60,000 self-loading box truck (facilitate delivery of firewood logs and sawlogs) to be shared 50/50 with firewood operation.
- \$25,000 for dry kiln to be shared 50/50 with firewood operation.
- \$247,262/year labor cost (approximately five full-time equivalent employees, 2 @ \$40/hr, 2@ \$35/hr, 1@\$55/hr) for 120 days/year at 40 hours per week.
- \$19,300/year (insurance, legal, utilities) to be shared 50/50 with firewood operation.
- \$1,200/year land lease cost to be shared 50/50 with firewood operation.
- \$4,380/year portable office and restroom rental to be shared 50/50 with firewood operation.
- \$8,110/year maintenance cost.
- \$4,500 every 10 years maintenance cost for sawmill engine overhaul.
- \$18,000 base rock surface (site improvement) to be shared 50/50 with firewood operation.
- \$20,538/year diesel and propane costs.
- 10-year accelerated tax depreciation schedule.
- 20-year debt service (amortization period).
- 5% interest rate on debt.

- 50% debt/50% equity in year one.
- 1%/year escalation for sawlogs, labor costs and lumber sales.
- \$400 MBF for ponderosa pine, white fir and Doug fir sawlogs.
- \$500/MBF for incense cedar sawlogs.
- 1.25:1 lumber over-run factor.
- 3 MBF lumber produced per eight-hour day.
- 360 MBF lumber produced annually (120 milling days/year).
- 180 MBF rough green lumber and 180 MBF dry finished lumber sold into local and regional markets.
- Local prices for lumber sold averages \$1/ board foot for White Fir and Ponderosa Pine and \$1.75/board foot for Incense Cedar.

Using these assumptions results in a first-year positive cash flow (after expenses) of \$219,299 and an IRR of 159%. This scenario is entitled “Base Case.”

Financial Sensitivity Analysis

TSS conducted a financial sensitivity analysis with sawlog pricing and grant funding as key variables. Table 6 summarizes findings.

Table 6. Sensitivity Analysis – Sawlog Pricing and Grant Funding

| Cash Grant for Capital Expenses | <u>Log Expense (\$/Load)</u> | | Year One Cash Flow After Expenses | Internal Rate of Return (IRR) |
|--|-------------------------------------|---------------------------|--|--------------------------------------|
| | Pine and Fir Logs | Incense Cedar Logs | | |
| \$0 (Base Case) | \$400 | \$500 | \$219,299 | 159% |
| \$0 | \$350 | \$450 | \$220,983 | 160% |
| \$0 | \$500 | \$600 | \$215,929 | 157% |
| \$100,000 | \$400 | \$500 | \$222,215 | 246% |
| \$250,000 | \$400 | \$500 | \$226,589 | 1,266% |

TSS also conducted financial sensitivity analysis with lumber sales pricing and grant funding as key variables. Table 7 summarizes findings.

Table 7. Sensitivity Analysis – Lumber Sales Pricing and Grant Funding

| Cash Grant for Capital Expenses | Pine and Fir Lumber (\$/BdFt) | Incense Cedar Lumber (\$/BdFt) | Year One Cash Flow After Expenses | Internal Rate of Return (IRR) |
|--|--------------------------------------|---------------------------------------|--|--------------------------------------|
| \$0 (Base Case) | \$1 | \$1.75 | \$219,299 | 159% |
| \$0 | \$.75 | \$1.50 | \$149,099 | 109% |
| \$0 | \$1.25 | \$2.50 | \$345,659 | 248% |
| \$100,000 | \$1 | \$2 | \$250,295 | 276% |
| \$250,000 | \$1 | \$2 | \$254,669 | 1,421% |

Lumber Sales

Lumber sales opportunities are based on production of three primary product lines:

- Rough green lumber: ponderosa pine, white fir, and Doug fir.
- Rough green lumber: incense cedar.
- Dry finished lumber: ponderosa pine.

Rough green lumber is a product that is available for sale with no secondary processing (e.g., surfacing or drying). Examples of end uses for rough green lumber include corral boards and outdoor structures (e.g., storage sheds, hen houses, barns). Rough green incense cedar lumber has additional value due to the insect and decay resistant qualities that facilitate use in outdoor siding, decking, and raised planting beds. Discussions with local sawmill operators indicate that there is significant demand for incense cedar lumber at a current average price of \$1.75 per board foot.

Dry finished ponderosa pine lumber is a product that has been air dried or kiln dried and then surfaced using a planer. Typically sold as one-inch thick boards at an average of \$1 per board foot, this lumber has a variety of uses, including indoor paneling, shelving, or for value-added utilization secondary manufacturing such as wood boxes. Ponderosa pine lumber is the preferred species for these end uses due to ease of manufacturing and visual appearance.

Due to regional competition for lumber products, both rough green and dry finished lumber will likely be sold locally (0 to 60 mile radius). Regional (61 to 150 mile radius) competition is significant due to industrial-scale forest product producers and lumber retailers that have economies of scale that allow them to be the low-cost producers. As the low-cost producers, they are able to market lumber products at relatively low prices.

Biomass Fiber to Local Markets

Local commercial energy markets for biomass fiber are limited to existing biomass power generation facilities. The Pacific Ultrapower biomass power facility at Jamestown and DTE Energy biomass power facility in Stockton will be the closest to the wood yard and should be considered as potential long-term customers. If a wood yard were sited on the northern end of the SA (Amador, Calaveras, or western Alpine County) then Woodland Biomass in Woodland becomes a viable option for wood waste delivery.

Pacific Landscape Supply in Vernalis accepts wood waste mulch and has steady demand for cedar bark. Their facility is located within 100 miles from any of the three potential product yard sites reviewed for this study and they are accepting new suppliers. Conversations with other product yard operators in the Central and Northern Sierra Nevada also indicate potential in smaller local markets, selling mulch and ground sawmill residuals directly to landscaping companies.¹¹

¹¹ Per discussions with Rich Taeger, Woodyard Placerville.

Table 8. Woody Biomass Markets

| MARKETS | RAW MATERIAL | COMMENTS |
|----------------------------|---|---|
| Landscape Cover | Bark, chips | Limited local markets. |
| Compost and Soil Amendment | Tree trimmings, logyard waste, sawdust | Limited local markets. |
| Animal Bedding | Softwood logs | American Wood Fibers at Jamestown is procuring softwood logs (no incense cedar) up to 42” diameter. |
| Firewood | Softwood and hardwood logs | Woodyard Placerville and California Hot Wood at Oroville are actively purchasing firewood logs. |
| Biomass Feedstock | Forest-sourced biomass, urban wood waste, agricultural byproducts | Closest biomass plants include Pacific Ultrapower in Chinese Camp and DTE Biomass in Stockton. |

WOOD CAMPUS SYNERGIES

Based on the equipment and capital investment required to produce commercial-scale firewood and milled lumber (even on a small scale as is this study’s focus), the best approach is to share resources on a wood campus to maximize value-added production. In addition, siting this campus within economic transport distance of a facility that can utilize biomass wood waste, whether as a landscaping product or as an energy fuel source, will significantly reduce transportation costs to move woody biomass residuals to market.

Vertical Integration

Given what we know about the current state of the forest restoration economy and the level of commitment to reducing hazardous fuel loading in the forest, stewardship contracting (primarily on National Forests) will be a dominant force in the next 10-20 years. This presents an opportunity for in-woods service providers who are already engaged in harvesting smaller diameter sawlogs and hazard trees to vertically integrate their operations into a wood yard business. Under this scenario, the wood yard could potentially have a steady supply of smaller diameter trees (down to 8” DBH) at a relatively low cost to deliver to the wood yard and could leverage existing equipment and employees. Contractors could then have control over how much and which species of timber to deliver to their value-added utilization wood yard and which to deliver to other commercial log purchasers.

Shared Labor and Equipment

Sharing the labor and equipment resources in a mixed-use wood yard will be an essential ingredient to financial sustainability. Assuming four employees are cross-trained on the use of all the equipment – firewood processor, sawmill, front-loader, skid steer – both operations can be run in tandem. Two employees can be processing firewood while two move logs onto the mill and into the

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TSS Consultants

dry kiln. Alternatively, two can remain in the wood yard either milling or processing firewood while two employees handle firewood or lumber deliveries.

Potential to Operate Year-Round

The relatively mild winter climate at lower elevations of the Sierra Nevada foothills opens the opportunity to operate a wood yard business year-round. This report assumes a 10.5 month operating window, allowing for some down time during inclement weather and vacation time. The cost estimates (as noted above) factor in all portable equipment, rental office trailer, and shipping container for the dry kiln. A business owner may wish to explore the possibility with the local planning department of installing a prefabricated metal warehouse to allow for full operations during wet weather.

Permitting Considerations

Some permits are already covered under existing zoning and approved uses for each site. The list summarized in Table 9 should be consulted when considering which types of permits may be required. Requirements may change based on site ownership and/or changes to Counties' General Plan.

Table 9. County Permits for Wood Yard

| PERMIT TYPE | LEAD ENTITY |
|--------------------------------------|--|
| Road Encroachment | County Public Works Department |
| Grading Permit | County Public Works Department |
| Building or Establishing Structures | County Planning Department |
| Air Pollution | County Environmental Management Department |
| Water Quality / Pollution Discharge | County Environmental Management Department |
| California Environmental Quality Act | County Environmental Management Department |

OTHER CONSIDERATIONS

Local Competition for Similar Products

Tuolumne Biomass, LLC, a local subsidiary of Heartwood Biomass, plans to sell bundled firewood into regional retail markets. The Tuolumne County facility is currently under construction but their product – kiln dried softwood supplied by their existing wood yard in eastern Oregon – is for sale at local retailers in 0.7 cubic foot packages.

Two commercial sawmills in the area operate under the ownership of Sierra Pacific Industries, both in Tuolumne County. One mill in Chinese Camp specializes in incense cedar fencing lumber, while the mill in Standard processes mixed species including Doug fir, incense cedar, white fir, sugar and ponderosa pine into framing materials, heavy timbers, and by-products such as biomass for energy production.

Direct Employment

The product yard site will initially employ 5 to 7 people, including yard manager, assistant manager, and operators for loaders, sawmill and/or firewood processors, with the potential to bring on additional operators and drivers as needed. Full-time firewood businesses that were reviewed for this report typically employ 10 or more people so it's anticipated as both sides of the product yard business grow, the need for more employees will also increase. The business should be able to operate at a scaled-down level of 5 employees with opportunities to scale up as sales increase.

RAISING CAPITAL

Financing and Business Support

In many cases, processing equipment manufacturers have access to financing entities. For example, Wood-Mizer has a partnership with Geneva Capital to provide financing for new Wood-Mizer equipment. Options are available for all types of credit, with flexible terms, including same day loans and 100% financing. Finance offers and interest rates change quarterly.¹²

The SA counties' Economic Development (ED) offices are part of a regional support network¹³ that offer a range of helpful resources for the entrepreneur, including access to programs with the Northern California Small Business Development Center¹⁴ and the US Small Business Administration.¹⁵ In addition to free advisory services on funding and expanding small businesses, these organizations and the county ED offices will have information on revolving loan options specifically for rural wood products and utilization enterprises.

Blue Forest Conservation has an innovative finance model that leverages private capital to fund both forestry services and wood products utilization facilities. Among their funding programs, Blue Forest Asset Management would be the most appropriate for supporting a small-scale wood products business. However, they are generally targeting those businesses that seek at least \$1M in capital in order to be attractive to their investors. Prospective entrepreneurs can take advantage of Blue Forest's Advisory Services,¹⁶ which are offered at no cost and underwritten by grants from the USDA Wood Innovation program (see below) and the USDA Innovative Finance for National Forests.

A Joint Powers Authority (JPA) is a collaborative of public agencies that is currently being proposed within the SA as a vehicle to help manage the large volumes of biomass and small diameter timber slated for removal from the region's National Forest lands and non-industrial forestland ownerships.¹⁷ It is anticipated that a JPA would be comprised of entities spanning all counties within the SA and would also be able to provide stability in securing long-term contracts for forest material to downstream utilization facilities. JPAs can also provide a suite of funded services to

¹² <https://woodmizer.com/us/Financing>

¹³ <https://www.csedd.org/>

¹⁴ <https://www.sierrasbdc.com>

¹⁵ <https://www.sba.gov/>

¹⁶ <https://www.blueforest.org/advisory-consulting>

¹⁷ *Executive Summary for Entities Options*, CLERE, Inc. 2024.

small businesses, including advising and consulting, business plan creation and financial modeling. It is also proposed that a JPA could potentially own forest products manufacturing infrastructure as well as equipment to be leased to forestry and forest products businesses.

GRANT FUNDING OPTIONS

Wood Products and Bioenergy Business and Workforce Development Program

Cal Fire has a competitive grant program for small businesses to expand their capacity to serve the forestry sector, called the Wood Products and Bioenergy Business and Workforce Development Program.¹⁸ Depending on available state funding, this program accepts applications on a quarterly basis. Currently there is between \$5 and \$7.5 million available each quarter. Eligible applicants include academic institutions; local, state and federal agencies; Tribes; non-profits; as well as businesses and other private entities. Business development projects that provide in-woods services such as wood processing, chip production, logging and fuels treatments are eligible for these grants, as are those projects looking to develop new bioenergy facilities that use forest biomass as a feedstock. Among the priority projects eligible for funding are those that focus on trucking, as transportation costs are one of the biggest hurdles to removing biomass material from the woods to utilization facilities.

Grant funds can be used to purchase new equipment, but all business development funds require a matching dollar amount from the applicant. The match can be in-kind goods and services, additional financing from another source, existing assets and equipment owned by the business, or a combination of all these. One potential challenge with this grant funding is that it is paid out through reimbursements, which requires smaller organizations to secure lines of credit to finance the work for six to nine months up front.

Workforce Development criteria is focused on providing training opportunities that will help bolster the state's workforce capacity in the forestry sector and forestry sector support services. Qualifying projects include those that can provide ongoing training and education to unique cohorts of individuals in typically underserved communities.

USDA Community Wood Energy and Wood Innovation Program

This USFS sponsored program is an annual competitive grant program that supports early phase development of community wood energy projects or innovative wood product production facilities. It is open to local, state, and tribal governments as well as businesses, non-profits, higher education institutions, and special purpose districts. The program's mission is to both stimulate local economies and find beneficial uses for forest byproducts, such as woody biomass. Priorities for funding include retrofitting or upgrading a sawmill facility in communities with high unemployment, supporting communities that are historically underserved or marginalized, and supporting areas where forest restoration is needed.

¹⁸ <https://fire.ca.gov/what-we-do/natural-resource-management/environmental-protection-program/wood-products-and-bioenergy>

APPENDIX A. List of Contacts/Interviewees

Special acknowledgements to the following for their assistance in compiling this report.

| Person(s) Contacted | Affiliation |
|----------------------------|--|
| Luke Carpenter | Blue Forest Asset Management |
| Rich Taeger | Woodyard Placerville |
| Travis Neel | California Hotwood |
| Greg Cook | GC Wood Products |
| Michelle Mullanix | Far West Forest Products / Woodmizer Sales |
| Serge Rolling | Cord King Firewood Processors |
| Brian Finigan | Ace Tree Service |
| Terry Poston | Poston Logging |
| Preston Leslie | Leslie Heavy Haul (logging and trucking) |
| Nate Gray Sr. | Nates Tree Service |
| Chris Rinauro | Proper Pruning Tree Service |
| Richard Tanner | Tanner Logging |
| Kathy Gallino | Central Sierra Economic Development |
| Joel Barnett | Bear Valley Real Estate |
| Carrie Shinn | Cedar Creek Realty |
| Paul Feriani | Calaveras County Integrated Waste Management |
| Larry Rieger | Sierra Resources (commercial landowner) |
| Steven J. Daus | Environmental Consultant (CEQA) |
| ACCG Meeting Attendees | Amador Calaveras Consensus Group (presentation at monthly meeting November 2023) |
| Brian Roller | Roller Trucking (rock and haul rates for surfacing wood yard) |
| Larry Swan | USDA Wood Innovations Team |
| Helena Murray | USDA Wood Innovations Team Lead |
| Justin Britton | Cal Fire Business and Workforce Development Grants |