State of Oregon
Western Juniper Legislative Report[1]

Resource and Commercialization Status, Trends, and Issues

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Resource Status and Trends

> *U.S Forest Service inventory scientists predict that within the next 50 years western juniper woodlands will be the most extensive forest cover type in Eastern Oregon.*

Inventory and Woodland Development

There are over 2.2 million acres of western juniper (*Juniperus occidentalis*) woodlands in Eastern Oregon with 10% crown cover or more. About 58% of this acreage is private. There are another 2.8 million acres with scattered juniper (less than 10% crown cover). Over 95% of western juniper trees in Eastern Oregon are less than 100 years old (Gedney et al. 1999).

The total number of Eastern Oregon acres with 10% crown cover or more of western juniper has increased about 500% since the first inventory was completed in the mid-1930s. Eleven of 17 Eastern Oregon counties have at least 100,000 acres of juniper (the six which have insignificant amounts are Gilliam, Morrow, Sherman, Umatilla, Union, and Wallowa). Four counties have juniper on over 50% of their non-forested lands (Crook, Grant, Jefferson, and Wheeler). It is projected that hundreds of thousands more acres will convert to woodlands over the next 20 to 40 years (Gedney et al. 1999).[3]

Western juniper is the least-utilized wood fiber resource in its range. Total volume in juniper woodlands with crown cover over 10% and in mixed conifer forests is estimated to be 467 million cubic feet.[4] Average volume per acre is 198 cu. ft. (ranges between 15 cu. ft. and 700 cu. ft.). About 53% of the total juniper volume and 90% of the volume in mixed conifer forests, which is often considered higher quality by commercial interests, is on private or Indian reservation lands (Gedney et al. 1999).

Forest Service inventory scientists estimate that total juniper woodland area (all densities) could increase to 6.0 million acres within the next 50 years, which represents 10% of Oregon's total land area. This would make juniper woodlands the most extensive forest cover type in Eastern Oregon (instead of ponderosa pine).[5]

Major factors contributing to the expansion and increasing densities of western juniper are believed to be: 1) Over-grazing in the late 1800s, which reduced fine fuels and extent of natural fires (western juniper is highly vulnerable to fire at the seedling and sapling stage); 2) More aggressive fire control policies and measures beginning in the early 1900s; and 3) Above-average precipitation in the early 1900s. Some scientists also believe there may be a link to increased atmospheric carbon dioxide concentrations (Miller and Wigand 1994). No signficant insect or disease outbreaks have yet been observed in juniper woodlands, contrary to what

normally occurs when unnaturally-high vegetative densities and conditions are created in forest ecosystems.

> Key Inventory Issue – How do results of the 1999 U.S. Forest Service, Pacific Northwest (PNW) Research Station, Eastern Oregon juniper inventory compare to the late 1980s inventory, and what are implications for management and regulatory options?

Watershed Conditions

The expansion and increasing densities of juniper woodlands greatly concern private landowners, government land managers, and scientists (Miller et al. 1999a). Over one million acres already show clear evidence of watershed degradation, loss of site productivity, decrease in forage production, loss of wildlife habitat, and overall-reduction in biodiversity.[6]

> Key Watershed Issue – How to reduce the overall rate at which rangeland habitat associated with juniper woodlands is deteriorating, and emphasize restoration on woodlands with the most potential to respond in sensitive watersheds?

Wildlife

Prior to 1870, juniper woodlands were primarily open stands, often with dominant trees 400 years old (Miller et al, 1997). Old-growth stands today are estimated to constitute less than 3% of all juniper woodlands (USDI-BLM. 1990).

Old-growth juniper trees provide habitat for at least 81 species of wildlife. Wildlife values are associated mainly with old-growth characteristics of individual trees. These characteristics include large twisted trunks or branches, deeply furrowed bark, dead branches and spiked tops, large lower limbs, cavities and hollow trunks, nonsymmetrical tops, and branches covered with bright, yellow-green lichen (*Letharia sp.*). Heavy berry crops have been observed on trees over 500 years old growing in relatively open stands (Miller et. al., 1997).

However, the majority of juniper is less than 100 years in age. Wildlife use in younger stands is based primarily on stand structure and characteristics of understory and surrounding vegetation. Mid-aged stands with a full complement of understory vegetation appear to support the greatest abundance and richness of wildlife species. Maser et al. (1984) report that 146 wildlife species use habitat provided by juniper woodlands and juniper/shrub vegetation types.

Wildlife use is less in young juniper stands that lack height structure, and decreases in dense 80- to 120-year old stands that have lost their understory of forbs, bunchgrasses, and shrubs (Miller et. al, 1997). Loss of understory vegetation makes these stands susceptible to increased overland flow and soil erosion (Bedell et. al. 1993), which in turn reduces soil productivity and increases stream siltation. The end-result is detrimental to both terrestrial and aquatic wildlife species. Juniper encroachment into shrub-steppe habitats, wetlands, riparian corridors, and in aspen and mountain mahogany stands can also adversely affect wildlife species.

State and Federal “listed” sensitive, threatened or endangered wildlife species may use juniper woodlands, but none are dependent on juniper woodlands for their survival. There are exceptions though, where individuals of certain species are dependent on a particular juniper stand (e.g. nesting habitat for Ferruginous and Swainson’s Hawks).

Several aquatic species can be negatively affected by improper or no juniper management. Listed species of particular concern are the endangered Lost River and Shortnose Suckers in the Klamath Basin, and the sensitive Inland Redband Trout. The importance of juniper woodlands for wintering wildlife has also been documented. For example, wintering mule deer require a mosaic of hiding and thermal cover intermixed with forage, while juniper berry crops are important to Townsend solitaires and American robins.

> Key Wildlife Issue: How can conservation of fish and wildlife resources in juniper woodlands be better incorporated into land management agency practices, Forest Practice rules, and Oregon Senate Bill No. 1010 processes and

outcomes?

Management Status and Trends

Juniper removal has been going on since at least the 1950s. Currently, an estimated 5,000 to 10,000 juniper woodland acres per year are cleared or thinned by public land mangers and private landowners in Eastern Oregon and Northeastern California[7]. Primary reasons for private landowners to thin or clear juniper are to increase forage production, improve watershed functions, and restore deteriorated rangelands. Due to lack of demand and markets, as well as economics, the juniper removed is either piled and burnt, left to decompose after being knocked-down, or cut for firewood and fence posts. Government agencies are currently less active in clearing juniper than private landowners, due to concerns about legal challenges and lack of funding for such projects.

Juniper treatments have evolved from an agronomic outlook that targeted juniper as a weed to an ecological approach. Prescriptions for juniper removal and plant community restoration are completed on a site-specific basis, which in turn are incorporated into overall watershed objectives. A cooperative educational effort between public land management agencies, Oregon State University research and extension, Oregon Department of Fish and Wildlife (ODF&W), USDA Agricultural Research Service, and private landowners is critical to this effort.

Landowner costs for removing juniper average $35-$50 per acre. Treatment methods include cutting trees down with chainsaws or pushing them over with a dozer. Additional treatments may be required to obtain desired results, such as seeding, and lopping and scattering branches. Manual falling, delimbing, and lopping and scattering the limbs can cost as much as $250 per acre.

Rangeland restoration efforts involving thinning and clearing of juniper are expected to continue, whether or not a commercial industry develops for juniper. According to Tom Birch, a Forest Service scientist who summarized data from a national study of forested land owners and their harvest plans, there are probably at least 3,000 ranchers in Oregon and California who plan to thin their juniper woodlands within the next 10 years.

> Key Rangeland Restoration Issue: How can juniper woodland technical and management knowledge and expertise be better disseminated to improve cooperative public/private rangeland restoration efforts?

Research Results and Management Implications

Vegetation and Soils

Research completed by Oregon State University (OSU) and USDA/OSU Eastern Oregon Agricultural Research Center demonstrates that proper juniper management can significantly increase forage yields (Vaitkus and Eddleman 1987; Bates et al. 2000), improve wildlife habitat (Willis and Miller 1999; Miller et al. 1999b), and increase overall biodiversity (Bates et al. 2000). Understory production in research plots increased as much as 1200% and plant diversity increased by 100% (Bates et al. 2000).

Soil erosion can also be significantly reduced. Buckhouse and Mattison (1980) documented that erosion during a 25-year storm event erosion was 10-times greater in juniper woodlands than in adjacent areas occupied by grasses and forbs. Wilcox and Breshears (1994) documented that increased understory is important in juniper woodlands because the spatial distribution of understory plants is more effective in controlling soil erosion than juniper canopy cover.

Timing of treatment in terms of woodland stand development is important. Costs to treat juniper with prescribed fire at the seedling/ sapling stage can be as low as $4 to $8/acre. Treatment of mature woodlands, where juniper has out-competed native grasses and shrubs, ranges between $30 to $100/acre, depending upon the amount of restoration work needed (such as seeding). Costs can range as high as $250 per acre if slash is

manually lopped and scattered.

The role of fire as a post-treatment follow-up is important. Timing of the reintroduction of fire can affect the survivability of desireable vegetation. For example, fire can reduce survival of grass and shrub seedlings (such as bitterbrush) if introduced too early or at the wrong time of year.

Fish and Wildlife

ODF&W reports that although research has helped generate general recommendations for fish and wildlife conservation measures in juniper woodlands (1994), specific wildlife guidelines do not yet exist (Glen Ardt, personal communication). Fish and wildlife conservation measures for juniper woodlands in the near-term will be formulated on a site-specific basis, in conjunction with watershed management guidelines.

Surface Water

Preliminary research results and years of anecdotal evidence suggest juniper management can increase capture, storage, and beneficial release of precipitation in watershed drainage subbasins with high juniper densities. For example, in areas with 20% juniper canopy cover or more, it is theoretically possible to increase precipitation going into the water cycle by two inches or more simply by reducing the amount of snow and rain intercepted by and evaporated from the woodland canopy. Given that average annual precipitation for many woodland areas is only 12- to 14-inches, this is equal to about a 15% increase (Eddleman and Miller 1991).

An increase in effective precipitation generates greater understory production. Increased precipitation also can prolong the growing season and shift species composition from less-productive to more productive understory species (e.g. Sandberg's bluegrass to bluebunch wheatgrass) (Bates et al. 2000). However, an increase in the water budget for most juniper woodland sites will not necessarily result in an increase in surface water. Forbs, bunchgrasses, and shrubs released as a result of juniper removal may utilize any additional water captured.

Juniper Commercialization Status and Trends

Historic Juniper Utilization

Although the majority of western juniper harvested over the years has been used for fence posts and firewood, there are reports going back at least 50 years of mills which tried to commercially process the species. The most successful commercial western juniper operation of any size was a mill owned and operated by Gary Gumpert in Prineville in the mid to late 1970s (five to 10 employees). Primary product emphasis was interior paneling, but other products were made in the course of refining the panel product (such as furniture and mantel pieces). At the time the mill was sold, about one-third of the production was juniper and the remainder incense cedar.

Probably the greatest use of juniper over the last 10 years has been as a source of fuel for power generation. In the early to mid-1990s, at least a thousand acres of juniper woodlands in Northeastern California were harvested for power generation biomass. Power generation markets for juniper have virtually disappeared though, due to changes in laws governing alternative power purchases.

Western Juniper Commercialization – 1990 to Present

Efforts to commercialize juniper were revitalized by the Forest Service in the early 1990s. An Industry Focus Group run the by Forest Service identified juniper as a potential source of fiber to partially replace government timber because of the spotted owl issue. Members of the Focus Group also owned ranches and were interested in how juniper harvest might improve grazing conditions.

An ad hoc Western Juniper Commercialization Steering Committee has overseen well over 100 western juniper

commercialization projects since 1993, ranging from lumber recovery to management demonstration areas. Much of the work undertaken is considered "ground-breaking". Very little was known about western juniper physical, mechanical, and fiber properties, and oil chemistry prior to beginning the commercialization process.

There has been significant gains in employment related to western juniper harvest and processing since 1991. At that time the juniper industry consisted of a few artisans, and seasonal firewood and post cutters. There are now at least 35 companies selling juniper products into at least 11 main markets or distribution channels, ranging from animal bedding shavings to doors and flooring. None of the companies have gross sales of juniper exceeding $250,000.

Over 35 full-time equivalent (FTE) jobs have been created in more than 14 Eastern Oregon communities. Due to increased awareness and publicity, it is estimated at least another 35 FTE jobs were created as an indirect result of commercialization projects. Private industry indicates that the number of jobs related to juniper processing are expected to double within the next two years. The ad hoc Steering Committee believes that the juniper industry will eventually generate gross sales of over $20 million per year, which translates to more than 250 direct and indirect jobs in rural Eastern Oregon communities.

Key Commercialization Issues:

Harvest Costs: How to reduce costs of juniper harvest and meet management guidelines (e.g. slash dispersal)?[8]

Markets for Low-Grade Material: What are economically-viable products and markets for the type of juniper commonly removed during range restoration?[9]

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[1] This paper is an edited version of a chapter from a larger report prepared by the Oregon Department of Forestry (ODF) in response to Oregon Senate Bill 1151 (A-Engrossed). Senate Bill 1151 requires ODF, in coordination with other agencies, to review program and regulatory issues related to western juniper, and determine how ODF can respond and resolve the issue identified in a manner that benefits landowners and improve watershed and rangeland health.

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[3] Crown cover of 10% or more is the arbitrary minimum criteria used by Forest Service inventory scientists to define "forest cover". Other states with significant juniper acreage (10% crown cover or more) are California (1.3 million acres) (Bolsinger 1989) and Idaho (275,000 acres) (Chojnacky 1995).

[4] For comparison purposes, red alder volume is about 7,436 million cubic feet and California laurel is about 297 million cubic feet (Niemiec et al. 1995).

[5] Most data cited above came from a late 1980s Eastern Oregon PNW Research Station juniper inventory. The late 1980s inventory concentrated on aerial photo interpretation and included fewer than 60 ground plots. Forest Service research scientists completed a more comprehensive Eastern Oregon western juniper inventory in 1999. The 1999 inventory included over 400 ground plots, and

gathered data about key questions not addressed during the late 1980s inventory, such as extent of juniper reproduction and juniper old growth (pre-1880s origin). Results of the 1999 Eastern Oregon inventory are not yet available according to PNW inventory scientists (David Azuma, personal communication).

[6] The “one million acre” figure was calculated based on juniper woodlands with 20% canopy cover or more.

[7] The estimate of 5,000 to 10,000 acres represents between 0.1% to 0.3% of total juniper woodland area with 10% crown cover or more.

[8] It is estimated juniper harvest costs average two to three times that of other common Eastern Oregon commercial species. Special techniques and equipment design are needed to significantly reduce costs, improve slash dispersion for watershed restoration purposes, and improve safety. The Forest Service has committed about $200,000 to fund development and testing of harvest equipment specifically designed for juniper. Added costs due to regulation and taxation are also a concern. Government watershed restoration project subsidies are expected to play a key part in defraying harvest costs until better and more economic methods are developed.

[9] Juniper removed from rangeland restoration sites is commonly shorter (less than 30-feet), and has more taper and large branches than juniper removed from areas where it intermixes with ponderosa pine.