

Biomass Offtake Opportunities and Logistics

**Prepared for
California Department
of
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About this Report

This report summarizes existing and future forest products markets within California to help focus efforts of marketing, planning and policy making to optimize available forest-derived biomass. The report offers present and future opportunities to support the goal for the U.S. Forest Service and the State of California to collectively treat a minimum of one million acres annually year by 2025 (*million-acre strategy*), with the need to support, develop, expand, and promote California's forest product industry vertically with holistic resource planning.

Lignum Support LLC

Lignum is a natural resources company operating in the biomass feedstock and wood supply space. They support development; operations and execution; and future planning at the local, regional, and national levels to promote sustainable and reliable biomass feedstocks derived from forest, agricultural, and urban sources.

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Executive Summary

California has some of the most productive forestland and natural resources in North America. However, because of chronic drought conditions and lack of science-based resource management, the forestlands of California have been impacted by large-scale wildfires. Wildfire cleanup activities generate large volumes of sawlogs and wood fiber that often exceed existing traditional forest product markets. To date, only limited areas have been cleaned up by salvage operations due in part to lack of mill capacities and market demand. There is a critical need for additional market capacity to utilize wood products generated from wildfire recovery operations, as well as California's million-acre strategy to improve forest health and wildfire resilience. The purpose of this document is to identify existing and potential offtake opportunities to utilize the volumes of wood fiber available from wildfire cleanup and forest health and wildfire resilience projects in California in the coming years.

The U.S. Forest Service and the State of California have a shared goal to treat one million acres per year to improve forest health and promote wildfire resilience. This effort will have a positive impact on forest health productivity, while reducing the severity and likelihood of future wildfires and associated impacts (e.g., loss of property, emissions, landslides). The shared goal is a major step forward in protecting California's forests by bringing science-based forest management back into the natural resource planning policy.

The development and expansion of wood products markets are key components to accomplishing the million-acre strategy. Supporting existing regionalized markets and developing additional markets that utilize forest-derived wood fiber that have not been available to date will create potential incentives for private investment into local communities and provide future jobs for these regions.

Introduction

In California, millions of acres of timber and wildland have burned recently. Post-fire cleanup activities including powerline clearing, roadside hazard tree removal, and forest recovery operations are generating large volumes of wood fiber.

California has a goal to annually treat one million acres of private, State, and federal forestlands to improve forest health and promote wildfire resilience. During the intended treatments, wood fiber will be generated above what has been typically



photo credit Lignum Support

available for the present forest products industry in California. The goal of this report is to provide a high-level description and summary of existing and potential future wood fiber markets and the associated logistics to help realize the market potential for California.

To fully realize the million-acre strategy, forest products markets must be established, and biomass utilization capacity must be scaled to match the planned treatments, ensuring each can succeed simultaneously. Today, California's forest products markets are in sync with previous decades of available fiber supply from mostly private forestlands, but recent wildfires have changed this balance significantly. The demand side must adjust accordingly. Now is an exciting time for natural resource management in California, both from an on-the-ground aspect as well as from a wood products and marketing viewpoint.

Both CAL FIRE and the U.S. Forest Service are promoting development of new markets in the space utilizing grant programs. New growth in California for forest products will positively affect the health and fire resiliency of California forests.

Current Wood Products and Associated Markets

Planned forest health, wildfire prevention, and wildfire cleanup efforts produce diverse wood products. Some of the higher volume product types sourced from forest management projects have been categorized into a summary for reporting, discussion, and future planning purposes.

Sawlogs – defined sections of a tree at a market-defined length deemed suitable for production into lumber or lumber products sellable in defined markets at specified grades.

Wildfire cleanup activities and forest health projects produce high volumes of sawlogs of varying quality. The minimum specification for a sawlog, per U.S. Forest Service rules, is a log that is at least 8 feet 6 inches in length, with at least a 6-inch small-end diameter, and that is at least 25 percent merchantable. During wildfire salvage activities, most logs from burned trees exceed these specifications in both length and diameter. The quality of logs from burned timber is highly variable depending upon the severity of the fire and the time that has elapsed between the fire and the salvage logging. Logs produced from burned timber generally have a three-to-five-year shelf life for utilization as lumber, after this period the fiber is generally only usable for biomass (see *Cull/Utility Logs*, *Pulp Logs*, *Biomass* below) or wood fiber projects. Generally, low quality logs are produced from wildfire cleanup efforts around residences and along power utility lines. The species mix within the recent wildfire areas in California include ponderosa pine, Douglas fir, white fir, and incense cedar. At higher elevations Jeffrey pine and lodgepole are present.

Veneer Logs – Used to produce thin sheets of wood that are produced by peeling or slicing logs with specialized equipment.

Rotary peeled veneer is used to manufacture plywood by laminating several sheets of veneer into a wood panel. Rotary veneer is also used as an overlay that is applied to medium density fiber (MDF) and particle board. Currently there are only two veneer mills in California, one in Weed and one in Yreka. There are no plywood plants in California at present. Current demand for plywood in the U.S. is strong and plywood plants purchase veneer from producers to maximize their production facilities. Oregon is a major producer of plywood and both a current and potential market for veneer logs and or veneer sheets produced in California.

Veneer sheets may be sold as a green product or after drying. The advantage to producing green veneer is that it is a simple product that may be shipped the same day it is produced. A by-product of the production of rotary peeled veneer are cores, the round log centers that remain after a log is peeled. Cores are often used to make posts and tree or shrub stakes for landscaping, vineyards, orchards, and urban tree planting.

Cull/Utility Logs, Pulp Logs, and Biomass – defined as sections of a tree not meeting sawlog specifications, and can be log length, shorts, chunks, chips, or ground material. Generally, any logs which are not at least 25 percent merchantable per U.S. Forest Service log scaling rules.

Common products produced from cull/utility logs:

1. Clean Chips – chips produced for making of paper products or MDF board, require debarking (removal of bark in full prior to chipping) of cull logs and screening of the wood chips after production to remove fines and contaminants prior to delivery to market;
2. Processed Biomass Fuel for Power Generation – can be wood chips or ground wood produced to specifications that meet a power generation plant’s requirement. Branches, log trims, chunks are commonly converted into processed biomass;
3. Animal Bedding Products;
4. Wood Pellets- both industrial and residential;
5. Landscape Project Mulch – wood chips or ground wood produced to meet the size specification of a landscaping project. This also includes Caltrans highway mulching projects;
6. Nursery/Greenhouse Applications, Soil Amendments, Wood fines, etc.– Can be chipped or ground wood to meet the specifications desired by individual nurseries or soil amendment companies such as Scotts Miracle Gro, Kelloggs Garden, or localized nursery growers in the designated region;
7. Wood Chips for Landscape Mulch- Produced to specifications needed for coloring and then bagged for residential landscaping supplies at commercial retailers (e.g., Lowes, Home Depot) or similar market segment. This market segment utilizes a high volume of sawmill residuals (biomass chips) for coloring; however, the seasonality of demand presents challenges.

Cull or utility Logs make up the largest volume of non-merchantable fiber recovered from salvage and forest health and wildfire resilience activities in California. At-scale, utilization of this product class plays a vital role in supporting forest health and wildfire mitigation activities. There is currently a critical need to expand capacity in this market segment.

Available Markets and Associated Logistics

Wood Product - Sawlogs for Grade Lumber Production

Grade log markets have been limited in California since the 1990s, primarily due to the lack of volume coming from U.S. Forest Service lands since that time. As such, sawmill capacity has decreased and adjusted to suite the log supply that can be met with harvests from private forest lands. As a result, California log markets are in equilibrium with annual localized sustainable harvest and struggle to process the increasing volume from recent wildfire cleanup programs. The additional inputs of fire-recovered log volumes continue to exceed local log market capacity, resulting in foregone financial and forest health opportunity.

Log trucks remain the standard mode of transportation for logs to current California markets. In the past, California, like much of the country, had extensive rail systems for transport of forest products. However, as rail lines were abandoned with the closure of manufacturing facilities over the years, log transport converted to trucking. Today, this creates challenges in moving logs from the forests where they were harvested to facilities where they can be processed or transloaded, such as the ports of Sacramento, Stockton, Eureka, and Coos Bay, OR. There may be opportunities to revisit rail transport of logs, but this would require extensive renewed infrastructure investment.

Table 1 provides a list of California sawmills in operation today. Small, local, community sawmills have not been listed but are important to the local communities and forest industry.



Shorter length logs (10- to 20-foot lengths) are common with wildfire salvage and are less preferred by regional sawmills due to the increased handling needed per log to process into lumber.



Smaller diameter logs (less than 16-inch diameter) are also not preferred by regional sawmills as general rule. Fire salvage and fuels treatment projects will produce large volumes of small-diameter logs.

Table 1. California sawmills

Name	Location	Preferred Species
Agwood Mill & Lumber	Ukiah, CA	redwood, Douglas fir, incense cedar
Arcata Forest Products	Arcata, CA	Douglas fir, redwood, hemlock, pine, spruce
Big Creek Lumber	Davenport, CA	redwood
Collins Pine	Chester, CA	white fir, Douglas fir, ponderosa pine, sugar pine, incense-cedar
Humboldt Redwood	Scotia, CA	redwood, Douglas fir, incense cedar
Mendocino Forest Products	Ukiah, CA	redwood, Douglas fir, incense cedar
Northfork Lumber	Korbel, CA	Douglas fir, redwood, hemlock, pine, spruce
Redwood Empire	Cloverdale, CA	redwood, Douglas fir, incense cedar
Schmidbauer Lumber	Eureka, CA	Douglas fir, redwood, hemlock, pine, spruce
Shasta Green	Burney, CA	white fir, Douglas fir, ponderosa pine, sugar pine
Sierra Forest Products	Terra Bella, CA	white fir, ponderosa pine, sugar pine, incense cedar
Sierra Pacific Industries	Anderson, CA	white-fir, Douglas fir, ponderosa pine, sugar pine, incense cedar
Sierra Pacific Industries	Burney, CA	white fir, Douglas fir, ponderosa pine, sugar pine
Sierra Pacific Industries	Shasta Lake, CA	white fir, Douglas fir, ponderosa pine, sugar pine, incense-cedar
Sierra Pacific Industries	Lincoln, CA	white-fir, Douglas fir, ponderosa pine, sugar pine, incense-cedar
Sierra Pacific Industries	Quincy, CA	white fir, Douglas fir, ponderosa pine, sugar pine, incense cedar
Sierra Pacific Industries	Sonora, CA	white fir, Douglas fir, ponderosa pine, sugar Pine, incense-cedar
Sierra Pacific Industries	Oroville, CA	Incense cedar
Sierra Pacific Industries	Chinese Camp, CA	Incense cedar, white woods
Sierra Valley Enterprises	Loyalton, CA	ponderosa pine
Trinity River Lumber	Weaverville, CA	Douglas fir, white fir, hemlock
Trinity River Lumber	Oroville, CA log yard	Douglas fir, white fir, hemlock
Willits Redwood	Willits, CA	redwood

Sawlog markets may be available outside of California to support log marketing and utilization. However, to ship logs from one state to another (or internationally) several considerations must be addressed:

- **Invasive pest and/or disease transport limitations.** Several states and countries limit species and wood transport due to invasive pests that may come along with the logs. In some cases, products must be chemically fumigated before transport.
- **Negative effects on local and regional forest landowners and raw material suppliers at destination.** Out-of-region wood products displace local businesses at destination and create unintended negative effect on the local markets.
- **Destination equipment setup/configuration.** Mills receiving products must be equipped to handle logs in terms of species, length, diameter, and grade. There must also be a market readily available for the finished goods being produced.

Even considering these possible logistical and market challenges, shipping sawlogs and wood chips to other domestic regions outside of California is a possible future market. Section 4 of this paper provides further discussion of options.

China, Korea, Japan Export logs have been a reliable market for many years in California; however, Title 16 of U.S. Code section 620a restricts the export of unprocessed timber originating from federal lands¹. Thus, timber originating from federal lands requires primary processing of the logs into secondary products (e.g., lumber, wood pellets, wood chips, biomass) prior to export. Log yards in the San Francisco Bay Area and Sacramento ship non-federal logs from the Port of Oakland via containers (Table 2). Another log export facility in Eureka serves the northern coastal region markets by shipping via vessels. Several small yards have also been developed around the San Francisco Bay that are shipping logs via containers. Recent changes to China’s fumigation and pricing strategies have caused a slowdown in these markets.

Table 2. Export log operations

Name	Owner	Location	Product
West Sacramento Log Yard	American Tongren Log Export	Port of Sacramento	Mixed conifer by container
Eureka Log Export	Eureka Forest Products, Inc	Port of Eureka	Mixed conifer by vessel

¹ [16 USC 620a: Restrictions on exports of unprocessed timber originating from Federal lands \(house.gov\)](https://www.congress.gov/116/plaws/pub/16/116-plaws-pub-16-2019.html)

Wood Product Markets – Veneer Logs

Veneer logs are purchased according to the specifications for each consuming mill. Typical log specifications define species, diameter, length, and allowable defects (knots, sweep, rot, etc.). All veneer logs are transported to mills by truck. The completed veneer sheets are transported to plywood mills in Oregon via rail and truck. Rail infrastructure exists in the northern California making rail transport possible for secondary wood products to other Pacific Northwest (PNW) markets.

Presently there are two veneer mills in California (Table 3); however, this product class could likely see expansion with the increase in California wildfire mitigation forest management practices.

Table 3. Veneer mills in California

Name	Location	Product
Roseburg Forest Products	Weed, CA	Douglas fir, white fir, ponderosa pine
Timber Products	Yreka, CA	Douglas fir, white fir, ponderosa pine

Wood Product Markets– Cull and Utility Logs, Pulp Logs, Chunks, Topwood, Logging Waste, Precommercial Thinning

This product class represents the largest volume of forest products that can be produced in California from a holistic viewpoint, especially under the million-acre strategy. It is difficult to estimate how much market potential exists given current market capacity. This product class presents significant market challenges, but also provides many opportunities when considering alternative transportation (e.g., rail, barge) to diverse domestic and international markets. More critically, this product class encompasses the full operational value chain in terms of the forest management practices that are needed to recover forestland areas that have been burned, allowing silvicultural treatments to improve the health and wildfire resilience to remaining intact forests.

Wood Product Markets - Biomass for Power and Energy Generation

The largest market for woody biomass in California is currently biomass power generation. Future woody biomass markets may grow to include liquid and gaseous fuels. California has long been a U.S. market leader in the production of renewable energy from woody biomass. Presently in California there are power plants designated to utilize high hazard fuels and wildfire salvage biomass as the fuel source (i.e. BioRAM and BioMAT) that benefit from subsidized power purchase agreements (PPAs). However, designated power plants cannot be

the only outlet for high hazard fuels or wildfire salvage biomass. Any of California’s biomass power plants presently in operation can also utilize woody biomass (Appendix A). Table 4 lists California’s current biomass power plants with a nameplate capacity greater than 10MW. Unless co-located with a sawmill, wood fiber is transported to the consuming plants via truck from regional forest operations, fire salvage, and sawmill operations.



Traditional forest derived fuels from forest wildfire and forest resiliency projects

Table 4. Biomass power plants in operation with a capacity greater than 10MW

Name	Location	Capacity MW/Grid
Burney Forest Products	Burney, CA	31.2/29
Chowchilla II Biomass Power	Chowchilla, CA	12.5/10
DTE Stockton Biomass Power	Stockton, CA	50/45
DTE Woodland Biomass Power	Woodland, CA	28/24
Greenleaf Desert View Power	Mecca, CA	47/44
Honey Lake Power	Wendel, CA	32/24
Humboldt Redwood Company	Scotia, CA	25
Merced Power	El Nido, CA	12.5/
Mt Poso Cogeneration	Bakersfield, CA	45/44
Pacific-Ultrapower Chinese Station	Jamestown, CA	22/18
Rio Bravo Fresno Biomass Power	Fresno, CA	28.7/24.3
Rio Bravo Rocklin Biomass Power	Rocklin, CA	27.3/24.4
Roseburg Forest Products	Weed, CA	15
Sierra Pacific Burney Biomass Power	Burney, CA	20/12
Sierra Pacific Lincoln Biomass Power	Lincoln, CA	19.2/11
Sierra Pacific Quincy Biomass Power	Quincy	27.5/16
Sustainable Resource Management	Anderson, CA	54.9/34

Wood Facility Database, Woody Biomass Utilization Group. The University of California Agricultural and Natural Resources. Retrieved from http://www.ucanr.edu/sites/WoodyBiomass/California_Biomass_Power_Plants/

There are also opportunities for further utilization of biomass fiber for international export, which has grown significantly within the last few years. At present, export markets in California are limited by the lack of seaport infrastructure for loading vessels and barges. Export markets represent a growing opportunity for this product class as renewable energy gains market share on a global scale. However, further development of existing port infrastructure will be needed at the ports of Sacramento and Stockton to increase vessel loading capability. For example, Stockton can currently load vessels, but operations are limited due to lack of storage capacity at the Port. Table 5 lists biomass and wood chip export facilities serving California.

Table 5. Biomass and wood chip export facilities serving California

Name	Location	Type
Roseburg Forest Products	Coos Bay, OR	Bulk Vessel
Green Diamond Chip Dock	Eureka, CA	Bulk Vessel
ML Commodities	Port of Stockton	Vessel & Barge loading
Lignum Support	Port of Oakland & Long Beach	Container

Wood Product Markets - Wood Chips

There are several markets in California that utilize wood chips (Table 6). The wood chip market requires a cull or utility log, log chunks, or sawmill residual wood chip that is free of char, burned or blackened wood content. In many cases the log must be debarked then chipped to a ¾ to 1” target size and screened for fines and oversize pieces. The resulting chip is utilized for many markets including animal bedding, landscape mulch, and bagged mulch markets.

Pulp and Paper. Clean wood chips are a present and potential scalable volume market estimated at up to 500,000 bone dry tons (bdt) per year that has only been available in the North Coast and northern California region. Present paper wood chip markets are made possible by bulk vessel loading at Green Diamond Resource Company’s (GDRCo) Eureka Chip Dock. The port’s current export demand reaches approximately 180,000 bone dry metric tons (bdmt) annually. Additional opportunities are provided with rail movements from Northern sawmills into the PNW that are supplying regional paper mills in Washington and Oregon. The GDRCo facility has served the sawmills of the North Coast as an outlet to export their clean sawmill residue chips to Asian paper mill markets. This is currently California’s only option for pulp and paper wood chip loading of wood chip vessels for export (45,000 mt per shipment). Sierra Pacific Industries (SPI) utilizes rail loading capacity at their sawmills to transport paper wood chips to paper mills in the PNW, which creates more demand for local sources of biomass.

Table 6. Pulp and paper chip facilities and consumers

Name	Location	Type
Green Diamond Chip Dock	Eureka, CA	Bulk Vessel & Barge loading for Asia & PNW
Roseburg Forest Products	Coos Bay, OR	Bulk Vessel loading for Asia
OJI Paper	Coos Bay, OR	Bulk Vessel loading for Asia
American Chung Nam / Nine Dragons Paper	China	Pulp Mill
M&L Commodities	Port of Stockton, CA	Bulk Vessel & Barge loading for Asia & PNW
SSA Sacramento	Port of Sacramento	Former Chip Loading site
International Paper	Springfield, OR	Paper Mill
Georgia Pacific	Toledo, OR	Paper Mill
Georgia Pacific	Wauna, WA	Paper Mill
Georgia Pacific	Toledo, OR	Paper Mill
Nippon Paper	Longview, WA	Paper Mill
NORPAC	Longview, WA	Paper Mill
PCA	Wallula, WA	Paper Mill
WestRock	Longview, WA	Paper Mill
WestRock	Tacoma, WA	Paper Mill
Port Townsend Paper	Port Townsend, WA	Paper Mill

The mixed conifer paper-quality wood chip market dynamics are changing on an international level, which will impact markets globally. With Nine Dragons build out of new pulp mill capacity in China, the demand for mixed conifer wood chips will grow by 4 million bdmt annually over the next 2-4 years. The new demand will open more opportunities for California mixed conifer fiber both domestic and internationally, with an estimate of 315,000 bdmt of paper chip volume needed, whether it supports the PNW or is exported. The continuing changes will provide a scalable market for private investment and positive support for California’s forests. Table 6 lists present markets and ports for paper chip facilities and consumers. To further explain the dynamics unfolding, the demand for mixed conifer paper chips for Asian pulp and paper mills is the primary driver of future growth opportunities for California wood chips. Historically, West Coast shipments to these markets have been from Coos Bay, OR, and Eureka, CA. This is very important for California wood fiber because it will create the opportunity for supply chain development of this product class both to Asian markets, as well as PNW paper mills. The new Chinese mills will require increased volumes of mixed conifer paper chips above what existing global volume can produce, which in turn will begin to pull volume traditionally bound for domestic paper mills in the PNW. In turn, PNW paper mills will look to expand their purchasing opportunities to meet their own fiber demand, thus creating the opportunity for California wood chips. A consistent demand for California’s high-quality wood fiber, both domestically and internationally, may provide an opportunity to expand infrastructure and jobs locally in California while supporting future forest health projects. Further development of possible vessel or barge loading from the ports of Stockton or Sacramento is recommended. Additionally, the expansion of rail loading infrastructure at currently operating sawmills can also provide access to the emerging chip export market. There are several pulp and paper mills in

the PNW that could utilize paper chips from California if additional port storage, port and railcar loading, and supply chain transport capacity were to be developed.

Wood fiber other than biomass or paper chips. Medium Density Fiber Board (MDF), particle board, animal bedding, clean wood powder, and wood pellets are other important products that utilize wood fiber. Clean sawdust from sawmills and logs that have been debarked make up the bulk of this fiber supply.

California lost a critical wood fiber market when the AMPINE particle board plant in Martell was destroyed by fire on July 26, 2022.

American Wood Fibers of Jamestown and Marysville, CA, uses cull logs and wood chips/planer shavings for production of animal bedding. The facility utilizes cull logs, clean wood chips and planer shavings to produce dried animal bedding products.

Wood pellet plants in the State are either co-located with sawmills or secondary processing manufacturers to minimize raw material costs. Furthermore, existing pellet producers are focused on the domestic residential market, which demands less volume than the international industrial wood pellet market. The wood pellet space could be a good market segment for the State; however, industrial wood pellet plants require long-term fiber supplies at a large scale [300,000 to 500,000 green tons(gt) annually] to meet financial proformas and financing requirements. The financial demand to make large pellet producing facilities makes this type of market segment challenging for California fiber due to land ownership and the extent of federal lands. Wood pellets are another opportunity for future growth as the supply of wood fiber develops. However, without consistent availability (annual guarantees) of wood fiber, future private investment into the wood pellet market will be limited.

Finally, there is another important market segment utilizing California's cull logs and forest-derived wood fiber available for both primary and secondary processing. This market serves the soil amendment, nursery stock, and colored mulch production business segment, and it relies heavily on California's wood fiber products.

Products in this market space:

- Landscape Mulch – wood chips or ground wood produced to meet the size specification of the landscape project, market segment, or the producing company marketing program. Much of this product is bagged and sold by large retailers such as Lowe's and Home Depot.
- Soils medium – wood fiber, bark fines, wood fines are used to produce soil mixes for bagging or bulk sales to nurseries, bagged to be sold by large retailers.

In California there is a well-established and mature residential and commercial landscaping and nursery demand for wood chips and wood byproducts from forest residues such as bark and bark fines. This includes mulch projects for Caltrans highways and other projects throughout California. Production of these products occurs locally, with many small producers and sellers

combining to make up a large market segment. Additionally, there are large producers using high volumes for their national bagging programs. Both Scott's Miracle Gro and Kellogg's Garden Supply have large manufacturing locations scattered around the State to take advantage of regional fiber sources to support their national programs. These markets support the demand for sawmill residual by-products and forestry operations that otherwise may not have an outlet in California. However, more wood fiber exists today than can be consumed by the current market, so further development of secondary markets will be important.

Caltrans provides a sizable market for wood mulch, which it uses to beautify and control dust and weeds along California highways. Unfortunately, this practice has slowed in recent years due to budget constraints. The use of wood mulch products provides an opportunity for market growth within the government organizations themselves and should be further expanded.

Additional Market Recommendations

California's existing forest products markets are at capacity in terms of inbound supply from wildfire cleanup and developing forest health projects. Furthermore, the potential future supply will continue to exacerbate market limitations. The ability to move logs, chips and byproducts to markets is necessary and critical to support the million-acre strategy. Therefore, outlets are needed sooner than it will take to build new complex facilities such as sawmills, plywood plants, and wood pellet plants. Short-term innovative approaches are necessary to bridge the gap to longer term private investment solutions and market equilibrium. This section provides potential offtake markets by product class that could absorb large volumes of logs and chips with key investments or subsidies. Most large-diameter high-quality (premium grade 20-inch diameter and larger) sawlogs meeting market specifications will continue to be absorbed by existing sawmills in the region. The goal is to fully support the existing California markets while contemporaneously creating new scalable markets that do not compete directly. Sawmills will naturally migrate to the higher quality larger logs due to available volumes, allowing them to target quality and size to lower costs, thus making lower grade smaller logs available to secondary markets.

Woody biomass is a high-volume product in need of new market outlets. This product class is sourced from cull and utility logs, pulp logs, log chunks, topwood, logging waste, precommercial thinning. This class includes branches, charred logs, and logs that are spoiling due to blue stain. The following are recommendations that could lead to private investment and business opportunities to expand into the future. Smart planning by government agencies and private business today will create a positive business environment that supports California forest products for the future.

Pacific Northwest Paper Mills and Sawmills

Paper mills and sawmills of the PNW have been an off-and-on market for California wood products. Paper mills require a clean wood chip, which must be free of char, which is blackened wood from forest fires. Small sawlogs are a critical future feedstock that will require markets to support the million-acre strategy. Both products can be transported by water barge or rail to the PNW, and there is infrastructure within California to enable this effort today.

Port of Sacramento and Port of Stockton - Truck unloading, storage, and bulk vessel and barge loading opportunities

A clean-wood-chip storage and loading facility for export vessels was operated at the Port of Sacramento starting in 1967 by Mitsui Co (Japanese Trading Company) and operated until the early 1990s. The remnants of this operation are still visible at the port with large conveyance and storage buildings along with acres of concrete pad storage under stack-out conveyors. Historically, the Sacramento and San Joaquin Rivers have been used for both domestic transport of bulk commodities by barge and transport of import-export commodities by ocean-going vessels, which are loaded and off-loaded at the ports of Sacramento and Stockton. Today these sites offer an opportunity to revisit water transportation of forest products. This would provide the single-largest volume opportunity with the lowest transport cost for wood fiber generated throughout California. This opportunity represents a timely option for expanding biomass utilization capacity at-scale.

Understanding the dynamics of market development, the entire value chain must be considered given the scale of the effort and individual parties involved. *What is the supply? What is mode of transportation? Where is the destination? Can it handle high volumes? What is the supporting infrastructure success?* In this case, there is a mature infrastructure of forest product suppliers, transportation routes, and an existing destination with infrastructure in place that would support this effort from the forest to the port. Enabling expedited port investment (front-end processing equipment and port bulk-vessel portable loading) to create the needed port infrastructure will accelerate access to gap markets and increase offtake volumes.

Port of Sacramento

This facility that previously loaded chips still exists today and could be repurposed. SSA Marine presently resides as tenants of this space. Storage pads for wood chip inventory exist and could provide quick ramp-up opportunity using portable electrified equipment. Investment is needed for a portable ship loader and conveyor system to load wood chips and biomass onto bulk vessels or barges for transport to markets. The port has rail access that provides additional transportation options.



Based on similar port-side loading setups in the US (truck tipper, material handlers, conveyors, portable ship loader), an estimated \$10 million would be needed for a portable system for inbound truck unloading and vessel/barge loading. The following is a high-level assumption of the \$10 million investment based on similar infrastructure and port space in Eastport, Maine

- Truck scales and wood chip lab = \$0.5 million
- Truck tippers and conveyance systems = \$2.5 million
- Storage Pad, Chip Pile Dozer, and Reclaim system (reclaim hopper) = \$4.5 million
- Conveyance to Portable Vessel Loader (portable enables movement along pier instead of lining vessel) = \$2.5 million

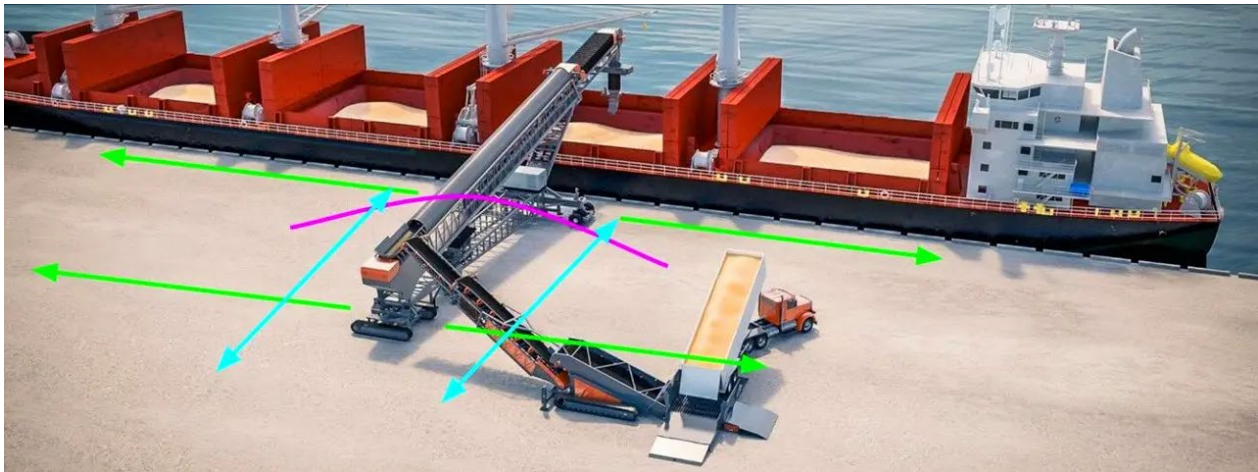
This investment will support a large volume movement. For a similar installment please visit the Port of Eastport's website. There, a new wood chip unloading (truck dump and stack-out conveyor), chip storage, and pad reclaim system and portable vessel loading conveyor system was installed. [Home Page – Eastport Port Authority \(portofeastport.org\)](http://portofeastport.org).

Investment at the Port would encourage private companies to invest in existing forest equipment mixes and production upstream in the forest to supply biomass and wood chips into the port.

Ensuing target markets include biomass to Asia, clean wood chips to Asia, clean wood chips to PNW paper mills, and would utilize the lowest cost-per-volume transportation mode. Ocean vessels already call on the port today and could be used to support this trade; ocean tug service already exists supporting PNW movements.

Current shipping lanes and markets for these products exist presently and port storage is in place. The Port provides an optimal location for a large return on investment in a short timeframe. The port is at the bottom of the funnel of supply, meaning California's largest forest producers access this Port directly with truck deliveries and other mature transportation infrastructure (e.g. major highways, truck routes).

Below is an example of portable ship/barge loading equipment, which in many cases is preferred to avoid permanent installments and crowding the piers. Portable loading systems enable high volume loading that would otherwise not be possible without permanent setups. Portable equipment also allows rapid project execution because it does not require the extensive permitting that a permanent installation would.



Courtesy of <https://www.skecon.com/product/ship-loader/>



photo courtesy of <https://www.skecon.com/product/ship-loader/tracked-radial-telescopic-shiploader.html>

This is an example of a pier-side set up, along with portable electric conveyors from on-site storage piles. The portable electric conveyors and vessel loader require a shorter ramp up from planning and production.



photo courtesy of <https://www.emeraldequipmentsystems.com/products/barge-loading-conveyors-1>

Some portable equipment examples that can be used for loading wood chips into barges for transport to the PNW paper mills.

Port of Stockton

The Port has existing facilities in place to load vessels and barges, but biomass and wood chip on-port storage space is limited. To efficiently load a vessel the cargo must be located at the mooring site and ready to be loaded prior to the vessel docking. Wood chips would need to be stored off site and trucked in during loading, making the process more expensive and less efficient. Barge shipments to the PNW at smaller volumes could be accomplished with existing loading capacities in the port today, as smaller volumes allow for partial on-port storage combined with trucking. Stockton has rail access with a rail car tipper (roll over) in place that could provide support. However, it would need additional planning as the present use is coal for export to China out of Metro Ports' Stockton facility.

Sawlogs & Veneer Logs

To invest, permit and build a new, modern large-scale sawmill in California would require several years-time. Sawlogs have a limited duration between removal from the forest and processing into finished products; therefore, additional sawlog and veneer log solutions should be developed to enable utilization of existing fire-affected timber. Sawlogs of acceptable quality that are not fire-impacted will continue to go to existing sawmills. However, sawlogs of marginal quality and short length logs that sawmills reject need a short-term destination. Small log veneer mills offer a solution to this need today. There are several former and existing sawmill or forest product locations in California where a sawmill or veneer processing facility could be executed in the near-term.

Loyalton, CA, is a former SPI sawmill and biomass power site. This facility requires investment and permitting assistance to restart its biomass power and sawmill/veneer facility. Loyalton is a strategically located forest products site with existing infrastructure; however, investment is needed to rebuild the power plant operation and sawmill facility to industrial scale. Loyalton is well suited to support the east slope north of I-80, Tahoe Basin, and Plumas National Forest. The site could also support a market for low-quality wood fiber that would allow holistic forest management for forests in northern and eastern California. U.S. Forest Service logs and biomass would provide a consistent and reliable source of supply to create an at-scale market with dual benefits for the eastern slopes of the Sierra Nevada.

Terra Bella, CA, is an existing Sierra Forest Products (SFP) sawmill that is in operation. The furthest southern operating sawmill on the West Coast, SFP is a critical demand center for the southern Sierra range. SFP could benefit greatly from a consistent supply of sawlogs from U.S. Forest Service lands in the region, which, based on recent project work and U.S. Forest Service investment, log supply outlook is improving. To support this facility, it is essential that the flow of sawlogs to their mill continue sustainably year over year to enable the ownership to reinvest with confidence.

At least four small sawmills north of Sacramento are planned to start operating in 2023, each milling 2-8 MMBF log scale per year. These mills will provide key localized volume utilization. Support of these mills from a labor, trucking, and sawlog perspective is essential. The businesses will benefit from support from all levels of government.

Carbon, Renewable Energy, Biomass Energy

Development of the biofuels market, carbon sequestration, renewable hydrogen, renewable natural gas, biochar, and carbon markets is underway at full pace; however, true-scale operations are still three to five years away due in part to permitting times. The good news is that some of these developments are anticipated to be operating as quickly as California's regulatory and permitting system will allow. There are currently several large renewable natural gas, green hydrogen production, and carbon sequestration facilities being developed in southern San Joaquin Valley, northern Bay Area, and north of Sacramento. The new facilities will provide critical, high-volume markets for the most important forest product class to facilitate forest management and promote forest health and wildfire resilience. Combined, the planned facilities and new businesses will be capable of utilizing more biomass than is currently generated. As planning proceeds, many developments will fall short and facilities that make it to actual operations will sync with available forest biomass supply from the million-acre strategy. The developments will provide a positive planning and execution perspective for resource managers to support planning future projects and infrastructure investment. In California, investment is always leery of litigation against forest management activities; however, with changing views of wildfires and their causes perhaps we can move forward more

quickly in improving the health of the forests. The new carbon market space will become a critical component of policy and planning, improving air and environmental quality and lowering dependence on fossil fuels.

California has seen an increase in gasification project development and encouragement through grant programs, like the Department of Conservation's Forest Biomass to Carbon-Negative Biofuels Grant program for 2022-23. Gasification will bring new transportation fuels to the marketplace with opportunities at many levels including at-scale sustainable and long-term biomass consuming markets to support the million-acre strategy. Although this market will not be an option for at least three more years, the future volume opportunities will solve the need for supporting markets that help drive forest health and resilience for the future.

California is a leader in biomass power generation in the US. However, several biomass power purchase agreements are timing out and the policy and regulatory environment is leaning towards alternatives like wind and solar. Losing biomass power plants due to the present shift is a short-term loss of a major energy resource for the State. California should consider maintaining and operating the biomass power plants until future renewables come online. The plants provide critical markets for woody biomass recovery and use of the waste biomass derived from forest wood fiber as an alternative to field burning or left behind to increase fire hazards in the forest.

Challenges in Forest Product Markets

Labor

One of the largest issues facing businesses at all levels today is obtaining trained and skilled workers. Unfortunately, the traditional technical schools of the recent past have seen decreased enrollment or have closed. A social perspective change occurred in the recent past that made technical schools and trades unfavorable to young people entering the working world. Over the last few decades, the trades have lost skilled employees. There is need to increase investment into training people in technical fields, such as equipment operations, maintenance, truck driving, and forest management. Investing in training programs at the college level, community college, and technical schools should be a top priority for Sacramento policy makers. Resources should also be invested into marketing training programs and recruiting the workforce. Some of the most rewarding and well-paid careers are those in the technical trades and that message should be advertised and exploited to garner interest.

Trucking

The transportation of forest products is currently the most cost-impacted link in this chain of production and supply. In many cases, the lack of markets close to forest projects requires long transport distances for products to reach the markets. With higher diesel prices and inflationary

drag on equipment and parts, a form of transportation subsidy could assist with these cost pressures and stimulate the movement of forest commodities from project areas to present markets. Example programs include the previous American Forest Foundations My Sierra Woods subsidy and CAL FIRE's current Biomass Transportation Subsidy Grant Program. Subsidies are gap-management tools that enable transport of wood products longer distances to help create and foster regional markets. In some cases, this has already been used for many CalRecycle, Caltrans, and FEMA cleanup efforts in part by the high rates paid for disposal. Further development of a larger transportation subsidy program should be considered with clear guidelines and requirements to qualify for program funds.

Limitations on New Project Permitting and Execution

California can be a challenging state to plan, permit, construct, and then operate a business. The forest products space is no exception and may be one of the hardest in the U.S. due to regulations and the legal obstacles. In 2020 Governor Newsom attempted to enact policy to assist with speeding up permitting and project execution. Policy makers and regulators must continue to refine the process so projects can be executed from the forest outward in a timely manner, further supporting the million-acre strategy.

Existing Transportation Infrastructure Opportunities

Traditionally, forest products have been transported from harvest sites to conversion facilities by truck. From conversion facilities, products are transported to end markets by several transportation modes including truck and rail. Historically, sawlogs were moved from the forest or sorting yards by rail using purpose-built rail cars, but this transportation mode is now rarely used in the western United States, and many log cars have been decommissioned by the railroads and private owners. Historically, pulp mills in the PNW received clean chips by rail and barge, and chip mills received pulp logs via barge and rail. In recent history SPI shipped chips out of the port of Eureka to PNW paper mills by way of barge. In summary there are modes of transportation available to move California products, but investment will be needed in both rail and shipping infrastructure to ensure their viability.

Rail movements

Rail could be utilized for sawlogs, pulp logs, and wood chips, but phytosanitary requirements will need to be managed and executed if shipping sawlogs from California to another state or country. Shipping wood chips by rail has been common over the years across the U.S., as it is a high-volume commodity movement that provides many advantages to both the supplier and the buyer. However, in recent times the paper mills of the PNW have reverted to truck movements as paper markets and subsequently wood fiber demands have shrunk. As a result,

local paper mills have been relying on local fiber supplies to meet demand. Presently there has been a market shift for paper and the demand for wood fiber and clean wood chips. Demand is developing both domestically from paper mills in the PNW and internationally due to new pulp and paper mill construction in China. Paper manufacturing has largely moved offshore to China due to more stringent domestic environmental regulations and higher labor costs. Understanding this dynamic and how it will change purchasing practices is critical, as this new overseas market could be utilized for California wood fiber, driving future private investment into rail transportation.

For rail wood chip movement, transporting cull or log chunks via railcar to the PNW is not practical since net weights per railcar make the movement inefficient and costly. Instead, movement of clean paper chips, or small diameter logs would be recommended. This supports previous comments about the Port of Sacramento and the development of a clean paper chip business within California. Using both rail and barge presents two viable options to further develop transportation solutions. Selling clean chips or small diameter tree length logs to pulp mills or clean chip producing mills in the PNW will require planning and investment to utilize rail as mode of transport.

A typical drop bottom commodity railcar that can be used for wood chip transport. Requires the destination market has drop-bottom discharge unloading capacity



A typical log or rack railcar that can be used for pulp log or small-diameter sawlog transport. Assuming destination market has rail unloading capacity

Table 7 shows existing California rail spur lines or transload yards that are or could be used for forest products. Several yards are well located throughout the forest corridor of California and could be utilized to transload paper chips or pulp logs for transport to the PNW. This report assesses the yards that could be utilized today with little investment, though further analysis of the locations of planned forest projects would need to be completed. Transloading of logs at these facilities would need to be further developed (local CUP permitting), along with securing enough railcars to provide consistent supply to the mills in the PNW. Upstream investment into clean chipping and wood processing for paper chips could create new high-volume markets for forest products that would then need to be matched by water and rail transportation to final markets. Rail yard investment could be setup in the same fashion as outlined for the Port of Sacramento, using portable conveyors, shovel log loaders for roundwood, and railcar loaders to enable fast setup while minimizing extensive permitting requirements. However, the railcar fleet that once served the PNW has seen most wood chip cars transferred back east or dismantled. Commodity cars could be used for transporting chips, but car specifications would need to match receiving paper mills unloading capabilities.

Table 7. California rail sidings and spurs

Name	Location	Readiness
BNSF Riverbank	Riverbank	Mainline spur, needs further development
BNSF Oroville	Oroville	Mainline spur, needs further development
Siligan Containers	Riverbank	Needs spur work and yard work
Wood Treaters	Riverbank	Needs spur work and yard work
Army Depot	Riverbank	Needs spur work and yard work
Norcal Lumber #2	Olivehurst	Needs spur work and yard work
Pacific Ethanol Madera	Madera	Not ready, setup for ethonol operation
Ivanhoe	Ivanhoe	Operating today
American Pallet	Oakdale	Operating today
American Wood Fiber	Keystone	Operating today
Keystone Yard	Keystone	Operating today
Ivory Yard	Port of Ivory	Operating today for Ag commodities
Empire Yard	Modesto	Operating today for Ag commodities
Ag Yard - Oakdale	Oakdale	Operating today for Ag commodities
North Valley AG	Chico	Operating today for Ag commodities
Lignum Support	McFarland	Operational today, needs spur rework
Sierra Valley Enterprises	Loyalton	Rail line spurs need rework, line to mainline needs reopen
Norcal Lumber #1	Olivehurst	Sawmill today
Specialty Granules	lone	setup for mining
Silica Resource	Oroville	setup for mining
UP Truckee	Truckee	siding, would need yard work

Water Movement via Barge & Vessel

The ports of Sacramento and Stockton can load barge and vessels with wood chips and biomass today. The Port of Eureka currently has an operational facility that loads clean wood chips for export to Asia. Eureka services the North Coast and northwest region of the State very well.

For the central and eastern mountain ranges, Stockton and Sacramento are the best destinations.

The Port of Stockton has existing vessel loading capability at two piers, one of which is an existing coal transloading facility in use today that could also be used for biomass. However, this would require significant logistical work prior to use. The second site has portable loading equipment used presently to load agricultural products and Tire Derived Fuel (TDF) for export to Asian countries. The Port of Stockton has grown over the past 10 years due to the rail, truck, water barge, and vessel modes of transportation serving it; combined with an aggressive port staff it is a preferred place to do business in California. As markets develop the Port of Stockton will play an important role in supporting the growth and shipments of forest products directly or indirectly.

Conclusions

The purpose of this document is to identify existing and potential offtake market opportunities to utilize the volumes of wood fiber that will be generated in California in the coming years to support forest health and fire resiliency. Moving forward California needs to re-establish the once robust forest products marketplace it had prior to the early 1990s. Markets are needed to execute planned forest wildfire cleanups, hazardous fuels reduction, and forest health projects supporting the million-acre strategy. Without wood products markets, the shared annual acreage treatment goal is unlikely to be fully executed. The following represents a summary of short-term focus areas to address market issues.

- In 2020 Governor Newsom enacted policy to help speed up permitting and actual execution of new and developing projects statewide. Today, efforts remain hampered by permitting and regulatory delays. Policy makers need to continue to assist with new project funding and with navigating the permitting and execution of projects in a timely manner. Project planners should find the methods to execute plans given the constraints of the system. An example of this would be the Port of Sacramento utilizing portable loading equipment to minimize permanent structure permitting.
- The State should invest in the development of the two inland ports to facilitate the loading of barges and ships. This would be a relatively small investment to achieve a large impact and timely return on investment.
- A State-funded technical training program should be created for forest sector trades such as equipment operators, maintenance personnel, and truck drivers. The program should be supported by a well-funded marketing campaign to promote the effort and the importance of these jobs.

- Create a transportation subsidy that pays on a per-mile basis to assist in the movement of logs and wood fiber to markets for low-value forest products. To ensure the program is managed properly, funds should be paid for the transport not the receiving market.
- Funding for the California Infrastructure and Economic Development Bank’s Climate Catalyst Fund should be expanded and continue to finance equipment related to timber harvesting, transportation, portable debarking and chipping, and grinding and chipping. The Air Resources Board has a similar equipment grant program for orchard removal to prevent open field burning. The Air Board program provides direct grant money to cover 50% of the purchase allowing a small business head room (equipment equity) on the capital stack of the business.
- Encourage private investment to support expanded wood fiber markets for the long-term benefit of California’s forests and its people. Continue to utilize federal and State grant monies to promote recovery of low-value wood fiber otherwise left in the forest due to barriers such as high transport costs. This will promote the health of California forests, while simultaneously providing economic development and the needed avenue to private investment for the forest industry.

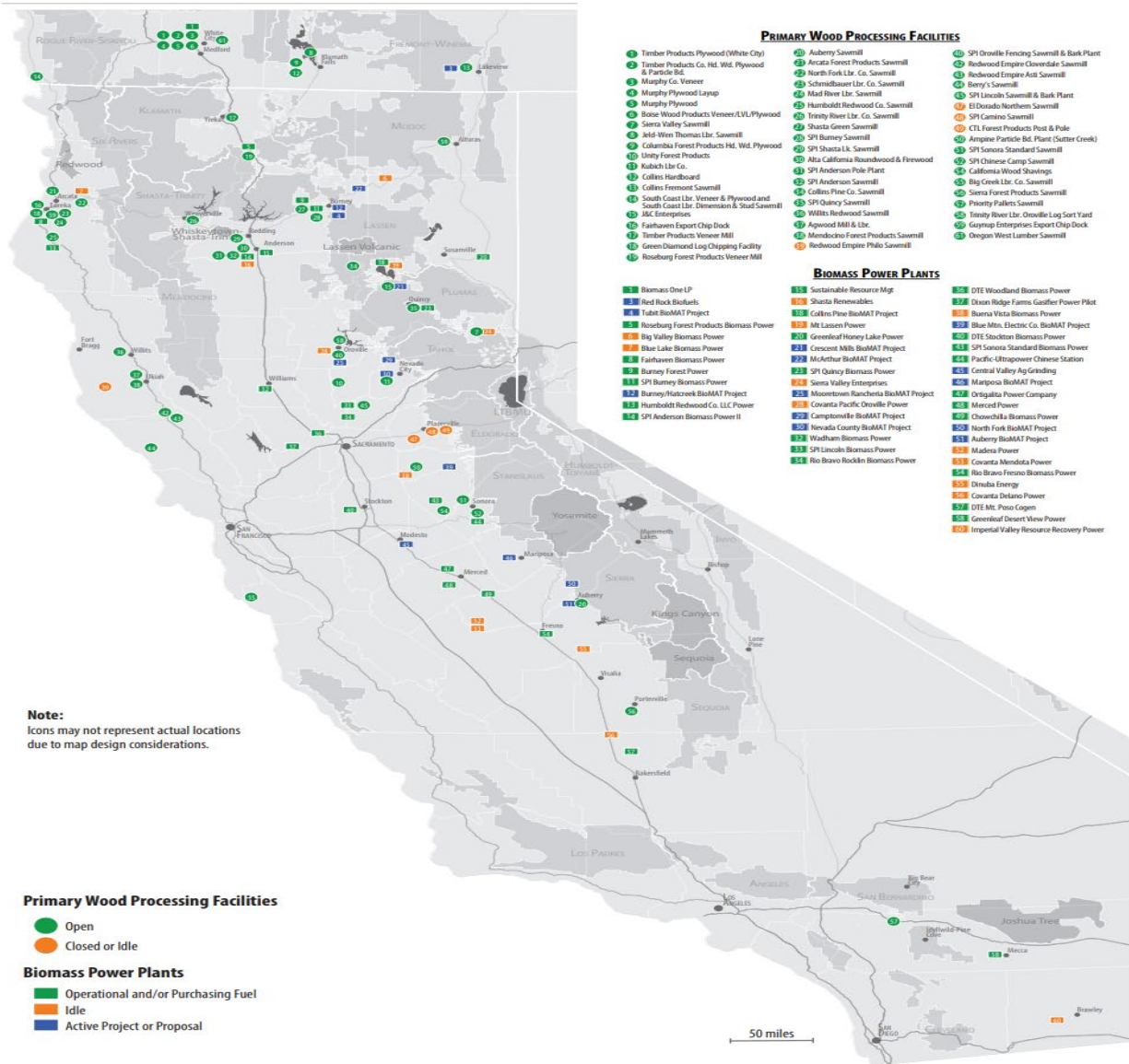
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- Restriction on export of timber from Federal Lands. [16 USC 620a: Restrictions on exports of unprocessed timber originating from Federal lands \(house.gov\)](https://www.congress.gov/bills/116/620a/text/1/20220727/16-USC-620a-Restrictions-on-exports-of-unprocessed-timber-originating-from-Federal-lands-house.gov)

Appendix A



WOOD PRODUCTS PRIMARY PROCESSING & BIOMASS ENERGY FACILITIES



This project is a collaboration between **USDA Forest Service Region 5 State and Private Forestry Program**, **UC Berkeley Woody Biomass Utilization Group**, and **CAL FIRE**. For more information, please contact **Larry Swan** (USFS R5 Wood & Biomass Utilization Program Mgr) | Office: (707) 562.8917 | Email: larryswan@usda.gov | Updated by meghan.woods@usda.gov
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Source: Wood Facility Database, Woody Biomass Utilization Group. The University of California Agricultural and Natural Resources. Retrieved from http://www.ucanr.edu/sites/WoodyBiomass/California_Biomass_Power_Plants/