



Woodland Fish and Wildlife

Managing Western Juniper for Wildlife

Western juniper can provide valuable habitat for many wildlife species. However, too many trees cause the loss of important understory plant species, a loss that can degrade wildlife habitat. When managing juniper woodlands for wildlife it is important to maintain a balance of plant layers, including wildflowers, grasses, shrubs, and trees. This publication provides information on managing your western juniper woodlands to improve habitat for a maximum number of wildlife species.

What We Know About Western Juniper

Western juniper grows on about 8 million acres of semi-arid lands in the Northwest. Pinyon pine, which typically grows with juniper throughout the Intermountain West, does not occur with western juniper. Western juniper is a relatively long-lived species, with trees attaining ages of more than 1,000 years. Most old trees grow on rocky surfaces where they are protected from wildfire. The most extensive old-growth western juniper woodlands occur in central Oregon on sandy pumice soils.

Western juniper has increased tenfold since the 1870s. The majority of present day woodlands are made up of trees less than 130 years old.

Western juniper female cones (frequently called berries) are an important food crop for many mammals and birds, especially during the winter. Although seed bearing begins at 10 to 20 years of age, significant fruit production starts at 50 to 70 years of age. Fruit production varies greatly among years and location. Female flowers receive pollen early in the spring from male cones that developed during the previous growing season. Once pollinated, flowers produce berries that remain on the tree into the autumn and winter of the second year. After falling off the tree they can remain on the ground for several years. Ripe

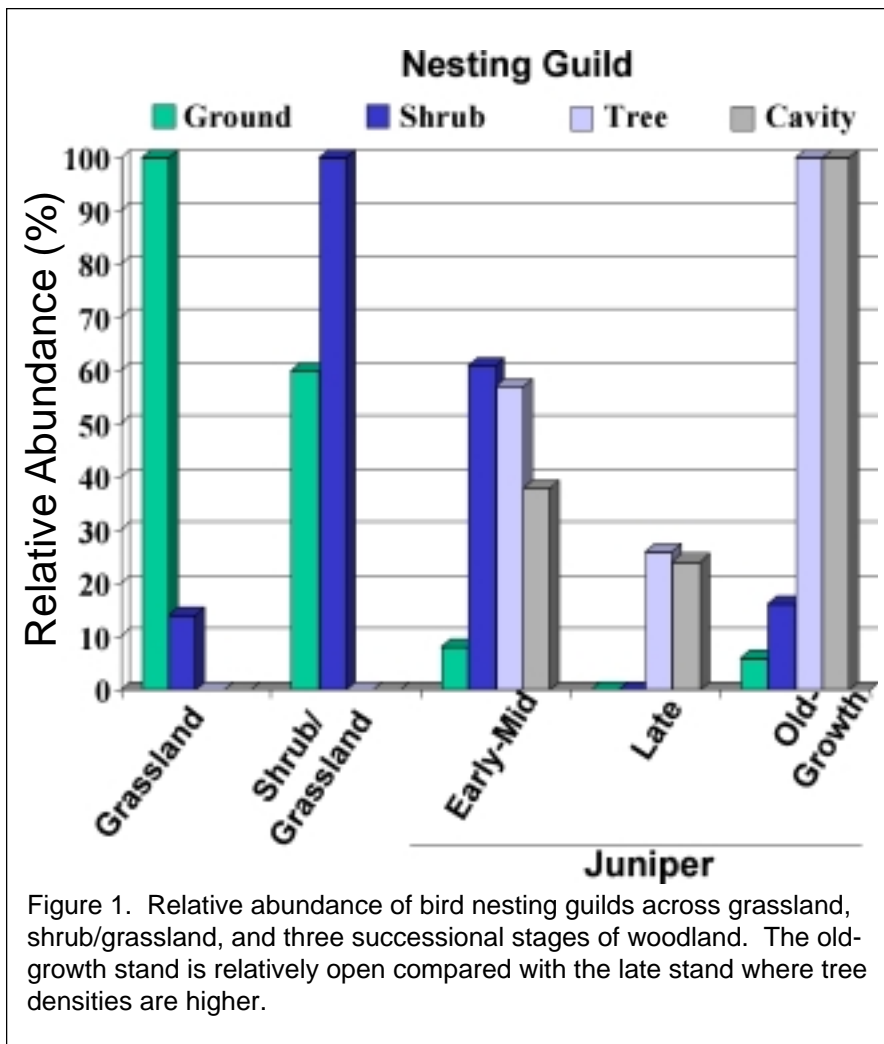
juniper berries provide an important source of energy, containing 46% carbohydrate and 16% fat. Birds eat and disperse the seeds. Rabbits, coyotes, and many small mammals also eat the juniper berries, spreading the seed across the landscape.



Western juniper woodland, in mid succession, encroaching into a mountain big sagebrush community on Steens Mountain.

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As juniper trees mature their tree canopies become less symmetrical and Christmas tree shaped. At about 150 years of age the bark begins changing from flaky to furrowed. As the trees continue to mature the bark becomes deeply furrowed and shaggy, and lichens and dead branches increase in the canopy.



Tree cavities, which provide nesting sites for many birds and some mammals, significantly increase in juniper more than 300 years old. Old trees can continue to produce berry crops at ages exceeding 1,000 years. The presence of old-growth juniper or old standing snags greatly enhances habitat values for wildlife in your woodlands or shrub grassland communities.

Wildlife and Juniper

The rapid increase in juniper during the past 100 years has greatly altered many wildlife habitats. Limited wildlife research and inventories have been conducted in juniper woodlands, and most failed to identify the successional stage of the woodland, quantify the composition of the understory, or identify the presence or absence of old-growth trees.

More than 100 wildlife species at some time have used open juniper woodlands for thermal and hiding cover, nesting, and food. The amount of tree canopy and composition of the understory determines which wildlife species continue to use these communities. Wildlife diversity in juniper communities relates strongly to the diversity and abundance of understory plant species.

Large herbivores

The amount of juniper cover, tree canopy depth, tree height, and stem density can moderate severe winter conditions. In south central Oregon, woodlands having 30% tree canopy, trees 15 ft in height, and 13 large trees per acre reduced temperature severity, wind, and snow cover during the winter. Deer occupied these woodlands during severe winter conditions. Deer fawns sustained higher survival rates during severe winter conditions in woodlands providing adequate thermal cover. However, woodlands that provide adequate thermal cover usually offer little food for wildlife, and little ground cover for smaller animals. Food plants grown in open sunlight are more nutritious than those grown under the shade of dense tree canopies. Closed woodlands provide poor structure for deer fawning cover. Optimal deer fawning offers a dense shrub layer (near 40%), which appears on productive north slopes having less than 5% juniper cover.

Antelope pass through open stands of juniper but prefer open shrub grassland communities. Their sense of security decreases as

canopy height and density increase. Elk frequent open woodlands and may use dense tree canopies during severe winter conditions. Treatments that reduce conifer canopy cover increase elk densities. Bighorn sheep also prefer open habitats. They do use juniper for shade during hot summer days.

Birds

A wide variety of birds use juniper communities. Open juniper woodlands have multiple plant layers that provide good habitat for many birds. The abundance of grasses, shrubs, and trees influences the abundance of birds in different nesting guilds. Nesting guilds are made up of birds, that nest in different locations (ground, shrubs, trees, cavities, variable, and brood parasite). In tree-dominated communities, ground and shrub nesting birds are absent or appear in low numbers (Figure 1). Birds make the greatest use of closed woodlands at the edge, where the woodland and other plant communities adjoin. Avian diversity and abundance can reach high levels in healthy treeless shrub communities. When trees begin to establish in these communities, new avian species such as mountain chickadees, Oregon juncos, flycatchers, finches, and chipping sparrows appear. The greatest avian diversity in eastern Oregon's semi-arid

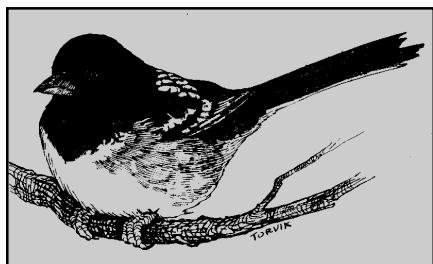
uplands occurs in the early and middle stages of juniper encroachment into shrub grassland communities or open old-growth woodlands. Where trees do not dominate the site shrubs, grasses, and wildflowers are still abundant in the understory. The old-growth trees often provide cavities for nesting. As tree dominance increases and crowds out the shrub layer, shrub and ground nesting bird populations decline except for the dark-eyed junco (Table 1). The lowest abundance and diversity of birds usually occurs in juniper-dominated communities that have lost the shrub layer and much of the grass and wildflower cover. Berry production greatly declines in closed juniper woodlands, due to tree competition for water and soil nutrients.

Juniper communities provide important winter bird habitat. Higher winter bird densities occur in open juniper woodlands than in any other plant community in Oregon's high desert. Juniper berries provide important food for a number of bird species during the winter. Townsend solitaires, American robins, mountain bluebirds, cedar waxwings, Steller's jays, and scrub jays readily consume the berries. During the winter, solitaires and robins may consume more than 200 berries per day.

Trees younger than 100 years old rarely provide cavities for nesting birds. Old-growth juniper stands offer a ready source of cavities, especially in trees more than 300 years old. Snags also supply holes for nesting. Among the different semi-arid communities in eastern Oregon, maximum densities of 13 bird species occur in old-growth woodlands. These include the noncavity nesting gray and dusky flycatchers, chipping sparrow, and brown-head cowbird, and cavity nesting mountain bluebird, mountain chickadee, northern flicker, American kestrel, ash-throated flycatcher, and red-breasted nuthatch.

Small Mammals

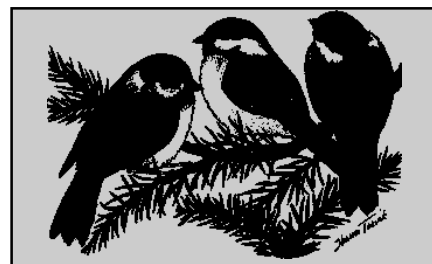
A few species, such as the pinyon mouse and woodrat, relate closely to juniper. Small mammals such as rabbits and seed caching rodents use the berries as a food source. However, the majority of small mammals depend on the composition and structure of the tree understory. Small mammal populations, including the desert cottontail, have increased where the slash remains on the ground after cutting of juniper trees. Small mammal abundance closely follows the response of shrubs, grasses, and wildflowers to juniper thinning or clearing. Understory seed production increases following reduction



Junco



Steller's Jay



Mountain Chickadee

Table 1. Birds, which commonly use early, mid-successional, and old-growth woodlands during the breeding season.

Species	Nesting Guild ¹
Dark-eyed junco	G
Horned lark	G
Western meadowlark	G
Vesper sparrow	G
Rock wren	G
Brewer's sparrow	S
Sage sparrow	S
Sage thrasher	S
Green Tailed Towhee	S
Cassin's finch	T
House finch	T
Dusky flycatcher	T
Gray flycatcher	T
Hammond's flycatcher	T
Pinyon jay	T
Chipping sparrow	T
Mountain bluebird	C
Mountain chickadee	C
Northern flicker	C
Ash-throated flycatcher	C
American kestrel	C
Red-breasted nuthatch	C
Brown-headed cowbird	BP
Mourning dove	VS
American robin	VS

¹Nesting Guilds: C=cavity, S=shrub, T=tree, BP=brood parasite, VS=variable substrate.

of the tree overstory, providing food for both small mammals and birds. The growing season for understory plants on cut sites extends for several weeks, increasing food quality later into the summer. Increased small mammal abundance increases food opportunities for raptors.

Amphibians and Reptiles

We probably know the least about amphibian and reptile use of juniper woodlands. Fifteen reptile and two amphibian species dwell in communities containing western juniper. However, the presence of rock outcrops, ant mounds, and other site characteristics appears to have a stronger influence on the abundance and diversity of reptiles and amphibians than the presence or absence of juniper. In old-growth stands the western fence lizard frequently uses juniper logs.

Woodland Successional Stages

Identifying the different woodland successional stages is important to successfully managing juniper woodlands for wildlife habitat. The majority of these woodlands are still increasing in tree density and cover. Western juniper is a very competitive species, which can easily become dominant in many important wildlife plant communities. The tree can readily invade big sagebrush, bitterbrush, mountain mahogany, aspen, and riparian communities. During the early stages of invasion western juniper increases the structural diversity of

shrub grassland communities by adding a tree layer. Trees provide additional hiding and thermal cover, nesting sites, and berries. However, as trees increase in density and size, the shrub layer dies out and berry crops decline. Depending on the site and soils, grasses and wildflowers also may be lost from the understory. Wildflower and grass seed production, an important source of wildlife and insect food, decreases too as the trees tie up many important plant nutrients in the soil. Maintaining a balance among wildflowers, grasses, shrubs, and trees is key in providing optimal habitat for many wildlife species.

Woodland successional stages can be separated into three general classes; early, mid, and late (Table 2). Woodlot owners should manage for the early and mid stages of woodland succession if they are interested in providing habitat for the greatest abundance and diversity of wildlife species. They also should retain any old-growth trees on their property. If woodlands are allowed to enter the late stage of succession both wildlife abundance and diversity will decline.

Table 2 summarizes guidelines for identifying which of the three stages your woodland is in. During the early stages of succession juniper trees are widely scattered and shrubs, grasses, and wildflowers dominate the landscape. During the mid phase of succession trees become equal partners with the understory plants. Leader growth on branches (the green part of the branches) is still actively growing on both small and large trees. Some shrub mortality may occur

around the base of the trees but shrubs growing between the tree canopies are still healthy. During the late stages of succession branch growth declines to less than 2 inches, especially on the small trees (< 10 ft tall). Dead shrub canopies are more frequent throughout the plant community. Juniper woodlands that are fully developed will have less than 1% shrub canopy cover, very minimal berry crops, and little to no branch growth on sapling size trees.

Managing Juniper for Wildlife

The key to managing juniper for wildlife is to maintain juniper trees in balance with understory plant forms such as shrubs, grasses, and wildflowers. The woodland owner can do this by managing for the early to mid successional stages. If thermal cover during severe winter conditions is important, then managing for a combination of the three stages is the best objective. Two commonly used tools for managing juniper communities are

fire and cutting. Chemical control of western juniper has produced mixed results. This method is not often used. The best selection of a management tool or tools for juniper woodland management depends on 1) site potential and soils, 2) condition of the site, 3) stage of woodland development, 4) size of the area to be treated, and 5) objectives.

Managing for Multiple Vegetation Layers

When managing juniper woodlands for wildlife, consider both the community and landscape levels. At the community level, maximum wildlife diversity will occur in juniper woodlands maintained in an open state with good shrub and herb cover. To accomplish this maintain five to twelve full size trees per acre or less than 10% tree canopy cover. On less productive sites, such as south slopes, less than 5% tree canopy cover will allow vigorous understory growth. Thinning juniper to these levels can enhance bitterbrush leader growth two- to fourfold compared with growth under nearly

closed juniper woodlands. Bitterbrush foliage and seeds are important foods for wildlife, especially in the winter. Open stands, where trees are not in competition with one another, will increase the potential for maximum berry crops, although production depends on weather and is highly variable. When thinning a stand, leave old-growth trees.

A mosaic of plant communities makes up the landscape. Composition, size, and shape of plant communities greatly influence wildlife abundance and diversity. Consider how juniper woodlands fit into this mosaic of surrounding communities when developing a management plan. For example, in one of our study sites in south central Oregon mountain bluebird densities were greatest in shrub communities adjacent to old-growth juniper woodlands. The composition of nonjuniper, open juniper, and closed juniper communities will influence wildlife use.

Managing Good Condition Sites

Managing woodlands having an intact understory of native plant species provides a great opportunity for manipulating plant community structure and composition for optimal wildlife use. Fuel levels usually are sufficient to burn mountain big sagebrush communities in early to mid woodland successional stages. Plant communities having a good composition of perennial native plants respond very well after fire. Grasses may or may

Western juniper woodland expanding into a mountain big sagebrush community in central Oregon. Inset: Mountain bluebirds eating western juniper berries (female cones) during late winter.



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Table 2. Characteristics of transitional stages during western juniper woodland succession in several community types, ranging from relatively dry to wet, for the mountain big sagebrush cover type. Estimated maximum juniper cover is 25-41% in Thurber needlegrass, 34-58% in Idaho fescue, and 60-75% in Columbia needlegrass associations.

Characteristics (Post Settlement Stands)	Early	Mid	Late
Tree Canopy (% of Max Potential)	Open, actively expanding ≤10%	Actively expanding 10 to 49%	Expansion reduced >50%
Leader Growth (Dominant Trees) (inches/yr)	Leader growth terminal >4 lateral >4	Leader growth terminal >4 lateral >4	Leader growth terminal >4 ¹ lateral <4
Crown Lift²	Absent	Absent	Lower limbs beginning to die where tree canopy >40%
Potential Berry production	Low	Moderate to high	Low to moderate
Tree Recruitment	Active	Active	Reduced, limited primarily to beneath trees
Leader Growth (Understory Trees)	Leader growth (cm/yr) terminal >4 lateral >4	Leader growth (cm/yr) terminal >2 lateral >2	Leader growth (cm/yr) terminal <2 lateral <2
Shrub Layer	Intact	Nearly intact to significant thinning	≥75% dead

¹During the late stage of succession, leader growth in mature trees is usually confined to the upper 1/3 of the canopy.

²Crown lift is the mortality of lower tree limbs usually due to shading from neighboring trees.

not increase immediately following fire, depending on the species present. Perennial wildflowers typically increase two- to fourfold. Native annual forbs usually increase after fire. However, fire will reduce perennial forbs and shrub species that have growing points aboveground. Fire sensitive species include mat-forming plants such as phlox, buckwheat, and sandwort, and shrubs such as sagebrush, bitterbrush, and mountain mahogany. In the absence of fire, shrubs decline as juniper

dominates a site. At the landscape level, a mosaic of burned and unburned patches increases the overall diversity. Abundance and diversity of wildlife species often is similar on adjacent burned and unburned plant communities. Wildlife species composition differs between burned and unburned communities, increasing the overall diversity of wildlife across the landscape.

When applying a prescribed burn to a site, wind, temperature, and relative humidity affect the

intensity of the fire. Fire intensity determines the patchiness of the burn and proportion of trees killed. Prescribed wildfire offers more opportunity to create a mosaic than do wildfire conditions. Prescribed fires also reduce the potential for future extensive and high intensity wildfires. Juniper trees 10 ft tall or less are most susceptible to fire. However, the composition and structure of fuels and severity of environmental conditions at the time of the burn will determine tree mortality. Prescribed or controlled

burns can be an economical way to treat large areas. Fire is a natural process that has occurred for thousands of years across these landscapes. The greatest disadvantage of using fire, particularly for private landowners, is liability. Burning small units containing less than several hundred acres is expensive and places the communities at risk from overgrazing by domestic and wild animals.

Cutting is a useful tool for treating smaller land areas, especially where desirable fire-sensitive species such as bitterbrush are present in the understory. Cutting is selective, allowing the landowner to thin to the desired tree density and leave trees such as old-growth or female trees for berry production. Liability is also low, but cutting is expensive and not practical for treating large areas. The Oregon Department of Forestry does not require permits for cutting juniper on private land unless the land is classified as commercial timberland.

Managing Poor Condition Sites

Do not burn juniper communities that have limited understory native plant species or an understory of exotic plants such as cheatgrass or medusahead. Often communities in poor condition cannot burn due to insufficient fuel. Where fire can occur on poor condition sites, burning causes further degradation, increasing the dominance of exotic weeds, or exposing bare ground that accelerates erosion. Under extreme climatic conditions crown fires can sweep across these communities, especially if cheatgrass or medusahead are abundant in the

understory. Exotic weeds will quickly reestablish following fire, especially below 5,000 ft elevation. Above 5,000 feet, native species compete better than introduced Mediterranean annuals.

Cutting juniper can restore the condition of sites that have lost the majority of understory cover and have large bare ground interspaces between the trees. Bare spaces are highly susceptible to erosion. Cutting the trees and spreading the limbs across the surface creates groundcover that protects the soils from erosion, provides sites for seedling establishment of understory plants, and furnishes cover for wildlife. A minimum of two desirable perennial grasses or forbs per 10 ft² are necessary for restoring the understory on sites receiving less than 12 inches of annual precipitation. One plant per 10 ft² is usually adequate on sites receiving more than 12 inches of precipitation. Restoration may be slow, especially if undesirable plants such as cheatgrass dominate the understory. If the site has fewer than the required minimum of perennial understory plants, seed the community in the fall or early spring following treatment. Choose a desired mix of species adapted to the site. Broadcasting seed directly on the bare soil surface will have little success. Spreading seed in slash greatly increases the success of seedling establishment. Most success occurs where workers can drill seed into the ground at the proper depths.

Decide whether or when to burn sites following cutting depending on your objectives and on vegetation response to cutting. Generally, juniper slash is more

important the lower the site condition. Burning can be delayed to reduce new trees establishing on the site until the trees approach a height of 10 ft.

Other Considerations

On sites where the understory is in very poor condition, determine whether poor understory health is due to the increase in juniper dominance, past or current management practices, or a combination of both. If practices such as grazing are a problem, thinning juniper trees will not restore the site. Base grazing management on maintaining a healthy stand of plants. Focus on minimizing soil loss and enhancing water infiltration rates. Allow plants to capture sufficient water, nutrients, and sunlight, and to retain sufficient plant cover and litter that protect both plants and soils. Manage thinned sites in poor condition as a new seeding and do not graze them during the growing season. Let the number of years of deferment depend on the condition of the site before treatment and weather conditions in years following treatment. The response of the plant community after treatment will provide the best guide for timing future grazing.

Water

Water frequently limits wildlife abundance in many juniper communities. Assuring water availability can greatly increase wildlife use of open juniper communities. This is particularly true in the pumice region where surface water is scarce. Providing water supplies such as guzzlers is an effective tool for increasing wildlife.

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