

Scaling Juniper Markets: Sustainable Solutions for Rangelands and Rural Communities
Oregon State University
Scope of Work

Project Team and Implementation Plan

Project Team:

Oregon State University – Research and Development

Oregon State University's Department of Wood Science & Engineering has a long history of research and development related to wood and wood products, including products from western juniper. In fact, some of the earliest reported research exploring juniper for commercial products was conducted at OSU in the early 1950s; research and outreach related to juniper has continued up to the present including two recent M.S. projects – one exploring properties of juniper foliage essential oils and the other developing the engineering design values for juniper lumber. With 15 research and teaching faculty in the Department of Wood Science & Engineering in Corvallis, and Extension faculty located in County offices throughout Oregon, OSU is well-staffed and equipped to conduct research as well as technology transfer to foster commercialization and market development.

TASK 1: Innovation in Research and Development

Objective: Inform new product development and value propositions, marketing, and commercialization for increased use of juniper wood products.

Despite expanding market opportunities and demand for western juniper timbers and lumber products, the vast majority of western juniper standing inventory and fiber is not utilized. Due to poor stem form (such as large and numerous limbs and high degree of stem taper) only a small fraction, perhaps 20%, of juniper trees are suitable for sawing into lumber. And of those logs that are suitable, as much as 50% of the fiber is waste residuals from the milling process. Therefore, there are little to no market options for a substantial amount of juniper fiber that is harvested.

Further, the current large-volume market options for wood residues such as chips, shavings, and sawdust, are for low-margin, commodity composite panel products such as particleboard and medium density fiberboard (MDF). Mills producing these products in the Northwest rely nearly entirely on residual materials from primary production facilities such as sawmills and veneer/plywood mills; and these residuals are as close to 100% 'pure' wood (i.e., excluding bark, foliage, and other non-wood material) as is possible. In short, the economics have not been favorable to produce composite panel products from whole trees. Further, it is not known if it is even technically feasible to produce such products from a resource such as juniper that contains significant amounts of chemical compounds that impart aromatic properties and durability, let alone a resource comprised of a mixture of wood, bark, and foliage (i.e., whole tree).

Oregon State University will work to address these challenges through research and development projects that will explore the technical and economic feasibility of producing products from lower-quality juniper stems (i.e., whole trees) as well as residual materials such as sawdust, shavings, and chips from existing juniper enterprises. Specific products to be explored include 1) aromatic flakeboard and 2) conventional particleboard with varying percentages of juniper fiber added. These activities would be undertaken via a postdoctoral scholar working at OSU.

Activities:

1. Aromatic flakeboard – there are existing markets for Aromatic cedar (*Juniperus virginiana*) flakeboard as closet lining (e.g., CedarSafe Natural Closet Liner). As more of a niche product vs. a commodity panel product like particleboard, the margins are likely higher for this product. This research would seek to explore several variations of such products using western juniper (*Juniperus occidentalis*):

Year 1:

- a. Panels made from 100% wood as well as whole juniper trees (bark, foliage, and wood) in 3 thicknesses using a conventional adhesive (urea formaldehyde) as well as a new formaldehyde-free, bio-based adhesive
- b. Technical feasibility - Properties to be tested include moisture resistance/dimensional stability, mold resistance, and internal bond strength (resistance to delamination).
- c. Results will be presented in a report that lists details of the materials tested and results of the tests of mechanical and physical properties. The report will be shared via the Oregon Wood Innovation Center's website and newsletter and directly communicated to key stakeholders in Oregon including composite panel manufacturers. Data will also serve to inform additional work to be conducted in year 2.

Year 2:

- a. Product and process optimization – Follow-up research will be conducted based on results from year 1 with the goal of determining optimal combinations of processing parameters such as press time, moisture content, resin content, etc. to produce panels that meet or exceed established performance requirements. These efforts will be coordinated with interested composite panel manufacturers to facilitate commercialization of the findings. The data will be presented via an addendum to the year 1 report and will detail the estimated costs for sourcing required materials, development of a custom production facility, and market value of products.

2. Conventional particleboard – Oregon has several existing mills producing particleboard, primarily from residues of local pine and Douglas-fir sawmills and veneer mills. Collins Companies (Klamath Falls) and Boise Cascade (Elgin) in particular, have facilities in areas where juniper is abundant. Therefore there is existing high-capital infrastructure that could potentially add juniper residues to their existing mix of materials. The following tasks would be undertaken:

Year 1:

- a. Panels will be made with 3 mixes of juniper wood particles - 5, 10 and 20% using conventional particleboard industry adhesives and pressing procedures
- b. Technical feasibility – Properties to be tested include moisture resistance, internal bond strength, and impact on lamination (e.g., with common industry materials such as hardwood veneer or a paper overlay).
- c. Results will be presented in a report that lists details of the materials tested and results of the tests of mechanical and physical properties. The report will be shared via the Oregon Wood Innovation Center's website and newsletter and directly communicated to key stakeholders in Oregon including composite panel manufacturers. Data will also serve to inform additional work to be conducted in year 2.

Year 2:

- a. Product and process optimization – as with task 1, additional experimentation will be conducted to establish optimal process parameters such that products meet or exceed product standards. Costs for sourcing materials will be developed in Activity 1 above; if

technical feasibility is demonstrated, there will be no other impact on economics for existing producers

These activities will be conducted by a postdoctoral researcher using OSU's composite panel laboratory in Corvallis. Drs. Fred Kamke and Scott Leavengood will serve as co-principal investigators and supervisors.

Expected Outcomes:

A. High quality assessment of the unique features and commercial value of a range of juniper residual products to be marketed for greater utilization and increased sales.

B. Direct technical information provided to existing Oregon-based companies (i.e., particleboard producers) on the properties of panels produced with mixtures of juniper residues and their existing raw materials.