

Developing Markets for Lesser-Known Species: The Case of Western Juniper in Oregon

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Abstract

Western juniper (*Juniperus occidentalis*) acreage in the Great Basin of the western United States has increased dramatically in the past century. In Oregon alone, western juniper woodlands have expanded from approximately 607,000 hectares (1.5 million acres) in 1930 to about 2.6 million hectares (6.5 million acres) today. As juniper trees dominate a site, erosion increases, stream flows are reduced, forage production declines, and wildlife habitat is altered. Thinning juniper stands has been shown to help restore rangelands. However such efforts are economically marginal at best in the absence of markets for juniper logs.

Over the past century, numerous small-scale efforts have been undertaken to develop markets for western juniper. The Western Juniper Commercialization Project began in Oregon in the early 1990s as a concerted public/ private effort to develop markets for a wide range of value-added juniper products. Dozens of studies have been conducted including harvesting trials, mechanical and physical properties testing, kiln schedule development, mill recovery studies, and animal toxicity trials for essential oils. Products such as fencing, flooring, furniture, animal bedding, fuel pellets, hardboard, and essential oils have been developed; and market response to these products has been quite favorable. Technology transfer has been conducted via direct technical assistance, conferences, and a website for technical data; as part of the project, another website was developed for commercial enterprises to advertise their products. Yet after over 15 years and a great deal of enthusiasm and investment of resources, the western juniper industry is still in its infancy.

This presentation will discuss the Western Juniper Commercialization Project as a case study in market development for lesser-known species. Lessons learned will be shared as well as recommendations provided for how others considering similar activities can overcome the inevitable hurdles in lesser known species market development.

Keywords: lesser-known species, market development, western juniper.

Introduction

Western juniper (*Juniperus occidentalis*) is native to the arid intermountain region of the western United States. The species is common in eastern Oregon and northeastern California, and also found in limited areas of northwestern Nevada and southwestern Idaho.

Western juniper woodlands have expanded dramatically since European settlement of the western U.S. In Oregon alone, western juniper woodlands have expanded from approximately 607,000 hectares (1.5 million acres) in 1930 to about 2.6 million hectares (6.5 million acres) today (Azuma et al. 2005). Figure 1 shows a site near Prineville, Oregon in the U.S. The upper photo shows the area circa 1890 with scattered juniper trees, and some ponderosa pine (*Pinus ponderosa*). The lower photo shows the same site approximately 100 years later. Long-time residents in the region confirm what these photos show – juniper trees are now far more widespread than they were in the past.



Figure 1. Expansion of western juniper near Prineville, Oregon. Upper photo taken in 1890. Lower photo of same site in 1989 (Source: Miller et al. 2005).

Research has shown that as western juniper dominates a site, erosion increases, stream flows decline, forage production declines, and wildlife habitat is altered (Bedell et al. 1993, Miller et al. 2005). When conducted properly, thinning juniper stands has been

shown to help restore rangelands (e.g., Bates et al. 2000) however such efforts are economically marginal at best in the absence of markets for juniper logs. Development of sustainable markets for juniper products can help to improve the economics of rangeland restoration efforts in addition to providing jobs in rural communities.

Efforts to Utilize Western Juniper Wood

Over the past century, there have been numerous efforts to develop viable markets for western juniper wood. Settlers used the wood for fence posts and firewood; and given the natural durability of the species (Morrell et al. 1999), fence posts are still a common use for juniper. An abbreviated timeline of western juniper research and utilization is as follows:

- 1920s and 30s – juniper wood was tested for use as a substitute for cedar in pencil stock (Anonymous 1920)
- 1940s and 50s – research was conducted on essential oil distillation (Kurth and Ross 1954) and hardboard production (Frashour 1953, Frashour and Nixon 1956)
- 1970s – dry kiln schedules for juniper lumber were developed and tested (Kozlik 1976); a juniper ecology and management (wood utilization was also discussed) workshop was hosted in Bend, Oregon (Martin et al. 1978); a sawmill that processed western juniper lumber, paneling, and other value-added products operated in Prineville, Oregon¹.
- 1990s – thousands of acres of juniper have been harvested and chipped for use as boiler fuel in cogeneration facilities in northern California².

In 1991, the U.S. Forest Service hosted a meeting of wood products manufacturers in south-central Oregon. Impetus to discussions was provided by the closure of several local sawmills. The goal for the meeting was to identify critical issues from the perspective of wood products manufacturers, potential areas of cooperation, and entities that might work with the U.S. Forest Service and other government and non-profit economic development organizations. Raw material supply (regardless of tree species) was identified as the major issue facing the industry. In particular, there was renewed interest in better utilization of and markets for western juniper. Participants saw juniper as having the potential for a ‘win-win’ situation – restoration of rangelands and employment opportunities in rural communities.

The Western Juniper Commercialization Project (hereafter simply referred to as ‘the project’) developed as an ad hoc effort to address research needs and utilization opportunities for juniper. Within a few years of the initial meeting hosted by the U.S. Forest Service, the group grew to include nearly 900 interested parties that included a mix of government agency personnel, non-profit organizations, private landowners, and private industry. A steering committee composed of 7 to 10 individuals representing the same mix of entities directed the efforts of the project.

¹ Fire destroyed the mill in the late 1970s and it was not rebuilt.

² These activities are ongoing in 2008.

The first steps taken in the project were to contract with sawmills to produce kiln-dried lumber and then distribute the material to secondary manufacturers for ‘experimentation’ in value-added products such as cabinets, flooring, and furniture. Results of these trials were generally favorable; many companies expressed interest in developing a product line using juniper wood. However, since little was known about western juniper (and/or the results of prior research were not widely available), manufacturers posed a wide variety of questions such as availability and cost of juniper lumber, long-term sustainability of the resource, mechanical and physical properties, durability, chemical composition and properties of essential oils, to name only a few. To address these questions, the steering committee sought funding and partners to conduct a wide variety of applied research projects.

Research

During the 1990s, state and federal agencies in partnership with private organizations funded and/or conducted numerous studies related to juniper utilization. The Oregon Economic & Community Development Department and U.S. Forest Service in particular, invested a substantial amount of resources. Topics of studies spanned the forest industry value chain – from rangeland management and harvesting through value-added manufacturing and residue/by-product utilization. A brief summary of the projects conducted is described below. The purpose here is not to provide an exhaustive list of projects and their results³, but rather to demonstrate the comprehensive approach taken to explore as many opportunities as possible.

- Eastern Redcedar Industry study tour – the steering committee visited eastern redcedar (*Juniperus virginiana*) mills in Missouri to learn from a well-established industry using a similar species.
- Harvesting – trials were conducted to assess various harvesting systems (e.g., felling with chainsaws vs. mechanized systems), the impact on soil compaction, product yields, and costs
- Mechanical and physical properties – basic fiber and chemical properties of juniper wood were assessed (e.g., lignin content and fiber length) as well as determination of standard properties such as specific gravity, strength (bending, tension, compression and shear), hardness, fastener withdrawal, and dimensional stability. It should also be noted that durability research has been ongoing since the late 1940s (Morrell et al. 1999).
- Primary manufacturing –
 - Log grade rules – proprietary log grade rules were developed to assist logging contractors to sort logs for sawmills, veneer mills, or for ‘fiber’ applications (i.e., animal bedding, chips for composites, or hog fuel).
 - Log homes – commercial producers tested several approaches for producing log structures from juniper logs or cants.
 - Log storage & debarking – various durations of log storage and log end-coatings were evaluated to assess the impact on end checking/splitting; trials were conducted with rosserhead and ring debarkers to determine if the stringy nature of juniper bark would lead to debarking challenges.

³ Detailed results on all of the projects described here are available at <http://juniper.oregonstate.edu>.

- Lumber and veneer manufacturing – lumber and veneer (rotary-peeled and sliced) were produced and data were collected on finished product yields. Decking and siding were produced and test-marketed.
- Kiln drying – to complement work done by Kozlik (1976), additional drying research was conducted to test and refine dry schedules, develop moisture meter correction factors, test kiln schedules for mixed-species loads, explore alternative drying techniques such as presteaming, and test the saw-dry-rip technique commonly used with hardwoods.
- Lumber grade rules – proprietary lumber grade rules were developed to address manufacturer requests for consistency in lumber quality. Grades included premium, tight knot and better, cutstock, and rustic.
- Secondary manufacturing – Numerous secondary wood products were developed including finger-jointed/ edge-glued panels, moulding, doors, paneling, flooring, cabinets, furniture (a market research and design project as well as contemporary and rustic style furniture), and gift/novelty items.
- Residue utilization –
 - Composites – several composite products were developed including particleboard, hardboard, and wood-plastic composites.
 - Fuel pellets – fuel pellets were manufactured from pure juniper sawdust and from a mixture of juniper and Douglas-fir sawdust. Higher heating values (BTUs) of the pellets were determined.
 - Animal bedding – shavings for animal bedding were tested for potential toxicities due to skin contact for dogs. Efficacy of odor control for horse bedding was tested.
 - Essential oil distillation – distillation yields and chemical analysis of essential oils were conducted. Dermal toxicity trials were conducted on small animals (mice and rabbits) as well as efficacy for control of fleas and ticks.
- Industry facilitator – a full-time facilitator was hired for 18 months to serve as a ‘matchmaker’ of sorts. The facilitator visited logging contractors and primary and secondary manufacturers seeking to ‘link’ buyers and sellers. The facilitator essentially served as a log and lumber broker (without taking ownership of materials).

As can be seen, numerous opportunities were explored. Consequently, one might expect that the majority of the questions posed by manufacturers had been addressed. However, the results of these activities also needed to be disseminated and made readily available to interested parties. Hence, the steering committee also focused its efforts on technology transfer and outreach.

Technology Transfer/Outreach

Technology transfer has been conducted via direct technical assistance to manufacturers, a quarterly newsletter, numerous regional workshops, as well as two large-scale conferences; the conferences included technical presentations and displays of products & equipment. Direct technical assistance was provided in large part by the author (as a county Extension Agent for Oregon State University) and by a resource specialist with the U.S. Forest Service. In addition, a website (<http://juniper.oregonstate.edu>) was developed to ensure the results of projects were readily available. The website includes a

factsheet on juniper, newsletter articles, links to reports on woodland management, harvesting, and manufacturing. The website also includes a bibliographic system that serves as a permanent searchable archive for hundreds of published and unpublished reports related to western juniper management and utilization. Lastly, as part of the project, a second website was developed for commercial enterprises to advertise their products (<http://www.westernjuniper.org>).

Current Status of the Commercialization Project and Juniper Industry

Around the year 2000, activities related to the project slowly came to a halt and the committee disbanded. This was due in part to job changes for the two lead members of the steering committee. However, it also appeared that ‘meeting fatigue’ had set in. That is, since much of the questions had been addressed (which is not to say all the challenges had been overcome) and the results disseminated, it seemed there was little interest in continuing to conduct projects and host meetings. There was a sense among the committee that the time had come for the juniper industry to ‘take off.’

After over 15 years and a great deal of enthusiasm and investment of resources, the western juniper industry has not grown as expected by members of the steering committee. Several companies have come and gone. The enterprises that have endured include 2 or 3 log home builders and several micro-enterprises producing rustic roundwood furniture. However, in 2008, one intermediate-sized sawmill that was among the firms that had ‘come and gone’ was operating again under new management; this mill had strong financial backing and appears to have good potential to remain a viable business. And as has been the case for several years, juniper use as a boiler fuel in cogeneration facilities in northern California remains high.

So why hasn’t the industry grown as expected? Or might expectations have been unrealistic? Perhaps the current status of the industry is precisely what can be supported given the characteristics of the species - i.e., low volumes per acre and poor stem quality. These questions, as well as some recommendations applicable to others working with lesser-known species, are addressed below.

Lessons Learned & Recommendations

The simple answer to the question of why the juniper industry has not grown as anticipated (presuming the expectations were not unrealistic) is that high harvest costs combined with low lumber recoveries make it difficult for logging contractors and sawmills to make a profit. However, these issues have been encountered by other successful industries using species with similar characteristics; eastern redcedar is a case-in-point. Thus, it seems the simple answer may not be adequate.

Many lessons have been learned with western juniper and these lessons are, of course, interrelated. These lessons include:

- Basic economics – every enterprise involved in the value chain must be profitable for the system as a whole to work. For western juniper, several secondary manufacturers sought to establish product lines for western juniper products. As a result, demand for kiln-dried lumber rapidly outstripped supply. It is not entirely clear why supply of lumber was inadequate aside from the challenges presented above (high harvest costs and low lumber recovery values). A solution, of course, is for logging contractors and sawmills to simply charge more for logs and lumber. However, any increase in cost ripples through the entire value chain. The challenge for many lesser-known species is that buyers often expect to pay less given that there is some risk in experimenting with a new species or, in the case of western juniper, when the tree has a reputation as a ‘noxious weed.’
- Supply, supply, supply – when asked to consider working with a new wood species, most manufacturers will ask the same two questions – 1) how much is available? and 2) at what price? While the price of lumber for a lesser-known species is difficult to know early in the commercialization process, standing timber inventories must be known as soon as possible – preferably before product testing. Further, these inventories must be developed with utilization in mind – key criteria include volume, log grade, and accessibility (from the standpoint of proximity to roads as well as regulatory barriers related to timber harvesting). Once a company fails to satisfy customers due to gaps in supply, their interest in a lesser-known species quickly wanes.
- Harvesting and processing infrastructure – this is the familiar ‘chicken-and-egg’ problem. For a logging contractor to invest in equipment they must have confidence that there will be reliable demand for logs (i.e., that sawmilling infrastructure is in-place). For sawmills to invest in equipment, they must have some assurance that there will be a reliable supply (i.e., that there are logging contractors ready to provide logs). In addition, where there is existing infrastructure, it must be suited to the unique characteristics of the species. For example most mechanized harvesting equipment is not well-suited to western juniper due to the large limbs at ground level.
- Full utilization – for a wood species with unique characteristics (e.g., color, odor, etc.), generating sufficient demand from secondary manufacturers for high-value lumber is likely to be far less of a challenge than generating demand for low-value materials. That is, the real challenge is to establish viable markets for mid- to lower grades of lumber as well as residues such as bark, chips, sawdust, and hog fuel.
- Communication – technology transfer & outreach are critical. It is not enough to solicit funding and conduct studies; results must be communicated and readily available well after the studies are completed. The internet makes this task relatively straightforward. Of course, there are also advantages to hosting workshops and conferences in that face-to-face gatherings foster the networking that is critical in business. Further, with wood products, people like to be able to see, touch, and even smell a new wood species.
- Industry credibility – a couple items fall within this category:
 - Lumber grades – For structural products, many building code officials require a grade stamp validated by an accredited testing/grading agency. Even for non-structural uses, lumber grades help ensure standardization in the industry such that secondary manufacturers can have confidence in the consistency of lumber they purchase.
 - Business management – gaps in juniper log and/or lumber supply occurred due to the fact that logging was not the main focus of the business for the landowner. For example, in the absence of logging contractors and milling infrastructure, harvesting and/or milling are only conducted ‘as time permits.’ For an industry to grow, all the entities involved in the value chain must be operated like run as a business.

In summary, developing markets for lesser-known species requires a long-term commitment and the involvement of a wide variety of players. Lessons learned with western juniper suggest that a good approach is to focus first on assessing standing timber inventory and accessibility and harvest systems and costs. For species where there will be large volumes of residues (e.g., a species with poorly-formed stems), it is recommended to pursue markets that can use high volumes of residues before focusing on markets for lumber. Markets for secondary/ value-added products may develop without significant effort. With regards to the challenges of the infrastructure ‘chicken-and-egg’ described previously, there are no simple solutions. Either a private enterprise will have to incur the risk or, if possible, ‘seed funding’ from a public entity such as an economic development agency can help encourage investment. Technology transfer and communication are crucial at all stages of the process of market development.

Several of the recommendations discussed above could be achieved through the auspices of an industry association. An association can lead the efforts to spur demand by promoting the species, linking buyers and sellers, establishing and maintaining standards, managing research projects, and of course, certain as the focal point for communication about the species. While creation of an association was discussed for the juniper project, a key hurdle was related to cooperation. Industry personnel are often fiercely independent and competitive. Thus, even while recognizing a need to cooperate to grow the industry, firms are reluctant to do so. Further, it must be acknowledged that there is yet another chicken-and-egg problem with establishing an association – funding for the association staff and operating expenses typically comes from member dues. For a fledgling industry, there may not be enough cash flow for members to support an association until the industry has reached a critical mass.

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