UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources
Forest Stewardship

Forest Stewardship Education Newsletter
February 2023
Woody Biomass & Forest Products, Part 2

Greetings from UC ANR

Continuing our exploration of woody biomass and forest products, this issue looks at wood products in the building sector and their roles as viable alternative materials to traditional energy-intensive materials, as well as biomass to bioenergy. Thanks to Cindy Chen and Haris Gilani for their contributions.

If you are interested in Part 1: woody biomass-based energy products (e.g., biochar, bioenergy and biofuel, and wood pellets), you can find it here.

UC ANR is fortunate to have recently hired Haris Galani, Biomass and Bioenergy Advisor. Haris is located in Riverside County and also serves San Bermardino County. His current research is focused on commercializing and deploying low-carbon and carbon negative fuels using non-merchantable forest biomass in the state of California. Read more about Haris below!

Cheers,
Kim Ingram, Forest Stewardship Coordinator

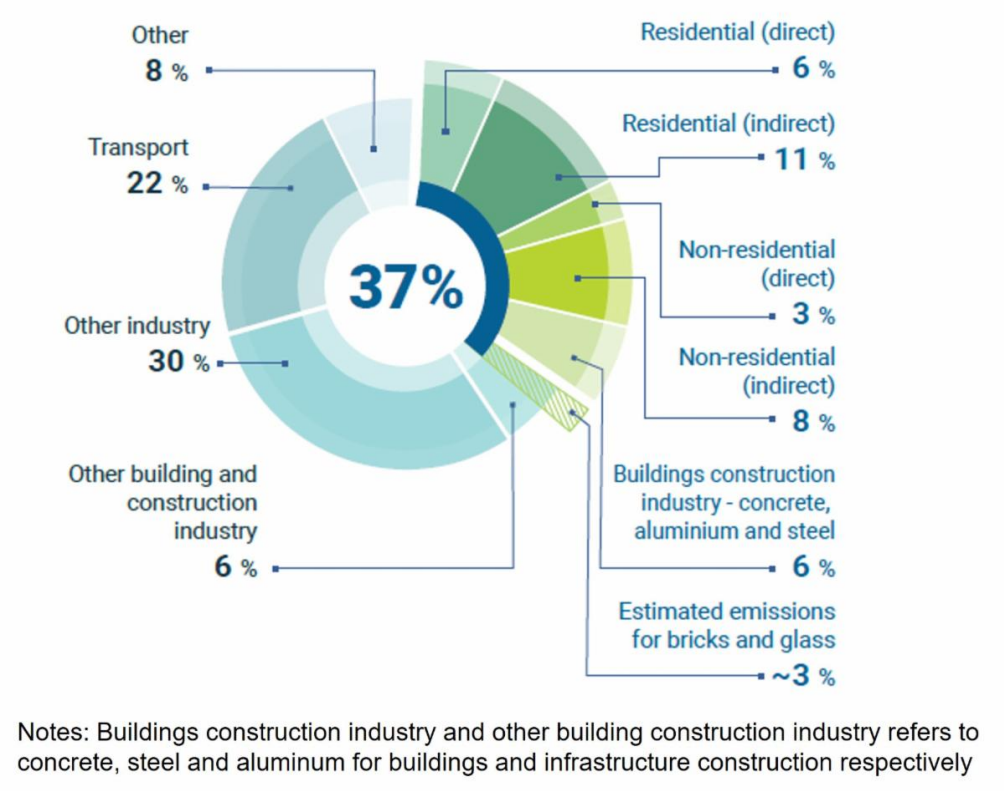
Composite panels and wood fiber products allow the use of small diameter trees and encourage the removal of hazardous forest fuels since they can generate economic returns.

Common Wood Products in Construction

Wood products can be produced using woody biomass and timber. For example, woody biomass is used in composite panels and wood fiber insulation, and dimensional lumber can be used in many engineered wood products, in particular, mass timber products. Mass timber refers to a category of large-scale structural engineered wood product, usually layered with lumber, in the form of panels and beams. Some of the main features of mass timber are its carbon storage capacity, fast construction time, lighter weight compared to concrete and steel, and high fire resistance rating.

Common wood products used in the building sector. Top row: dimensional lumber, plywood, and veneer. Bottom row: cross-laminated timber (CLT), glue-laminated timber, and wood fiber insulation.

The 2022 Global Status Report for Buildings and Construction published by the United Nations Environment Programme (UNEP) indicated that the building sector accounts a total of 37% of the global carbon emission. As shown in the pie chart below, direct emissions are from the direct use of fossil fuels while indirect emissions come from electricity use. The manufacturing of materials such as concrete, steel, and aluminum for buildings represents about 6% of global emissions. Increasing the use of renewable building materials has become an urgent matter in global emission reduction.



Share of the building sector in global CO2 emissions in 2021 (UNEP, 2022)

Wood Fiber Products

Small-diameter trees are often considered to have low commercial

value because they are not a viable raw material for lumber. They are often left in the forest, which, along with other woody residuals, become fuel for wildfires over time. Developing composite panels and wood fiber products from these trees encourages the removal of hazardous forest fuels since they can generate economic returns. Products such as composite panels and fiber insulation can be made with a mix of various materials, including agricultural by-products, woody residuals, biodegradable plastic, etc. The performance of these products varies by density, material mix, and physical features.

Mass Timber

Products such as composite panels, veneers, and plywood cannot be used as structural components in a building, but mass timber like cross-laminated timber, or CLT, can be used for walls or roofs. Other mass timber products, for instance, glulam (glue-laminated timber), can be used in beams. Compared to buildings using conventional non-wood materials, mass timber materials are lighter, meaning they are easier to transport and lift, reducing environmental impacts and costs associated with transportation and heavy equipment use. In addition, mass timber can come prefabricated, reducing the construction time. For instance, a typical mid-rise mass timber building can be completed in 2 to 3 months.

An overview of how mass timber is used in building construction

---

Demand for Wood Products in California

While California is one of the largest consumers of engineered wood products in the U.S., there are currently no mass timber manufacturers within the state. As of 2021, 178 mass timber construction projects were either in the design phase, started or completed in California, making the state a leader in the U.S. for the number of mass timber projects. Based on a report produced by the Sierra Institute, CLT accounts for 59% of the mass timber construction projects that are in design, indicating a growing market trend for CLT over other mass timber products. California's recently updated building codes allow mass timber buildings of up to 18 stories tall, which opens up new market opportunities for wood construction materials. On the local level, an innovative wood products industry can bring new job opportunities and economic revitalization.

For the latest information on mass timber projects in the U.S., see the market trends snapshot by WoodWorks.

Mass timber construction is a cost-effective alternative building material

---

Challenges and Future of Wood Products Utilization

Currently, some of the main challenges associated with mass timber utilization include:

- Mass timber is still relatively new in the U.S. and requires more public attentions and acceptance;
- Mass timber materials cost more than conventional building materials;
- Lack of skilled labor force and technical support in mass timber manufacturing and construction; and
- Customized product are not often available.

Public awareness, industry engagement, research, policy support, and community involvement are needed to lead to wider adoption of mass timber in the building sector.

Engineered wood products

UC Woody Biomass Utilization website	USFS Forest Products Laboratory	Joint Institute for Wood Products Innovation

Meet Haris Gilani, UC Biomass and Bioenergy Advisor

What excites you about the Biomass & Bioenergy position? I am thrilled about the Biomass & Bioenergy position at UC ANR as it will allow me to contribute towards the state's wildfire reduction and climate change goals and help improve the lives of all Californians.

Biomass & Bioenergy is a field that is growing in importance in California as the state looks for more sustainable and renewable sources of energy. The use of biomass & bioenergy can help reduce dependence on fossil fuels and lower greenhouse gas emissions, which is important for mitigating climate change. Additionally, the use of biomass & bioenergy can also provide economic and social benefits, such as creating jobs and improving energy security. Given the conducive policy environment, I envision a future where the sustainable production of biomass for energy will play a key role in California's future climate-friendly energy system.

What topics or projects will you be initially working on?I aim to develop and implement an innovative extension education and applied research program with the goal of increasing the utilization of low value woody biomass in the region. That said, the first step is to conduct a need assessment in consultation with the communities, industry, environmental NGOs and relevant state agencies to identify the priority research areas and bioenergy-related challenges in Riverside and San Bernardino counties.

My goal is to investigate opportunities and strategies for increasing the use of woody biomass though development of biofuels and bioenergy, as well as other products. In order to help establish my research program, I will also be working on grant applications through various federal and state grant opportunities.

What future do you see for private forest landowners in their quest to utilize woody biomass? Private forest landowners are a critical part of the woody bioenergy supply chain in California as they control the feedstock that is used in the production of heat, power, or other energy sources. In California, private forest landowners own and manage more than 40% of the forest resource. There are numerous potential economic and environmental benefits to forest landowners from bioenergy production, including revenues from biomass sales, forest management cost savings, potential carbon credits, and potential forest health improvements.
Given the largely private and fragmented ownership of forest land in California, a diverse range of social values could influence bioenergy development through public policy. Development of bioenergy facilities in the state would result in benefiting local communities through economic development and job creation.

Currently, what are the biggest challenges in woody biomass or bioenergy? Successful commercialization of low- and carbon-negative energy such as biofuels from woody biomass is far from certain, despite existing policy support. Fundamental challenges relate to the inability to secure long-term feedstock contracts from public lands, exclusion of forest biomass from public lands under the federal Renewable Fuels Standard, supply from municipal and agricultural biomass markets, and a lack of

bioenergy infrastructure situated near California's forested communities.

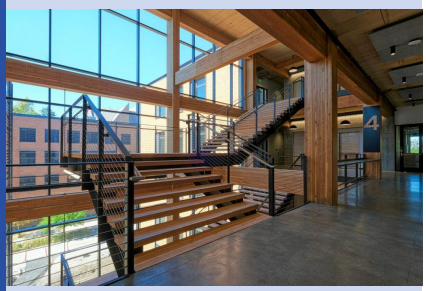
"Private forest landowners are a critical part of the woody bioenergy supply chain in California as they control the feedstock that is used in the production of heat, power, or other energy sources." - Haris Gilani, UC Biomass and Bioenergy Advisor

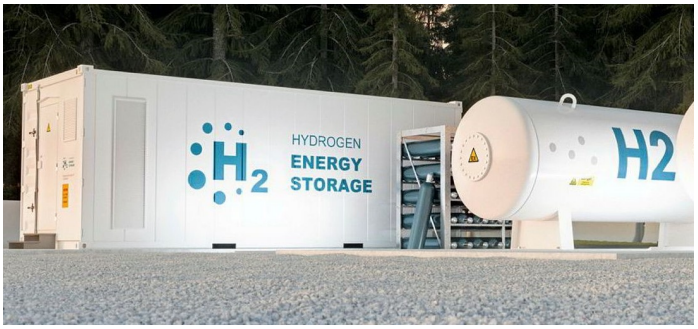
---

Mass Timber in Construction

WoodWorks provides a U.S. Mass Timber Construction Manual, highlighting the methods and technologies from preconstruction to finishing. This manual also includes an overview of different mass timber systems, as well as standards and requirements for building components.

The CLT Handbook by FPInnovations is a great documentation to learn all the basics of cross-laminated timber. The handbook comes in both the U.S. edition and the Canada edition and can be downloaded for free online. The handbook goes over the design and performances of CLT, which gives the readers a better understanding toward the unique features of this product.





Biomass to Biofuels

Biofuels are renewable fuels produced from sustainably sourced biomass, including plant material and animal waste. Examples of renewable biofuels include hydrogen, sustainable aviation fuel, ethanol, drop in gas/diesel, and renewable natural gas. Potential sources of renewable biofuels in California include sustainably sourced forest residues, agriculture residues, and municipal solid waste (MSW). These biofuels can replace fossil fuels (e.g., gasoline) and would contribute directly to energy independence as well as carbon mitigation goals.

Liquid or gaseous renewable fuels can be produced from sustainably sourced biomass using biochemical and thermochemical conversion processes such as gasification and pyrolysis.

Biochemical conversion of biomass involves the use of enzymes and microorganisms to convert biomass into alcohol-based fuels such as ethanol.
Gasification is a well-established technology that uses heat, steam, and oxygen to convert biomass to hydrogen and other products without burning the material (no combustion).
Pyrolysis involves heating of biomass in the absence of oxygen to decompose biomass into liquid, gaseous, and solid products (no combustion)

While biofuels have the potential to provide climate-friendly energy, not all biofuels are

Founder Hall at University of Washington (*Source: blog.foster.uw.edu*)

Forest Biomass

Agriculture Residues

Municipal Solid Waste

created equal. For example, ethanol is the same chemical product regardless of its source material; however, the renewable source material used (corn, forest residues, or MSW) results in very different greenhouse gas (GHGs) emission reductions.

Coupling biofuels with carbon capture and storage is an environmentally friendly and economically viable option because of existing financial policy incentives for emission reductions, including the state's Low Carbon Fuels Standard and the federal 45Q tax credit, a tax credit incentivizing CO_2 storage or utilization.

The production of biofuels in California can play a key role in sustainable, healthy forests; reduced wildfire risk; increased carbon sequestration; improved air quality; and increased energy security in the transportation, buildings, and industry sectors.

Other items of note...

- Have you had your initial site visit with an RPF, Burn Boss or Certified Range Manager? There is still time! No matter which workshop you participated in (even back in 2020!), if you completed the workshop, you are eligible. You DO NOT need to complete your forest management plan before your site visit, just having your management goals thought out is good enough! Need to make up a session in order to qualify for your free site visit, we can arrange that. Contact Kim Ingram at kcingram@ucanr.edu for more details.

- Susie Kocher is leading a new Post-fire Forest Resilience Workshop Series. The first series was held last fall in the Sierras focusing on the Dixie, Caldor and Tamarack Fires. The Post-fire Workshop Series is 5 weeks long, meeting once a week in the evenings with 1 field day. The goal of the workshop is to connect landowners to information, resources, and professionals to help them manage their own land post-wildfire. Check the 'Upcoming Workshops and Field Days' box below for dates and locations of upcoming series. You can also reach out to Katie Reidy, Program Coordinator at kkreidy@ucanr.edu for registration information.

Small Forest Landowner Field Day Participants, St. Helena. Photo by Kim Ingram

For more information on the workshops, and to share with a friend, please visit:

Stewardship: http://ucanr.edu/forestryworskhopregistration

Post-fire: http://ucanr.edu/post-fireworkshops

DIY Field Days: https://surveys.ucanr.edu/survey.cfm?surveynumber=40061

Upcoming Forest Stewardship and Post-Fire Forest Resilience Workshops and Field Days:

- **Forest Stewardship** Workshop Series, Trinity Co-hort beginning March 14th - May 9th (April 1st field day)
- **Post-fire Forest Resilience** Workshop, Napa County beginning April 19th - May 31st (June 1st, 2nd and 3rd field days)
- **Forest Stewardship** Workshop Series, Fresno-Madera Co-hort beginning May 3rd - June 28th (May 20th field day)
- **DIY Small Hand Tools** Field Day at Jackson State Demonstration Forest, Ft. Bragg. May 6th
- **DIY Small Hand Tools** Field Day at Blodgett, Georgetown. June 10th
- **Post-fire Forest Resilience** Workshop, Siskiyou County beginning Summer 2023 (exact dates TBD)
- **Forest Stewardship** Workshop Series, Santa Clara-Santa Cruz Co-hort beginning Summer 2023 (exact dates TBD)

University of California Cooperative Extension | 137 Mulford Hall, #3114 | Berkeley, CA 94720-3114 US