



White Paper:

Identifying Market Interests and Opportunities for Sierra Nevada Sustainable Forestry Materials

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Overview

This research, funded by a portion of a U.S. Forest Service Wood Innovations Grant, aims to support policymakers, forest managers, advocates, and entrepreneurs seeking to increase the pace and scale of forest health and resilience management efforts in California's Sierra Nevada region by developing viable uses for small-diameter (8" and smaller) green softwood (especially Ponderosa, Jeffrey, and Sugar Pine, Incense Cedar, and White Fir), an array of beetle-killed softwood, and various biomass materials, referred to collectively in this report as Sierra Nevada Sustainable Forest Materials, or "SNSFM."

Specifically, we looked at companies with significant real or potential presence in the California marketplace in order to better understand the drivers that would lead them to use SNSFM. This report supplements and expands upon existing research into SNSFM utilization research by identifying a) several **high-potential companies** for follow-up, and providing context about their interests and needs, as well as the barriers they face (or perceive), and b) unexplored (or less-explored) **high-potential SNSFM use-cases** for further research.

While our research covers a few use-cases based on burning, processing, or pyrolyzing SNSFM, we view these primarily as transitional uses. Given the increasing urgency to dramatically reduce greenhouse gas reductions over a 10-12-year time horizon, we purposely focus our research primarily on SNSFM uses that effectively "park" carbon in longer-lived durable goods. Finally, we caution that any SNSFM use-case must enable and demand ecological forest management practices that ultimately result in healthy, resilient forests that sequester carbon in place far beyond the life of any human-made product.

To discuss the findings and recommendations herein, please contact Joshua Harrison, Center for the Study of the Force Majeure, University of California Santa Cruz, at: 646-522-0187 or jpharris@ucsc.edu.

Summary of Findings

We interviewed representatives from eight companies that, in an online survey of 31 companies, reported either high to very high interest in using SNSFM in their products, or that they were already using such materials. These companies included a family-owned mill, several vertically integrated forest products companies, major furniture and home improvement retailers, and a cellulosic biofuels producer.

Findings on High-Potential Companies

The interviewees, whose insights we captured in the “High-Potential Companies” section that begins on page 6, expressed significant interest in using SNSFM (or, in the case of two out-of-state forest product companies—Freres Lumber Co. and Vaagen Timbers—in using more materials from forest management efforts in their own states). Their interest, they said, is driven by a variety of factors, especially a desire to be part of solutions to some combination of the following problems: forest health and wildfire resilience; local economic disadvantage or depression; greenhouse gas emissions and climate mitigation.

However, representatives of high-potential companies also reported significant barriers to incorporating SNSFM into their companies’ supply chains. The following list outlines these barriers in a loosely ranked order based on both the approximate frequency with which interviewees mentioned them in conversations and the level of emphasis they gave them.

1. **Availability of materials:** Everyone interviewed for this report expressed a high level of concern or doubt that their company would be able to access a reliable supply of SNSFM. Specifically, interviewees said that without long-term supply contracts of at least 10 years—and preferably 20 years—their companies would not feel comfortable building a product line—especially one that required a new or significantly upgraded manufacturing facility—with such assurances. Several interviewees cited contracting tools such as Master Stewardship Agreements and the Good Neighbor Authority as potentially helpful in mitigating this barrier, but several also expressed a lack of faith in the ability of public forest managers—especially the U.S. Forest Service (due to lack of resources, and lack of staff capacity and expertise)—to consistently conduct forest management activities at a pace and scale that will both achieve forest resilience management goals on Sierra Nevada forests, and net a reliable supply of materials from such projects.
2. **Cost of materials:** All interviewees mentioned materials cost as a barrier. Most highlighted their need for SNSFM to be priced competitively with other wood feedstocks. But interviewees placed an even greater emphasis on their need for *consistent prices*. While the price of timber products, even from private lands, tends to experience variability, the price of SNSFM might be particularly volatile, given that managers of public forestlands report highly variable treatment costs—\$500-\$3,000 per acre¹, depending on a variety of factors (slope, accessibility, potentially hazardous conditions in areas with large numbers of dead trees)—that could make business planning especially difficult for users of SNSFM. Mitigating this price volatility presents an opportunity—albeit a challenging one—for State and Federal agencies to design tax credits, rebates, or other incentives to help companies adopt SNSFM into their supply chains.
3. **Quality or appropriateness of materials:** A number of interviewees raised concerns or expressed ambivalence about the species or the condition of the trees and biomass comprising SNSFM. For example, Lee Jimerson of Collins Co. said beetle-killed pine is often harvested too late to provide any value to his company; Russ Vaagen of

¹ Lupien, Sandra. Removing Barriers to Cross Laminated Timber Manufacture & Adoption in California: A game-changer for wildfire, forests, and climate change. University of California at Berkeley Goldman School of Public Policy; E2 Environmental Entrepreneurs. May 2018.

<https://sagehen.ucnrs.org/pubs/Theeses/LupienMay2018.pdf>

Vaagen Timbers said Ponderosa Pine might not be viable for cross-laminated timber; and Gene Wilson of Room & Board said the company does not currently use pine in any of its products, but that doing so wouldn't be out of the question. The need to better understand the best applications for SNSFM provides exciting—and urgent—research opportunities that the California Board of Forestry's Joint Institute for Wood Products Innovation should prioritize. WoodWorks and other industry groups can also play an important role in communicating technical advice on potential uses of SNSFM.

4. **Transportation costs and logistics:** Several interviewees suggested that the cost of transporting SNSFM to their facilities could present a significant barrier to incorporating SNSFM into their supply chains. One interviewee—Eric McAfee from Aemetis—emphasized his company's need to pick up materials from a centralized location near a major interstate or on a rail line.
5. **Lack of workforce to process materials:** Although only one person interviewed for this report—Kent Duysen of Sierra Forest Products—mentioned it, existing literature has identified the lack of a milling workforce as a key barrier to increasing the use of SNSFM. Duysen cited a lack of workers in his region as a seemingly intractable barrier preventing him from operating a second shift at his mill in the southern Sierra Nevada. Further conversation with Duysen could be valuable to those working on rural workforce development at the State of California. State surveys also indicate key workforce shortages in forest restoration and treatment, which further complicates the materials supply.²
6. **Mixed opinions about forest product certification programs:** Currently few wood products grown in California are covered by any forest certification program.³ We asked interviewees whether bringing SNSFM under a forest product certification program, such those operated by Forest Stewardship Council (FSC) or Sustainable Forestry Initiative (SFI), would make it easier or more appealing for their companies to incorporate SNSFM into their supply chains. Their responses were not consistent. For retailers, these certifications elicited some enthusiasm. For example, Williams-Sonoma Companies consider FSC wood as the “gold standard” for sustainable wood, whereas Lowe’s said its customers like to see the FSC label, but not many are willing to pay a premium for it at point-of-sale. Representatives of wood products and lumber companies were more critical of the certifications: Freres Lumber opposes FSC specifically because U.S. Forest Service materials are not covered by the certification; Jimerson of The Collins Companies, on the other hand thought certifications have some value, but that FSC and SFI might be too politicized, and suggested a new certification for materials harvested as part of resilient forest management, like SNSFM. At the 2019 Mass Timber Conference in Portland, for example, challenges around certification were a major topic of discussion, and several presenters said that a new certification might well be needed especially for CLT and other mass timber products.

Findings on High-Potential Use-Cases

In addition to reporting on “High-Potential Companies,” we also profile a number of “High-Potential Use-Cases” of SNSFM that we identified throughout the course of our research, but were either unable to connect to a specific company, or—in most cases—were unable to reach for an interview. These uses include (not in ranked order):

- Mass Plywood Panels
- Structural Composite Lumber
- Store Development & Display
- Conferences & Conventions
- Wood Fiber Insulation

² <https://www.labormarketinfo.edd.ca.gov/data/employment-projections.html>

-- <https://lhc.ca.gov/sites/lhc.ca.gov/files/Reports/242/ExecutiveSummary242.pdf>

³ <https://news.mongabay.com/2017/09/does-forest-certification-really-work>

- Biolaminates
- Nanostyrofoam
- Fabrics & Threads
- Pyrolysis

A brief discussion of each of these use-cases appears in the section beginning on page 19.

Unless otherwise indicated, we envision the follow-up actions suggested herein being taken by various combinations of the following:

State of California

- Governor's Office of Business & Economic Development
- Board of Forestry & Fire Protection Joint Institute on Wood Product Innovation
- Governor's Office of Planning & Research staff to the California Forest Management Task Force's Rural Economic Development Subcommittee's Wood Utilization Group
- Department of Forestry & Fire wood and biomass development staff

U.S. Forest Service

- Wood utilization and biomass staff

Introduction

In 2016, the Center for the Study of Force Majeure at University of California Santa Cruz organized Living Forests (formerly Saving the West), to promote a whole-systems approach to the challenges of fire and drought in the Sierra Nevada and ultimately across the intermountain west. Living Forests is a collaborative group bringing together a range of individuals, organizations, businesses, artists, scientists, policy makers, and community groups committed to building enduring environmentally informed end-to-end solutions.

A key driver of Living Forests' work is the urgent need to reduce forest density on public forest lands in California to increase their long-term health and resilience to destructive wildfire, increased temperatures, drought, and pest infestation in order to protect human life, property, wildlife, and water, as well as forests' critical role as natural carbon storage sinks. Conducting this work at the pace and scale required—the State & Federal governments have an ambitious, yet conservative goal to “treat” (reduce density through thinning and prescribed fire, e.g.) one-million acres of public and private forestland each year in California—will result in an abundance of small diameter (8" and smaller) green softwood (especially Ponderosa, Jeffrey, and Sugar Pine, Incense Cedar, and White Fir), an array of beetle-killed softwood, and various biomass materials, referred to collectively in this report as Sierra Nevada Sustainable Forest Materials, or “SNSFM.” The fact that few developed markets exist for SNSFM is a key barrier to planning, financing, and implementing forest health management projects.

To address these missing markets, Living Forests supports the development of a renewable wood products economy that can create a sustainable economic engine for thousands of people in economically disadvantaged or depressed areas of California.

Numerous economic and policy analyses⁴ have already examined an array of use-cases for SNSFM. Nevertheless, stakeholders seeking to increase the pace and scale of health and resilience management on Sierra Nevada forests continue to cite inadequate demand for SNSFM as a key barrier to action.

At the same time, the high-profile nature of the dangers associated with inaction on Sierra Nevada forests presents an appealing opportunity for motivated companies to position themselves as social and environmental heroes and circular economy leaders by incorporating SNSFM into their supply chains. Our theory of change holds that in order to remove the demand-side barrier, forest management stakeholders must quickly begin connecting and partnering directly with companies that have both strong inclination and potential to incorporate SNSFM relatively quickly into existing or new product lines.

The research and findings described in this report represent a “quick-and-dirty” first go at identifying—within time and budgetary constraints—a handful of such companies in order to help accelerate actions by the engaged forest management, policy making, business development, non-profit, and community stakeholders who comprise the audience of for this report. Therefore, this report supplements and expands upon existing SNSFM utilization research by identifying a) several high-potential companies for follow-up, and providing context about their interests and needs, as well as the barriers they face (or perceive), and b) additional unexplored (or less-explored) high-potential SNSFM use-cases and recommending further research.

By collaborating directly with potential users of SNSFM, readers of this report can develop targeted policies, programs, and partnerships that enable SNSFM to move more rapidly into supply chains, in order to remove the demand-side barrier to achieving forest resilience management goals on public and private lands in the Sierra Nevada.

Research Scope & Approach

The research, conducted from May-July 2019, comprised the following steps:

1. **Identified a list of companies:** We developed a list of 31 companies (see Table 1) based on their potential to use SNSFM in existing or future product lines. We based our selections on use-cases that either a) are highlighted in the literature identified in Footnote 2, or b) we learned about at conferences, through online research, or word-of-mouth. We used company websites, LinkedIn, and referrals to identify target contacts within each company. Note: We added a few of the companies to the list later in the process after conversations with other companies or additional research identified them as strong candidates for future follow-up.
2. **Developed & Distributed Interest-Gauging Survey:** We knew we wanted to conduct telephone interviews with representatives of companies with the strongest inclination and potential to use SNSFM. In order to gauge that interest, we invited most of the companies on the list to participate in a one-question survey (conducted online using Google Forms) that asked them to report their interest using SNSFM (Already Using,

⁴ The Beck Group. California Assessment of Wood Business Innovation Opportunities and Markets (CAWBiom) Phase II Report: Feasibility Assessment of Potential Business Opportunities. 4 Jan. 2016, <https://www.nationalforests.org/assets/pdfs/CAWBiom-Phase-II-Summary-final.pdf>.

--- Dead Tree Utilization Assessment. Prepared for CalFire & California Tree Mortality Task Force., May 2017, http://www.fire.ca.gov/treetaskforce/downloads/WorkingGroup/Beck_Group_Report_5-1-17%20.pdf.

Lupien, p. 56. Public Policy; E2 Environmental Entrepreneurs. May 2018.

SB 859 Wood Products Working Group. Recommendations to Expand Wood Products Markets in California: Investing in Communities and California’s Climate Resilient Future. Oct. 2017, <http://resources.ca.gov/wp-content/uploads/2014/07/Wood-Products-Recommendations.pdf>.

High to Very High Interest, Medium Interest, Low Interest, No Interest). Ten companies responded to the survey, with seven reporting High to Very High Interest (Aemetis; Freres Lumber Co., Inc.; Lowe's; Pioneer Millworks; Room & Board; Vaagen Timbers; Williams-Sonoma, Inc.); three reported that they are already using SNSFM in their product lines (The Collins Company, Sierra Forest Products, Sierra Pacific Industries).

3. **Developed Interview Questions:** Meanwhile, in preparation for follow-up interviews with the companies identified above, we developed the following set of interview questions:
 - What are you currently making/might you make with SNSFM?
 - What motivates your use of/interest in using SNSFM?
 - In what format do you/would you need to receive SNSFM?
 - What species of SNSFM or other materials do you currently use, and what species of SNSFM might you use?
 - What barriers do you currently face/do you anticipate facing in connection with using SNSFM?
 - What incentives or actions would make you eager and/or able to use (or use more) SNSFM?
4. **Scheduled & Conducted Interviews:** In the end, we conducted interviews with eight of the 10 survey respondents; the interviews took place by phone or audioconference, and ranged in duration from 20-90 minutes.

5. Analyzed Interview Transcripts

6. Drafted Recommendations and Report

Appendix 1—Companies, Contacts, and Research Participation, captures the 31 companies we identified initially, key contacts at some of those companies, the level of participation of each company in the research process, and (for those companies that completed the online survey) their level of interest in using SNSFM in their products.

Research Findings & Recommendations

High-Potential Companies

Based on our interviews with their representatives, we've identified in this section companies with both high potential to relatively quickly incorporate SNSFM into existing or new product lines, and strong interest in doing so. Here we profile each of these companies describing, for example, what they (might) do or make with SNSFM, why they're interested in using them, how they source their current inputs, barriers they face or perceive in connection with using SNSFM, and insights around what might help them overcome these barriers.

For the reader's convenience, each company profile begins with a list of top takeaways from the interview, followed immediately by recommendations for follow-up informed by the interview findings outlined afterward.

Company: Aemetis

Contact:

Eric McAfee, Chairman/CEO/Co-founder

Top Takeaways:

- Can use materials in a variety of species and small formats (sawdust or chips) that typically do not require kiln-drying.

- Requires an “unadulterated wood stream” not contaminated by chemicals (in contrast to agricultural or municipal wastes).
- Desires a centralized materials pick-up location near a major interstate highway.
- Difficulty securing 20-year supply contracts at a stable price is a key barrier.
- Interest in SNSFM strongly motivated by desire to reduce emissions from petroleum-based transportation fuels and the negative health and environmental impacts resulting from them.

Recommended follow-up:

- Sierra Nevada Conservancy: Talk with McAfee about how Aemetis might access a long-term supply of SNSFM by partnering with the holder of a 20-year Master Stewardship Agreement, or one that has a Supplemental Project Agreement under a MSA.
- Governor’s Office of Business and Economic Development: Talk with McAfee about his financing ideas, as well as Aemetis’ need for centralized material pick-up sites.

What is the company currently making/might it make with SNSFM?

Aemetis makes cellulosic biofuel additives to reduce the emissions of petroleum-based fuels. Aemetis operates the largest biofuels plant in California, a 65-million gallon per year ethanol plant near Modesto.

What motivates its use of/interest in using SNSFM?

Environmental and Sustainability:

Specifically, Aemetis seeks to improve environmental health and air quality by reducing emissions from petroleum-based fuels. “California’s Central Valley is the worst air quality non-attainment zone in the United States [in part] because of [open] orchard and forest material burning. This is why we need to use forest wood—it is a source of emissions just like orchard waste.”

Particular Material Characteristics:

Aemetis likes the idea of using SNSFM because it needs “an unadulterated wood stream.” McAfee pointed out that waste wood from municipal solid waste streams and construction tends to be treated with chemicals or contains chemicals from other sources, whereas SNSFM do not have this issue.

In what format does/would the company need to receive SNSFM?

Aemetis would need to receive SNSFM as sawdust or chips (2” length maximum). It prefers to pick up the material in piles near a highway location that does not require its trucks to cross any forest properties. The company uses front-end loaders to load wood onto trucks for transportation to its processing plant site north of Modesto in Riverbank; the site is on a rail line. The moisture content of materials (sawdust, chips, leaves, etc.) needs to be 10% or less prior to processing; air drying is typically sufficient.

What species of SNSFM or other materials does it currently use, and what species of SNSFM might it use? Aemetis currently uses orchard waste as its primary feedstock. It is “species agnostic”—in other words, it can use a wide variety of feedstocks.

How is the company sourcing the materials it currently uses?

Aemetis has a 20-year supply agreement with the U.S. Department of Agriculture for orchard and agriculture waste. The agreement also includes financing to build a plant to convert both orchard and forest waste into biofuels

What barriers does it currently face/does it anticipate facing in connection with using SNSFM?

Reliable Availability:

McAfee expressed a sense that it is “impossible” to secure a 20-year supply contract for SNSFM. Without such a

contract, capital investment in a facility is extremely challenging to secure, and business planning is also very difficult.

Price Inconsistency:

Aemetis wants to know it can receive a reliable, 20-year supply at a fixed price (the price itself is less important than the fact that it is fixed over the term of the contract).

Something else:

McAfee emphasized that, in order for materials transport to be economically viable, Aemetis would need to obtain large volumes of SNSFM in a small, centralized collection area on a major interstate or rail line.

What incentives or actions would make the company eager and/or able to use (or use more) SNSFM?

Price consistency

A centralized SNSFM pick-up location

Ability to contract for 20 years:

"The ability to contract for 20 years minimum means you can finance a facility for 20 years. I can't build the plant if I have to pay it off in six months because I can't contract more than six months in supply."

De-risk capital:

McAfee emphasized a need to reduce risk for capital lenders, and suggested that the State of California could be taking significantly more action to create loans to help companies that want to use SNSFM access the capital they need to launch or expand. McAfee has been advocating at the State level for CALPERS and CALSTRS (the California Public Employees and State Teachers Retirement Systems) to make low-cost loans to such facilities as a way to decrease the interest burden faced by companies like his (Aemetis' cost of debt is 11% on the Modesto plant) that he says would increase the return on investment on the two retirement funds to a level sufficient to meet their commitments.

McAfee also suggested that the State could initiate a loan guarantee program for companies seeking to use SNSFM.

Stronger collaboration and consistency among forest management agencies across jurisdictions:

"When forests are owned by various public interests they don't collaborate—don't have systems for processing the equipment. Unless these [State and Federal] regulations agree, we won't be able to get the volume we need at scale."

Additional insights and comments:

McAfee expressed frustration that biofuels made and sold in California or elsewhere in the U.S. rely on waste materials (such as corn husks) imported from other states or countries. He said, emphatically, "People have to connect the dots so you're not importing materials. Until you've displaced 100% of your imported waste product you should be 100% focused on developing feedstocks from locally available materials [like SNSFM]." Similarly, McAfee was irked that some materials, like beetle-kill pine logs, are being exported to markets, such as China. "California already has the markets *in California* for these materials. This is a supply side problem, absolutely," he said.

Company: The Collins Companies

Contact:

Lee Jimerson, Collins Wood Sales Manager

Top Takeaways:

- Exploring the possibility of mass timber manufacturing.
- Processes logs—both green and dead—especially the main species that comprise SNSFM.
- Particle boards and siding are strong candidates for SNSFM.
- Finds it important to identify uses for SNSFM as part of the solution to restoring forest health.
- “Salvage” logs, like beetle-kill pine, usually lack value because U.S. Forest Service waits too long to harvest.
- Mixed opinions within the company about existing wood product certifications; might support a new certification specifically for “stewardship wood” from public lands.
- As an alternative to forest owners selling forest offsets, suggested that end users of the wood (builders, e.g.) should earn the carbon credits associated with eligible forest products.

Recommended follow-up:

- Jimerson recommended following up with two of his colleagues:
 - Paul Harlan, VP of Resources, to discuss what SNSFM Collins is currently using in its product lines, and to explore the potential for the company to use more (pharlan@collinsco.com); and
 - Brian Klengman to discuss needs for additional biomass for Collins’ cogeneration facility in Chester.
- California Air Resources Board: Follow up with Jimerson to further explore his idea about adjusting the State’s carbon offset market to enable end-users of SNSFM (builders, developers) to earn carbon credits for using SNSFM-based products they buy from forest owners like Collins.

What is the company currently making/might it make with SNSFM?

Collins currently makes a variety of softwood products that are and could be made from SNSFM, including:

Milled lumber (mostly dimensional) for building framing; industrial uses, as in doors and windows; pine “commons”⁵ in standard dimensions, such as 1X6, 2x12 inches, etc.

Engineered wood products made from fiber, whole log chips, and mill residuals from Collins’ and other mills, such as composite siding; pine particle board, including a Forest Stewardship Council-certified line.

Collins is also actively exploring manufacturing mass timber products, including cross-laminated timber (CLT).

What motivates its use/interest in using SNSFM?

Domestic/Local Material

Sometimes readily available

Sometimes good price

Environmental Sustainability

Comments on motivation and interest:

Jimerson explained Collins’ motivation to use SNSFM as follows: “Buying from the U.S. Forest Service is local, it’s somewhat available, sometimes economical. And, everyone agrees that these forests need to be thinned—everyone agrees that we’ve dicked up the forests enough that they aren’t going to survive on their own.”

Therefore, Jimerson says Collins is happy to be part of the solution by putting SNSFM to use in its products. Collins operates a mill on its 97,000-acre forest property near Lakeview on the Oregon/California border—the only mill in

⁵ “Common” is a term used by the Western Wood Products Association to grade the appearance of pine species, including Ponderosa Pine

the area available to serve nearby U.S. Forest Service lands. Jimerson said he's hopeful that access to SNSFM in the area will increase because, "we're seeing lots of trust built" among stakeholders there.

In what format does/would the company need to receive SNSFM, and how is it currently sourcing materials?

Collins receives and uses mostly logs—green and salvaged; these may be fresh or may have been left in the forest to dry for several years before Collins takes them in. Collins also uses chips, fiber, and mill residuals (sawdust, kiln-dried planer shavings—from its own and other mills) in its product lines. In addition, Collins takes in biomass for its co-generation facility in Chester, California. At one of its Oregon facilities, Collins receives "lots" of logs from nearby Fremont National Forest. Collins recently wrapped up a 10-year Master Stewardship Agreement⁶ in Fremont NF that gave its mill there about 10% of its supply during that period.

What species of SNSFM or other materials does it currently use, and what species of SNSFM might it use? Mostly Ponderosa pine (both green logs, as well as salvage, including beetle-kill logs) and White Fir; Sugar Pine, sometimes. Collins doesn't cut Douglas Fir, so if the company had to take it as part of a load of SNSFM, it would pass it on to another mill to process.

What barriers does it currently face/does it anticipate facing in connection with using SNSFM?

Reliable Availability:

In order to plan product lines, Collins needs to know it has a reliable supply of materials for at least 10 years—and it would prefer 20-year supply contracts.

High Prices:

If the price Collins has to pay for SNSFM isn't competitive with other feedstocks, "it's not something we can do," said Jimerson. But non-competitive prices aren't the only issue—Collins also cited price inconsistency as a barrier to using SNSFM.

Poor Materials Quality:

Jimerson said that in Collins' experience with salvaged material (either post-fire, or drought- or beetle-killed trees) received from or offered by USFS, all the value is often gone from the wood before it goes up for sale due to delayed harvests. For Collins, accepting such materials comes at the risk of processing something that, if sold, could "negatively affect our reputation as a business." When it has been faced with such materials, Collis has had to try to find new markets for it, such as pallets or packaging.

Costly Product Certification:

As Collins investigates the viability of moving into mass timber manufacturing, it has encountered a significant barrier associated with the cost of product certification. For example, any manufacturer of CLT must do panel lay-ups for each new species mix it uses in order to have the product certified to go to market. In other words, even if another company had already gone to market with a certified 100% Ponderosa Pine CLT panel, Collins would have

⁶ Master Stewardship Agreements (MSA) with the U.S. Forest Service allow entities (non-profit organizations, collaboratives, Joint Powers Authorities, etc.) and jurisdictions (counties, cities, special districts) to manage "large areas [of federal forest land], typically at the regional...or forest level." MSAs are widely viewed as an important tool in efforts to significantly increase the pace and scale of ecological forest management work on U.S. Forest Service lands (especially since U.S. Congress in 2018 increased the allowable term of an MSA from 10 to 20 years) by shifting the burden of project planning and management away from USFS onto partners with more capacity and access to different funding streams. Master Stewards are also able to enter into and manage Supplemental Project Agreements (SPAs) for specific project work, which further increases capacity. Finally, when a project generates revenue in excess of the project costs, those "receipts" are "retained," meaning they are reinvested in the forest for additional management work—this is in contrast to receipts generated in traditional timber sales, which must be deposited with the U.S. Treasury. https://www.nationalforests.org/assets/files/Stewardship-Authority-Overview_2014-7-24.pdf

to go through the certification process to market its own, identical 100% Ponderosa Pine CLT panel. Each new product certification process costs about \$250,000.

What incentives or actions would make the company eager and/or able to use (or use more) SNSFM?

Certification of SNSFM:

Jimerson reported that opinions are mixed within Collins when it comes to existing forest product certification programs, such as Forest Stewardship Council (FSC) and Sustainable Forestry Initiative (SFI). Jimerson himself tends to like FSC, but recognized that efforts to apply FSC or SFI certification to materials coming off USFS (or other public) lands could backfire due to mixed public opinion about and trust of these programs. Jimerson suggested taking off the “political edge” by pursuing a new certification, such as “Stewardship Wood,” which is an initiative Paul Vanderford at Sustainable Northwest has been advancing for wood from public lands only.

Get Major Projects to Demand SNSFM

For example, Jimerson noted that the Portland, Oregon airport has stated a preference for wood sourced from forest stewardship projects for a major remodel.

Shift Carbon Credits to End-Users

Jimerson said, “Collins is carbon restorative as a company,” which gives it the ability to sell forest carbon offsets. Rather than sell carbon credits in the market, he’d love, “to dump it back into the wood,” so that architects, builders, and developers using Collins wood in projects could earn credits, which Jimerson said, “from a sales standpoint would be great for Collins.”

Company: Freres Lumber Co.

Contact:

Tyler Freres, Vice President of Sales

Top Takeaways:

- Freres Lumber is pioneering Mass Plywood Panel (MPP) construction in the Western United States.
- Uses materials from USFS lands in Oregon in its products lines.
- Motivated to revive local timber economies and is frustrated it can’t access enough domestic, local products to eliminate the need to import.
- Typically uses softwood logs between 6-8” diameter.
- Does not use pine in MPPs.
- Does not support Forest Stewardship Council and other existing certification because they cannot be applied to products from public lands in Oregon.
- Needs reliable, 20-year supply contracts with competitive, stable materials pricing; views Master Stewardship Agreements as a useful tool.

Recommended Follow-up:

Although Freres might not be a candidate for using SNSFM in its product lines due to species preferences and potential barriers associated with the cost of materials transportation to Oregon, its team’s extensive experience developing MPPs, obtaining materials from forest management projects, and operating in the forest products industry more broadly is invaluable. The California Forest Management Task Force’s Rural Economic Development Subcommittee’s Wood Utilization Group should follow up with Tyler Freres and bring him to California to brief the Task Force, members of the business community, NGO stakeholders, investors, and other interested parties

What is the company currently making/might it make with SNSFM?

Freres Lumber makes a variety of products, but our conversation focused mainly on its Mass Plywood Panels.

Note: Freres does not currently use any SNSFM in its product lines, but uses wood from Federal and State forests in Oregon, and would be open to using SNSFM under the right conditions.

What motivates its use of/interest in using SNSFM?

Sometimes Ready Availability

Domestic/Local Material

Freres said his company is committed to local economic development: "We want to revive the legacy of a timber industry that supports local communities and economies with sustainably harvested timber," he said. "We remember the days of buying logs from the Federal government and the proceeds went back to the communities. We want to leave a legacy of bringing that back."

In what format does/would the company need to receive SNSFM?

Freres processes logs, as small as 6" in diameter, with 8" being the average. They also buy veneers from other producers across the West Coast and internally, as well as hog fuel⁷ from other mills.

What species of SNSFM or other materials does it currently use, and what species of SNSFM might it use? Freres currently uses a lot of Douglas Fir, as well as Western Hemlock (and they lump true fir species into hemlock mix and process it all together). Freres indicated they're also able to process various pine species, but cautioned that current plywood code is not especially friendly to pine⁸ and that, "Doug Fir is the benchmark softwood and nothing else is as good."

How is the company sourcing the materials it currently uses?

Douglas Fir from public lands in Oregon comprises 44-55% of Freres Lumber's annual feedstock; it acquires the materials through timber sales, stewardship contracts, as well as through small business set-asides for timber companies with under 500 employees.⁹ It imports other materials (especially veneers) from elsewhere.

What barriers does it currently face/does it anticipate facing in connection with using SNSFM?

Reliable Availability:

Freres cited the high cost of launching and operating a modern mill as presenting too much risk without a guaranteed 20-year supply.

High Prices:

Freres expressed frustration that the price of wood from public forestlands in Oregon is too high.

Price Inconsistency

Transportation Costs:

Freres said his company might be interested SNSFM, but that the cost of transporting them to Oregon from California was likely to present a barrier.

Product Specifications:

For plywood, including mass plywood, Freres said current product specifications limit the use of pine species.

⁷ Hog fuel is a wood residue and waste product that is processed through a chipper or mill and produces coarse chips and clumps normally used for fuel) for cogeneration.

⁸ Recommend further research

⁹ Tyler Freres explained that a federal program established in the 1930s requires that small business gain access to timber supply after a certain supply level with big contractors is met.

Comments on Barriers to Using SNSFM:

Freres said: "We would prefer to only use U.S. sourced wood harvested in a sustainable way, but that's not where we are right now. The Federal government owns 67% of the forestland in Oregon, but accounts for less than 10% of the harvest. And Oregon is the most expensive wood basket in the world—and we see the same problems in California. It's so frustrating that we have to buy imported feedstocks."

What incentives or actions would make the company eager and/or able to use (or use more) SNSFM?

More consistent availability:

Freres said, "If we could get a 20-year Master Stewardship Agreement, we could hire 20 college students to go out and thin the forests."

Lower price:

This includes the price of the materials themselves, as well as transporting them to Freres' facilities Oregon.

Predictability:

"I need predictable input at a predictable price," Freres said.

Company: Room & Board

Contact:

Gene Wilson, Director of Merchandising & Vendor Management

Top Takeaways:

- Room & Board already has experience with public-private partnerships, developing supply chains with U.S. Forest Service and local companies and non-profits, and marketing geo-specific products through its Urban Wood Project. This work is motivated by a strong commitment to corporate social responsibility.
- R&B's business model relies on an extensive network of domestic manufacturers.
- Wilson is not under the impression that adding SNSFM to its supply chain would cost less than other materials; rather he has the impression that doing so probably would not cost a lot more.
- Concerned about supply reliability with SNSFM.
- Pine would be a new material for the company.

Recommended Follow-up:

Contact Gene Wilson and explore:

- How R&B's Urban Wood Project model might be extrapolated to Sierra Nevada forest communities—What infrastructure and partnerships need to be in place, and which can R&B help build?
- Potential existing California manufacturers that R&B might bring into its network to support SNSFM R&B product lines.
- How R&B might act as a catalyst for other companies.

What is the company currently making/might it make with SNSFM?

Room & Board is not currently using SNSFM in its product lines, which include an array of home furnishings and decorative items. Products that are potential candidates for SNSFM include:

- Wood cases (bookshelves, dressers, cabinets)
- Tables (dining coffee, side)
- Framing for upholstered furniture
- Feedstock for plywood-based products
- Lamps and other accessories

What motivates its use of/interest in using SNSFM?

Brand Recognition for Environmental Sustainability/Corporate Social Responsibility:

While Room & Board does not currently use SNSFM in its products, it does have a number of product lines that feature reclaimed or otherwise “sustainable” wood. In its Urban Wood Project¹⁰ product line, the company uses wood reclaimed from Baltimore row houses slated for deconstruction and trees that must be excavated through a public-private partnership with US Forest Service and a non-profit organization that trains and employs people with barriers to employment. Wilson said a significant motivation for engaging in this process is Room & Board’s “commitment to the cause,” both from environmental and social impact perspectives. Wilson implied similar motivations would be at play were Room & Board to pursue such partnerships in order to incorporate SNSFM into its product lines.

Particular Characteristics of the Material:

This includes the wood’s grain and coloration, relative hardness, etc., as well as the story of where it came from. For example, the Urban Wood Project enables Room & Board to access an array of species not available elsewhere in the country and to tell a compelling story about upcycling, and local economic and workforce development.

Demand from eco- and geo-conscious customers:

A portion of Room & Board’s market, “will choose woods where there’s a story, and they know there’s a strong environmental impact.” Wilson said such customers are willing to pay a 10-15% premium on such products, but that such products (such as those featuring reclaimed wood) comprise only a small portion of Room & Board’s total demand. Such demand underpins the success of the Urban Wood Project.

Important Note about Price:

Room & Board is not under the impression that adding SNFSM to its supply chain would cost less than other materials; rather it has the impression that doing so probably would not cost a lot more.

In what format does/would company need to receive SNSFM?

Room & Board’s manufacturers receive dried lumber that arrives cut into standard dimensions, which they then mill into smaller formats to fit the designs they’re building. Manufacturers also receive live-edge slabs and “cookies;”¹¹ Wilson cautioned demand for the latter two is very limited, and for Room & Board to use softwood for these would be very unusual (but not out of the question).

Finally, Room & Board manufacturers work with a variety of veneers—particularly in their case products. Wilson said that SNSFM softwoods could be a candidate for the cores of these veneers and plywoods, but that would require intervening in the supply stream at the point-of-processing for those materials (that is, before Room & Board manufacturers receive them).

What species of SNSFM or other materials does it currently use, and what species of SNSFM might it use and how is it sourcing them?

Room & Board uses a wide range of hard and softwoods in its product lines, but pine—the most common species among SNSFM—does not feature in any of them. While it’s not out of the question, “Pine is just not a starting point for us because it’s such a soft wood,” Wilson said. “The magic formula [in selecting a species] is the level of hardness, the character, the ability to have it cut dimensionally. The holy grail is to find a wood that you can use over and over and build into a product that you can get using lumber on the open market.”

¹⁰ <https://www.roomandboard.com/catalog/living/urban-wood-project-baltimore> and
<https://www.roomandboard.com/blog/2018/06/salvaging-baltimore-with-the-usda-forest-service/>

¹¹ Disc-like slices of a tree often mounted—often with the bark left on—on a base for use as side-tables.

Rood & Board is currently working on developing supply chains from public lands in a couple areas of the United States (not yet in California), as well as with at least one additional urban source (see description of the Urban Wood Project above) in a location the company is not yet ready to disclose publicly.

What barriers does it currently face/does it anticipate facing in connection with using SNSFM?

Price Inconsistency:

Wilson emphasized that Room & Board wouldn't expect to pay a lower price for SNSFM than it would for other feedstocks because scaling the materials' use would require building out a supply chain from scratch. However, being unable to rely on a consistent price for the materials would represent a barrier for the company.

Reliable Availability:

Like others interviewed as part of this research, Wilson expressed concern about how reliable access to SNSFM might be. For example, as it explores sourcing from public lands in U.S. regions, Room & Board is finding a lack of milling and dry-kilning capacity presents a barrier, and raises questions around how long it would take to get up and running sufficient infrastructure to support its demand for materials.

What incentives or actions would make the company eager and/or able to use (or use more) SNSFM? "Supply and pricing need to be dialed in if you want to make major change for these forests, and make it possible for companies to utilize these materials over and over again versus doing one-off projects here and there," said Wilson. He suggested asking all partners to a project to hold pricing on the same schedule.

Additional insights and comments:

As a company that has always relied for production on a robust network of U.S.-based manufacturers, Wilson indicated that, while Room & Board could become a significant user of SNSFM or materials from forest stewardship in other regions, the company can't work with supply all over the country. Eventually, said Wilson, "more companies will need to come on board to shift supply chains. Room & Board's role is to be a heavy user and create a buzz; but we need others to get involved."

Wilson observed that plugging materials like SNSFM into their supply chains is hard for most other furniture companies because they tend to import most of the product they sell. On the other hand, he said, "If the mainstream furniture industry in America decided to shift even half of its volume back to the U.S., there's no way there's enough infrastructure (mills, kilns, manufacturers, workers, etc.) to support" such a move. We view this as a major potential area of expansion.

Company: Sierra Forest Products

Note: There are two companies named "Sierra Forest Products:" one makes laminates, cabinets, and other finished items; the other is a family-owned milling operation based in Terra Bella, California. This interview is with the latter.

Contact:

Kent Duysen, President

Top Takeaways:

- Sierra Forest Products is an experienced user of SNSFM.
- The company is committed to timber products as an important part of forest management solutions to forest health and resilience.
- Given its location in the Southern Sierra Nevada, it receives mostly dead, drought and beetle-killed SNSFM, but would be happy to process green SNSFM if it were available.

- Currently running a single mill shift and hesitant to add another because the region lacks the workforce to support it, and Duysen doubts supply from USFS will be reliable.

Recommended Follow-up:

Governor's Office of Planning and Research Wood Utilization Group of the Rural Economic Development Subcommittee of the Forest Management Task Force and Governor's Office of Business and Economic Development: As part of this group's workforce development efforts, talk with Duysen about the workforce challenges he faces as a miller in the southern Sierra Nevada, and discuss with him ways the State could help mitigate those challenges, specifically by enabling millers to add additional shifts so they might process more SNSFM as they become available.

What is the company currently making/might it make with SNSFM?

Sierra Forest Products offers a variety of kiln-dried dimensional lumber for home construction, framing lumber, exterior decking; crating; pallets; 1"x material boards; random width and length "shop" cut from the exterior of logs for door and window components; and residual and by-products from mill waste, such as shavings for poultry bedding, sawdust for eggs and potting soils, decorative bark, humous, and bagged colored (tinted) white wood chips colored, which it distributes in Southern California.

What motivates its use of/interest in using SNSFM?

Ready Availability

Environmental Sustainability

Domestic/Local Product

Comments about motivation:

Duysen likes being able to take in "wood that needs to come off the land for several good reasons and use it before it gets too old." He said he has a strong sense of commitment to timber products as part of the solution to wildfire and forest health resilience.

In what format does/would the company need to receive SNSFM?

Sierra Forest Products receives logs only, and they come in all sizes—from 6" up to 60", but most of what they're getting is 10-12" and up. Duysen reported that trees smaller than 6" are typically chipped or they decay in the forest so they're not making it to his mill. His operation sees mostly drought- and beetle-killed trees from U.S. Forest Service land and roadside hazard trees, given its location in the Southern Sierra Nevada. Duysen said he would happily "take any diameter green trees if they were available."

What species of SNSFM or other materials does it currently use, and what species of SNSFM might it use and how is it sourcing them?

Duysen said Sierra Forest Products takes in mostly Ponderosa Pine, White Fir, Incense Cedar, and that he would eagerly take Douglas Fir if it were available. About 90% of his supply is from federal lands, with the balance coming from a combination of private, state, and tribal lands.

What barriers does it currently face/does it anticipate facing in connection with using SNSFM?

In order to produce more lumber, Duysen said his operation—and California, more generally—needs to install more dry kilns and train a new workforce. He would need to add another full shift to his operation. But he said it doesn't seem worth it to him to make those investments because he isn't confident that the USFS is going to produce enough material: "Training a crew would take a couple of years, he said, "and by the time they're ramped up, there may not be feedstock." In addition to a lack of workforce on the milling side, Duysen also sees a supply barrier at the USFS level due to lack of funding, and a decline in the skill level of USFS employees because, "people

are retiring, and the people coming up don't have the experience." Duysen views this experience gap as a key barrier to supply for his mill.

What incentives or actions would make the company eager and/or able to use (or use more) SNSFM? "I don't think anyone could talk me into adding another shift," said Duysen, based on the barriers he identified above. Nevertheless, Duysen did see hope in partnership potential between the USFS and California Department of Forestry & Fire (CALFire) through the Good Neighbor Authority, which allows the State to manage forest management projects on federal lands. He also thinks increasing the use of Master Stewardship Agreements, and modeling them on them on the one managed by Yosemite Stanislaus Solutions¹², could increase the pace and scale of work on USFS lands, and in turn, the supply of SNSFM to mills like his. Finally, he said the USFS must invest in recruiting and training a new generation of skilled workers.

Company: Vaagen Timbers

Contact:

Russ Vaagen, Founder & CEO

Note: Our conversation with Vaagen was more free-form than other interviews conducted for this research, but we attempted here to organize Vaagen's comments as responses to the questions we asked of other companies.

Top Takeaways:

- Vaagen Timbers is not a top candidate to immediately use SNSFM due to its location in Washington, but Russ Vaagen's insights are valuable to forest management efforts in California and SNSFM product development.
- Vaagen believes that 20-year (minimum) supply contracts are key, and his companies have benefited from successful Master Stewardship Agreements, and were recently awarded a supply contract under Washington's first Good Neighbor Authority.
- Vaagen recommends locally driven and controlled manufacture and processing of lumber, supported by mass timber manufacturing located along major interstates or rail lines.
- Vaagen is concerned about the viability of Ponderosa Pine as a material for CLT.

Recommended Follow-up:

The California Forest Management Task Force's Rural Economic Development Subcommittee's Wood Utilization Group should follow up with Vaagen and bring him to California to brief the Task Force, members of the business community, NGO stakeholders, investors, and other interested parties. Stacy Caldwell at the Truckee Tahoe Community Foundation has expressed interest in helping to fund such a visit.

What is the company currently making/might it make with SNSFM?

Vaagen Timbers is a new company focused on making CLT and Glulam (glue-laminated timber) products. The company is currently prototyping and testing these products and plans to go to market soon. The company is not currently planning to use SNSFM in its product line.

In what format does/would company need to receive SNSFM?

Vaagen Timbers uses milled and kiln-dried dimensional lumber that it lays up into panels and beams.

What species of SNSFM or other materials does it currently use, and what species of SNSFM might it use?

In all its product lines, Vaagen will offer Spruce Pine Fir and Douglas Fir Larch varieties.

¹² <https://yosemitestanislausolutions.com/wp-content/uploads/2018/03/YSS-Goals-and-Objectives-for-2018-19.pdf>

How is the company sourcing the materials it currently uses?

Vaagen Timbers' founder Russ, is part of the Vaagen Brothers Lumber company, which has decades of experience sourcing timber from a variety of public and private sources. Recently, Vaagen Brothers Lumber was awarded a timber contract under the State of Washington's first-ever Good Neighbor Authority agreement.¹³

What barriers does it currently face/does it anticipate facing in connection with using SNSFM?

Particular Characteristics of the Material:

In considering the viability of using SNSFM in Vaagen Timbers products, Russ Vaagen was most concerned about the suitability of Ponderosa Pine for use in CLT and Glulam:

"Ponderosa Pine is tricky from a value standpoint when it comes to value-added products. Large Ponderosa Pines create stable and beautiful wood. But small trees grow without heartwood and sapwood, so it's not as stable. As a pioneer species, Ponderosa Pine grows back really fast and gets tall quickly, but the juvenile stuff also tends to have large knots. [Note: It's these young, small diameter trees that comprise much of what we consider SNSFM.] When you dry it [an essential step in processing wood for CLT and glulam] it twists like a dried-up sponge. The quality of this wood is very inconsistent, and not just DBH-predictive."¹⁴

Vaagen noted that X-ray and CT scan technologies can help predict lumber performance, but these are not widely adopted in the industry.

Additional insights and comments:

Russ Vaagen is exploring ways to scale mass timber and "right-sized milling" throughout the USFS system. His model is focused on creating value-added products from materials resulting from forest health management projects at the regional-landscape-scale, and is predicated on bringing together "all ownership types" (private commercial, private non-commercial, federal, state) to collaborate with millers and manufacturers on projects that are at least 20-years in length. The model hinges on forest management contracts—such as Master Stewardship Agreements—held by trustworthy local entities; the materials they produce would feed centralized CLT facilities located on major interstate highways or rail lines. In addition to the forest health benefits, Vaagen sees his model as helping to reinvigorate independent family owned timber companies that he said, "took the brunt of the timber wars [of the late 1960s and early 1970s]." Vaagen is currently collaborating with Melissa Jenkins and Steve Marcus at U.S. Forest Service and working with members of Congress to build bipartisan support for large pilots to launch his model.

Useful Insights from Other Companies Interviewed

Company: Lowe's

In an interview, Chris Cassell, Director of Corporate Sustainability for the home improvement chain indicated that conversations with the manufacturers of Lowe's products would be more likely to lead to valuable insights about interest in incorporating SNSFM in supply chains. The company he recommended most strongly was Trex, which manufactures structural composite lumber decking (see "Structural Composite Lumber" in the *High Potential Use-Cases* section, below). He also suggested manufacturers of tool handles might be worth approaching. Cassell shared that most of the timber products (lumber, etc.—not finished products made from wood) Lowe's sells are cut, milled, and sold within a 100-mile radius of the point-of-sale (local Lowe's store). In his role, Cassell works with multiple stakeholders, and has observed that the appeal of certified lumber products is limited among Lowe's

¹³ "The agreement allows states to enter into contracts for restoration work on U.S. Forest Service lands as an agent of the federal government, but the states must follow federal laws." <http://www.spokesman.com/stories/2018/aug/31/vaagen-brothers-wins-state-contract-for-restoration/>

¹⁴ DBH=Diameter at breast-height, the standard way of measuring trees. Vaagen's comment is based on the understanding that, for many tree species, knowing the DBH allows timber processors to predict essential qualities of a tree.

customers: “NGOs are pushing for FSC certification of our products. And, most customers like the FSC logo, but are not willing to pay more for certified products,” he said.

Company: Williams-Sonoma Co.

While FSC and other certifications might not have much cachet at point-of-sale at Lowe’s, David Williams, Corporate Social Responsibility Manager at Williams-Sonoma Co. (W-S) said such certifications are an important planning tool for W-S as it seeks to improve overall supply chain sustainability across its family of home furnishing companies, including West Elm, Pottery Barn, and others. W-S has a goal to use 50% responsibly sourced wood in its supply chains by 2021, and uses a three-tiered system—good, better, best—to rate wood. Williams said W-S considers FSC the “gold standard” of existing certifications; therefore FSC-certified wood falls into the “best” category.

Williams shared that W-S updates its goals and standards on a regular basis, and would likely be open to other sources and certifications—if they were accompanied by a clear chain-of-custody. Therefore, a follow-up conversation with Williams and colleagues might be worthwhile in order to explore what it would take for W-S to bring SNSFM into its supply chain—particularly as the company prepares to update its sustainability goals for wood.

Williams also suggested that a potentially more straightforward W-S use for SNSFM might be as flooring, shelving, decoration in its stores. See “Store Development & Display” in the *High Potential Use-Cases* section that follows.

High-Potential Use-Cases

Significant economic and policy analyses, such as those cited in Footnote 2, have examined an array of use-cases for SNSFM. This section highlights high-potential uses that the literature has explored less, or has not yet explored because they are only beginning to emerge.

Mass Plywood Panels

What:

A Mass Plywood Panel (MPP) is a type of large-scale “mass timber” product made by laminating together many layers of veneers¹⁵ into large, structural panels that can be highly customized and used in multi-story buildings in the same ways as the more well-known Cross-Laminated Timber (CLT). At the time of this writing, Freres Lumber is the most prominent U.S.-based developer of MPPs.

Why:

A number of key reports identify Cross-Laminated Timber as a high-potential use for SNSFM, for its ability to use large quantities of “low-value” timber in a long-lived, durable product that stores forest carbon in a fire-resistant material in the built environment, while decreasing the need for concrete and steel in multi-story buildings. Research and testing demonstrate that MPPs offer the same benefits. In addition, since MPPs are composed of veneers, they might offer a more viable mass timber application of SNSFM than CLT, given the types of concerns about the characteristics of small-diameter Ponderosa Pine raised by Russ Vaagen, and reported in the section above. Versatility is an added benefit of MPPs; they are available in 4-foot to 12-foot standard widths and lengths up to 60 feet, which make it relatively simple to incorporate into existing building streams.¹⁶

¹⁵ Veneers are created by slicing or peeling logs very thinly, and laminating them together. Mass Plywood Panels comprise many veneers laminated together. Video content found here helps illustrate the process: <https://frereslumber.com/products-and-services/mass-plywood-panel/>

¹⁶ https://www.woodworks.org/wp-content/uploads/presentation_slides-FRERES-Mass-Plywood-Panels-WSF-180828.pdf

As California seeks to both increase and rebuild a stock of fire-resilient¹⁷, and in some cases, affordable housing, mass timber options, including MPP, offer significant appeal and promise. However, significant testing of Ponderosa Pine—both green and dead—is necessary to determine its viability or lack thereof for CLT, Glulam, or MPPs.]

Recommended Follow-up:

- The Joint Institute for Wood Product Innovation¹⁸ should prioritize robust testing of small diameter Ponderosa Pine, dead blue-stain and/or beetle-killed Ponderosa Pine (various diameters), and other common SNSFM species for viability in MPPs, as well as CLT.
- Contact The Collins Company, Freres Brothers, and Sierra Pacific Industries to explore interest in and barriers to manufacturing MPPs and/or CLT from SNSFM pending proof of materials viability.
- Conduct demand-side research to determine interest by companies such as Factory OS (modular construction company based in Vallejo), Fabric Homes (emerging mid-market, multi-unit housing startup based in Truckee), as well as architects, traditional developers, and contractors. Collect letters-of-interest from those companies eager to use SNSFM-made MPPs and/or CLT.

Structural Composite Lumber

What:

The Structural Composite Lumber (SCL) manufacturer, Performance Panels, defines SCL as:

“[A] family of engineered wood products created by layering dried and graded wood veneers, strands or flakes with moisture-resistant adhesive into blocks of material known as billets, which are subsequently resawn into specified sizes. SCL includes laminated veneer lumber (LVL), parallel strand lumber (PSL), laminated strand lumber (LSL) and oriented strand lumber (OSL). The term SCL was coined to capture a wide array of products, some of which are proprietary or unique to one manufacturer. In SCL billets, the grain of each layer of veneer or flakes runs primarily in the same direction.”¹⁹

Why:

SCL is sold in a variety of shapes and sizes, including common lumber dimensions, such as those used to frame houses and build decks; these can also be used to create CLT panels. SCL could be a viable use for SNSFM because its quality and integrity are likely less sensitive to inconsistent material quality since the billets are composed of veneers, strands, or flakes laminated together.

Recommended Follow-up:

- Trex has been making composite decking out of a variety of materials since 1996, and SNSFM seem a natural fit for its supply chain. While Trex declined to participate in this research, we recommend contacting Trex to explore potential interest in using SNSFM.
- Contact American Wood Products Association (APA) for help identifying SCL manufacturers with potentially high interest in using SNSFM.

¹⁷ See results of Freres Lumber’s MPP fire resistance tests here: <https://frereslumber.com/wp-content/uploads/2018/03/R23086.01.001c.pdf>

¹⁸ Led by the California Board of Forestry and Fire Protection in collaboration with the University of California and California State University: <https://bofdata.fire.ca.gov/board-committees/joint-institute-for-wood-products-innovation/>

¹⁹ <https://www.performancepanels.com/structural-composite-lumber>

Store Development & Display

What:

Large chain retailers often use wood panels for flooring, feature walls, as well as for display shelving and accents.

Why:

A conversation with David Williams, Corporate Social Responsibility Manager at William-Sonoma Companies (Pottery Bard, West Elm, etc.) (WS), revealed that large chain retailers opening stores in new markets often pursue designs that help the store reflect the culture, aesthetic, values, etc. of the local community. While most of WS's products are manufactured and sourced internationally, Williams thought SNSFM might be compelling to the company's store development and display team.

Recommended Follow-up:

Contact WS store development and display team (get contact information from David Williams) to understand how they select materials, and evaluate initial interest.

Conventions & Conferences

What:

This category includes a vast array of staging and display items used at conferences and conventions, including, but not limited to, exhibitor booth infrastructure, platforms/stages, flooring, temporary walls, furniture, decorations; it also includes "SWAG" items, such as coasters, key fobs, and logo pins.

Why:

Conferences and conventions are incredibly resource-intensive, and some convention centers are looking for ways to reduce their carbon footprints. A conversation with Betsy Longmire at Visit Sacramento (which runs the Sacramento Convention Center) revealed that conferences and conventions hire decorators (often from a list of vendors approved or recommended by the convention center) who create a design that gives the conference site the look and feel the host wants for their event. These decorators source staging, display, and SWAG items from a variety of sources, and sometimes have large warehouses of inventory they pull from on an ongoing basis. Since a number of conferences and conventions in California, including in the Sacramento area, focus on climate, environment, and conservation, decorators might find value in "greening" their supply of staging items by incorporating items made from SNSFM to accommodate certain clients.

Recommended Follow-up:

- Contact some of the companies found in *Appendix 2—List of Conference & Convention Decorators*, provided by Betsy Longmire at Visit Sacramento to explore how they source the items they use, what they keep in their inventory, and whether they're seeing increased demand for "green" materials. Also, ask them to recommend some manufacturers of "SWAG" items.
- Follow up with SWAG manufacturers to explore the same types of questions.
- Contact Betsy Longmire at Visit Sacramento to explore the potential for the Sacramento Convention Center to enact some requirements or incentives for conference hosts or decorators to use items made from SNSFM. Contact other conventions centers in the Sierra Nevada region (such as in Reno) and throughout California.

Wood Fiber Insulation

What:

According to the website for GoLab, a start-up manufacturer of this product, "Wood fiber insulation is made from the mountains of clean, residual wood chips that pile up daily at lumber mills. GoLab takes this valuable

byproduct, grinds it into wool-like fibers, adds some adhesives and presses it into innovative, highly efficient insulation.” GoLab, based in Maine, is currently planning to launch several wool insulation products for exterior and interior use.

Why:

This is a strong waste-to-use case that can help displace traditional, toxic insulation with a safe product. Since the insulation is made of fibers, and is therefore not sensitive to timber quality, it is a great use for mill waste, small forest biomass, and even the smallest diameter logs that lack other uses.

Recommended Follow-up:

- Contact Joshua Henry, President of GoLab to explore potential interest in a California-based operation that uses SNSFM.
- Begin seeking potential California-based developers of wood fiber insulation product, perhaps through the Joint Institute for Wood Product Innovation.

Biolaminate

What:

Biolaminates are biomass-based resin products produced through biotechnology.

Why:

Resins, which are often formaldehyde- or polyurethane- based, contain toxic chemicals that are not biodegradable. Biolaminates produced from forest biomass could offer less-toxic options for a variety of applications, including in mass timber products like CLT and mass plywood. A Berkeley-based company, Lygos, is developing biolaminates, and its CEO, Eric Steen, highlighted them during a bioresources summit hosted in early 2019 by the California Air Resources Board and UC Berkeley, as a potential use for SNSFM.

Recommended Follow-up:

Contact Eric Steen at Lygos to discuss current access to SNSFM as feedstock, as well the company’s interest in, and perceived barriers to, accessing an adequate supply of SNSFM to scale.

“Nanostyrofoam”²⁰

What:

This product, currently under development by a team at Washington State University, uses cellulose nanocrystals to create a petroleum-free Styrofoam-like material.

Why:

This is another use-case that is not sensitive to biomass/wood quality, can use very small material, and that also displaces a toxic, non-biodegradable product with a non-toxic one that does break down in the environment.

Recommended Follow-up:

Contact researcher Amir Ameli at Washington State University.

²⁰ <https://news.wsu.edu/2019/05/09/researchers-develop-viable-environmentally-friendly-alternative-styrofoam/>

Fabrics & Threads

What:

A growing number of companies are marketing fabrics and thread made from tree cellulose. Examples include Allbirds, the popular footwear company, which offers a line of sneakers made from its eucalyptus cellulose “Tree” material;²¹ Spinnova;²² based in Finland, which is making textiles from tree fibers; and Patagonia²³ (the outdoor apparel company), and sustainable apparel company Amour Vert²⁴ are among companies that prominently feature TENCEL, a fabric made from tree fiber.

Why:

All of these companies center environmental sustainability and social impact in their value propositions, and their products offer potential uses for SNSFM that can use very small material and are not sensitive to the quality of the material.

Recommended Follow-up:

- Contact Allbirds, Spinnova, Amour Vert, and Patagonia to understand their supply chains for these fabrics and threads, and to gauge interest in incorporating SNSFM into their products.
- Build out a list of companies that use TENCEL and other tree fiber fabrics and threads and reach out to them.

Finishes for Tiny Homes and Modular Buildings

What:

Tiny homes and modular houses or buildings can also provide clear potential uses and markets for SNSFM both as finishes and structural materials. We mention them here to note they are an additional market sector worth exploring

Why:

The Tiny Home market is currently a boutique niche in the housing market, comprising less than 1% of new housing starts, but may grow over time due to low cost of ownership. Meanwhile, a number of California-based housing innovators have launched or are exploring modular-based housing products and models.

Recommended Follow-up:

- Contact Factory OS, a modular builder in Vallejo, California.
- Connect with Fabric Homes, a mid-market housing start-up interested in modular and other models that use SNSFM, based in Truckee, California.
- Reach out to Tumbleweed Tiny Homes, now based in Colorado, is the most well-known tiny house company, and currently offers Colorado beetle-kill pine finishes as an option in its homes.

Pyrolysis

What:

Pyrolysis is a thermo-chemical process, using controlled heat to restructure molecules of wood and cellulose materials into useful products. It is a very old technology, used for millennia across the planet to produce charcoal. Biomass pyrolysis can generate a wide range of products directly, including various kinds of bio-oils, process steam, heat, biochar, carbon, charcoal, and synthetic gas (commonly referred to as syngas). There are many existing and emerging pyrolysis technologies each with associated ecological risks and benefits.

²¹ <https://www.allbirds.com/pages/our-materials-tree>

²² <https://spinnova.com/>

²³ <https://www.patagonia.com>

²⁴ <https://amourvert.com/collections/tencel>

Why:

Pyrolysis offers a low- to mid-cost tool to process a broad range of biomass from agricultural waste to urban waste, including major amounts of SNSFM. The range of potential outputs, in addition to those cited above, can be used to create higher-value outputs, such as activated charcoal. As a versatile technology, the right pyrolysis unit can anchor an efficient multipurpose forest industry cluster such as the Resource-Regen facility emerging in Loyalton, California. Forest industry clusters can be quite efficient both in terms of energy usage and economic benefits due to the ability to share heat, power and raw materials. Since Pyrolysis units can be designed for scaling, they can size both up and down to meet local needs and conditions. Some of the current focus on pyrolysis is based on its potential to displace from existing pipeline infrastructure natural gases obtained through hydraulic fracturing and other methods. While pyrolyzed fuels may become critical transitional fuel sources in California and elsewhere, regulation and oversight must ensure that supply sourcing and output advance overall carbon and environmental goals.

Recommended Follow-up:

Several companies have launched or are developing projects in California. We recommend following up with them including:

- All Power Labs
- Advanced Resilient Technologies
- Quanverge

Conclusion

Developing a renewable wood products economy can spark a sustainable economic engine for resilience management of forestlands in order reduce the spread and intensity of wildfires and protect critical carbon sinks in California's Sierra Nevada region—while also creating opportunities for thousands of people in economically disadvantaged or depressed areas of California. Our research concludes that, indeed, the high-profile nature of the dangers associated with inaction on Sierra Nevada forests presents an appealing opportunity for motivated companies to position themselves as social and environmental heroes and circular economy leaders by incorporating SNSFM into their supply chains. But these companies need State and Federal partnership in order to quickly and successfully build SNSFM into their product lines. The findings herein offer important context about the specific types of barriers these companies face, and we hope this report's recommendations serve as starting points for State and Federal actors seeking to increase the pace and scale of forest resilience management by designing and implementing policies, programs, and incentives that facilitate the rapid and robust flow of SNSFM into supply chains.

As California forests experience more intense and faster spreading fires that emit high volumes of carbon into the atmosphere, we must quickly implement scalable, ecological forest management practices that restore and sustain forest health, reduce the risk of such high-severity fires, and ensure forests' function as natural carbon storage sinks. Developing a right-sized renewable wood products economy that can create a sustainable economic engine for thousands of people in disadvantaged or depressed areas of California is central to achieving forest health and resilience goals. We recommend that, given the urgent need to reduce greenhouse gas emissions, those leading the development of such economies prioritize longer-lived, durable uses of SNSFM that effectively "park" carbon over the life of the product.

Appendix 1—Companies, Contacts, and Research Participation

Key											
Company Info			Interest Level		Research Participation						
Company Name & Headquarters	Product Types	Contact Name & Title	AU	HI	CS	INT	RF	RI	DR	DP	DC
Aemetis <i>Cupertino, CA</i>	Cellulosic Biofuels	Eric McAfee, VP/CEO	x		x	x	x	x			
Allbirds <i>San Francisco, CA</i>	Footwear (use eucalyptus fiber)										x
Armstrong World Industries/Architectural Components Group <i>Lancaster, PA</i>	Ceilings, Veneers	Charles Fowler, Dir. Of Wood Product Devel.					x		x		
Arauco (USA) <i>Santiago, Chile</i>	Pulp, Panels, Lumber										x
Cal Panel <i>Cerritos, CA</i>	Plywood, Veneers (Distributor)						x		x		
The Collins Companies <i>Portland, OR</i>	Siding; what else?	Lee Jimerson, Collins Wood Sales Manager	x		x	x	x	x			
Crate & Barrel <i>Northbrook, IL</i>	Furniture, Decorative	Candace M., CSR Specialist							x		
Disdero <i>Clackamas, OR</i>	Paneling, Dimensional lumber	Rob Burnett, Purchasing							x		
Factory OS <i>Vallejo, CA</i>	Modular building units	Rick Holliday, CEO					x		x		
Freres Lumber Co. <i>Lyons, OR</i>	Veneers, Plywood, Mass plywood	Tyler Freres, VP of Sales		x	x	x	x	x			
GoLab <i>Belfast, ME</i>	Wood Fiber Insulation	Joshua Henry, President					x	x			
The Home Depot <i>Atlanta Georgia</i>	Plywood, Fence Boards, Paneling, Lumber	Tiffany Seto, Mgr. of Sustainability							x		
Lowe's <i>Mooresville, NC</i>	Plywood, Fence boards, Paneling, Lumber	Chris Cassel, Dir. Of Corp. Sustainability		x	x	x	x	x			
LP Building Products (Louisiana Pacific) <i>Nashville, TN</i>	Dimensional lumber, Engineered wood products	Scott Johnson, Flame Block Market Devel. Mgr.							x		

Company Info			Interest Level		Research Participation						
Company Name & Headquarters	Product Types	Contact Name & Title	AU	HI	CS	INT	RF	RI	DR	DP	DC
Lygos <i>Berkeley, CA</i>	Biolaminate (Resin for CLT, e.g.)	Eric Steen, CEO					x		x		
Patagonia <i>Ventura, CA</i>	Outdoor clothing and athleisure wear	Ron Hunter									x
Pioneer Millworks <i>Farmington, NY</i>	Single origin batch products, flooring, paneling, etc.	Michele Caryl, Purchasing Mgr.		x	x		x	x			
Roseburg, <i>Springfield, OR</i>	Dimensional lumber, Plywood, Structural composite lumber										x
Restoration Hardware <i>Corte Madera, CA</i>	Furniture, Decorative	Alisa Cunningham, VP of Sourcing							x		
Room & Board <i>Minneapolis, MN</i>	Furniture, Decorative	Gene Wilson, Dir. Merch. & Vendor Mgmt.		x	x	x	x	x			
Sierra Forest Products <i>Mississauga, Ontario</i>	Plywood, Panels, Cabinets, etc.										x
Sierra Forest Products <i>Terra Bella, CA</i>	Dimensional Lumber, Secondary products	Kent Duysen, President	x		x	x	x	x			
Sierra Pacific Industries <i>Anderson, CA</i>	Dimensional lumber, Window frames, Engineered wood products	Andrea Howell, Corporate Affairs Dir.	x		x		x	x			
Spinnova, <i>Finland</i>	Tree cellulose fiber fabric							x			x
States Industries <i>Eugene, OR</i>	Panelized products	Shaun Attrell, Purchasing Mgr.							x		
Trex Building Materials, <i>Winchester, VA</i>	Composite lumber (decking, etc.)	Samara Norman, Senior Materials Buyer					x	x		x	
Truckee Tahoe Lumber Company <i>Truckee, CA</i>	Fence boards, Deck boards, Siding	Andrew Cross, Pres. & CEO							x		
US Slatwall <i>Leander, TX</i>	Low-pressure laminate slatwalls, etc.										x

Company Info			Interest Level		Research Participation						
Company Name & Headquarters	Product Types	Contact Name & Title	AU	HI	CS	INT	RF	RI	DR	DP	DC
Vaagen Timbers <i>Colville, WA</i>	CLT & Glulam	Russ Vaagen, Founder & CEO		x	x	x	x	x			
Washington State University <i>Pullman, WA</i>	Nanostyrofoam	Amir Ameli, Asst. Prof; Mech. & Mat'l's Engineering					x		x		
Williams-Sonoma, Inc. <i>San Francisco, CA</i>	Furniture, Decorative	David Williams, CSR Manager		x	x	x	x	x			

Appendix 2—List of Conference & Convention Decorators

Courtesy of Betsy Longmire with Visit Sacramento

- 1) **American Expo Services**
1627 Main Ave., Suite 2, Sacramento, CA 95838
Ph: 916-925-3976
www.american-expo.com
- 2) **Curtin Convention Services**
2269 Chestnut St., Suite 628, San Francisco, CA 94123
Ph: 415-883-7818
www.curtinconvention.com
- 3) **Freeman Decorating**
850 Spice Island Dr., Sparks, NV 89431
Ph: 775-355-4600
- 4) **GES Expo Services**
1400 K Street, Suite 309, Sacramento, CA 95814
Ph: 916-442-2252
- 5) **L.B. Lightswest, Inc.**
2488 Maggio Circle, Lodi, CA 95240
Ph: 209-333-0996
www.lbproductioncenter.com
- 6) **Rossi Exposition Services**
1040 22nd Avenue, Oakland, CA 94606
Ph: 510-436-7500
www.rossiexpo.com info@rossi.com
- 7) **STL, Ltd**
950 Richards Blvd., Sacramento, CA 95811
Ph: 916-447-5000
www.stlltd.com expo@stlltd.com
- 8) **The Party Concierge**
601 North 10th Street, Sacramento, CA 95811
Ph: 916-440-8080
www.partysacramento.com