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## Wildlife

Shrub-steppe communities in Phases I and II (Fig. 22 a, b) of woodland encroachment contain a high degree of vertical diversity, and are attractive to wildlife. These transitional communities are used by 83 species of birds and 23 species of mammals (Maser and Gashwiler 1978). Sixteen wildlife habitats were defined on the basis of structure and diagnostic plant species across eastern Oregon (Maser et al. 1984a, b; Puchy and Marshall 1993). Of the 16 types, the western juniper/sagebrush/bunchgrass type ranked third in having the highest number of wildlife species using this habitat for feeding or reproducing. However, these summary papers do not address woodland dynamics, successional states, or separate presettlement and post-settlement woodlands. Communities containing western juniper can range from open stands with a diverse understory of shrubs and grasses to closed woodlands with little understory vegetation. Open western

juniper/big sagebrush/bunchgrass stands are mid-successional (Phases I and II), and characterized by herbaceous, shrub, and tree layers. As western juniper dominance increases, structural diversity declines with the loss of shrubs and some herbs (Miller et al. 2000). Old-growth stands also differ structurally from post-settlement woodland, including having a greater density of cavities, which significantly influences cavity nesting species. The replacement of aspen, riparian, and mountain big sagebrush communities by western juniper may have detrimental effects on wildlife populations dependent upon these habitats. In summary, low levels of western juniper can be beneficial for many wildlife species but increasing dominance at both the community and landscape levels will result in a general decline in landscape and plant community diversity, resulting in a decline of wildlife abundance and diversity.

## Large Herbivores

Western juniper's primary influence on large herbivore habitat relates to cover and food. Lechenby et al. (1971) and Leckenby and Adams (1986) reported mule deer heavily used stands of western juniper during severe winter conditions. They found that weather conditions were less severe in western juniper woodlands with 30 percent cover of trees at least 15 ft tall compared to adjacent shrub communities. Leckenby et al. (1982) concluded that dense stands of trees or shrubs over 5 ft tall provided optimal thermal cover. However, these stands provide minimal food resources. Deer will browse western juniper during the winter if little else is available. Both digestibility and levels of available protein are low in western juniper. Increased western juniper dominance across the landscape will result in a decline in browse resources (Adams 1975, Miller et al. 2000, Schaefer et al. 2003). In northeastern California, the decline of mule deer populations in the late 1960's may in part be related to the concurrent increase in western juniper dominance and the decline in shrubs (Schaefer et al. 2003). The large decline in mule deer populations in southwestern Idaho in the late 1950's and 1960's also coincides with woodland transition from Phases II to III, resulting in the rapid decline in shrub cover. Replacement of big sagebrush with western juniper will also have negative impacts on fawning habitat. In the spring on Steens Mountain, Oregon, mountain big sagebrush with a canopy cover greater than 23 percent was the most preferred fawning habitat (Sheehy 1978).

The relationship between western juniper and other large herbivores such as elk (*Cervus elaphus*) and wild horses has received little attention. Trainer et al. (1983) reported that antelope (*Antilocapra americana*) rarely used western juniper woodlands during the winter or spring in eastern Oregon, preferring more open shrub-steppe communities or stands with only scattered trees.

## Birds

Until recently, few studies have evaluated the effects of western juniper and woodland structure on avian populations. Throughout the piñon-juniper biome, past work has not recognized woodland transitional states, separated old-growth from young post-settlement stands, or evaluated the effects of western juniper encroachment into various habitats on avian populations.

## Winter habitat and food source

Stands of old-growth western juniper and open post-settlement western juniper/sagebrush/bunchgrass communities provide important winter bird habitat. Densities of winter (December through February) birds in open western juniper woodlands were significantly greater than in adjacent shrub-steppe or grassland communities (EOARC, unpublished data). Large numbers of American robins and Townsend's solitaires use these wooded communities during the winter months. They first arrive in wintering areas late in the fall and remain until April. Western juniper berries (female cones) provide an important source of food for Townsend's solitaires, American robins, mountain bluebirds, cedar waxwings, Steller's jays, and scrub jays (Fig. 8) (Lederer 1977, Solomonson and Balda 1977, Poddar and Lederer 1982). Western juniper berries are the sole winter food used by Townsend's solitaires and make most of the American robin's diet throughout the winter (Lederer 1977, Poddar and Lederer 1982). Solitaires consumed up to 80 ripe berries/day and American robins up to 220/day. Ripe western juniper berries provide a good source of energy but contain low levels of protein (Poddar and Lederer 1982). Birds were observed avoiding the green berries, which are less nutritious. Densities of mountain bluebirds and territory size for Townsend's solitaires are closely related to the abundance of western juniper berries. Fruit production varies greatly among years and locations. As woodlands close and competition between trees increases, female cone production declines. Several species of birds, including cedar waxwings and American robins, also feed on the small pearl-like berries of mistletoe growing on western juniper (Kuijt 1960, Maser and Gashwiler 1978).

## Breeding habitat

Species richness (total number of species) and diversity (an index based on the total number of species and abundance of individual species) of birds generally increases with structural complexity of the plant community. The many birds that were reported to use western juniper woodlands in central Oregon (Fig. 32) (Maser and Gashwiler 1978; Maser et al. 1984a, b; Puchy and Marshall 1993) pertained to communities in Phase I and II (Figs. 22 a, b), which still contained a complex understory. In eastern Oregon, avian species diversity and richness were greater in Phases I and II western juniper mountain/big sagebrush

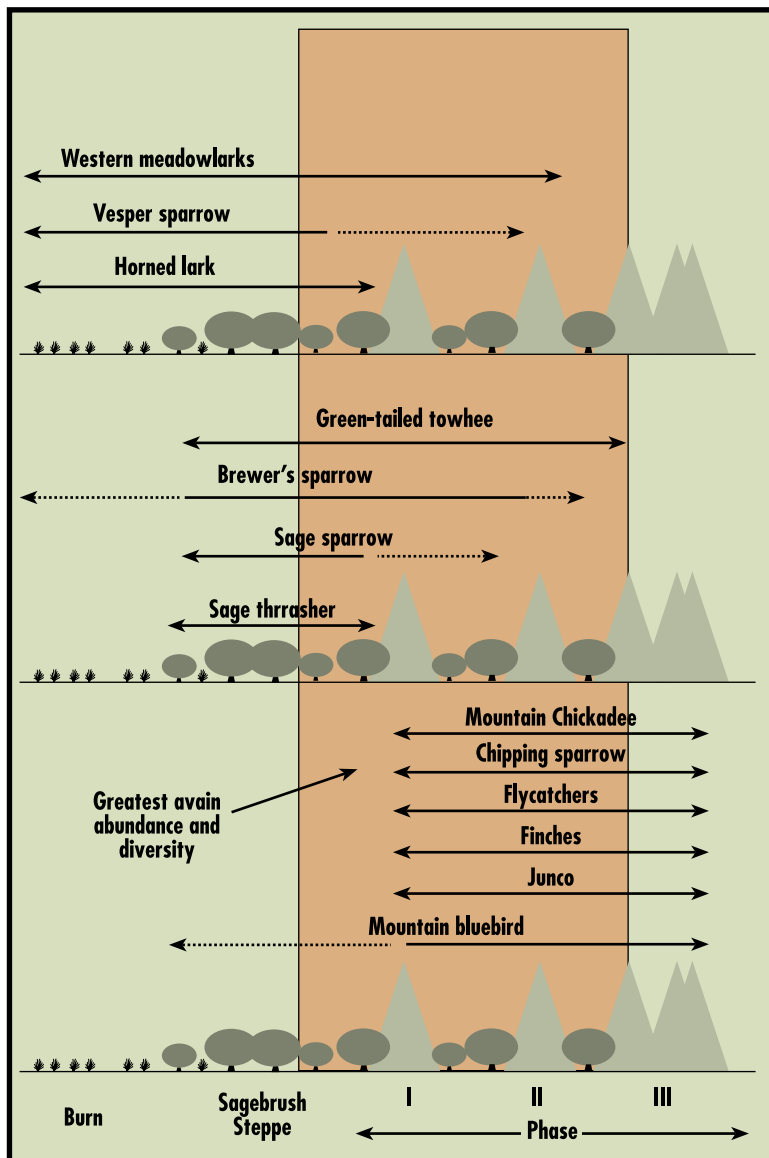
communities compared to mountain big sagebrush communities, where trees were absent. This results from an increase in tree-nesting species, which include the chipping sparrow (*Spizella passerina*), flycatchers (*Empidonax spp.*), Cassin's finch (*Carpodacus cassinii*), and house finch (*C. mexicanus*). Maximum densities of these species were reached at relatively low densities of western juniper (Noson 2002). No bird species reported

in the literature are obligates to closed western juniper woodland. Several shrub-steppe bird species showed differences in sensitivity but an overall negative correlation to increasing western juniper (Noson 2002, Reinkensmeyer 2000). Noson (2000) reported Brewer's sparrows (*Spizella breweri*), vesper sparrows (*Poecetes gramineus*), and sage thrashers (*Oreoscoptes montanus*) showed a strong negative correlation to increases in western juniper density and to area occupied by western juniper. The sage thrasher was the most sensitive to western juniper encroachment, sharply declining at very low western juniper densities. Reinkensmeyer (2000) reported a 90 percent decline in sage thrasher densities in western juniper stands with only 6 percent tree cover. However, green-tailed towhees (*Pipilo chlorurus*) were positively correlated with increases in western juniper communities, occupying up to 33 percent of the area (Noson 2002). Brewer's sparrows used transitional communities in Phases I and II that contained adequate levels of sagebrush cover (estimated to be more than or equal to 10 percent). Abundance of tree-nesting species including flycatchers, mountain chickadees (*Poecile gambeli*), dark-eyed juncos (*Junco hyemalis*), house wrens (*Troglodytes aedon*), chipping sparrows, and mountain bluebirds increased in the early stages of woodland encroachment (Phase I) (Fig. 32). However, the continued increase in juniper dominance did not result in an increase in these species. These studies suggest that as woodland succession enters Phase III, avian abundance, diversity, and richness will decline with loss of understory species and structural complexity.

Avian communities are also strongly influenced by aspen communities at the landscape level. Species richness and diversity in sagebrush communities were strongly and positively correlated with the presence of nearby aspen stands (Noson 2002). The encroachment and eventual replacement of aspen communities by western juniper would be expected to have a negative effect on this relationship (Wall et al. 2001).

Sagebrush obligate species, including sage-grouse (*Centrocercus urophasianus*), are sensitive to western juniper encroachment into sagebrush communities. The density of juniper at which use by greater sage grouse declines or ceases has not been determined. However, in central Oregon, sage grouse avoided western juniper communities for nesting and winter use (BLM 1994). As tree densities increase and woodland area continues to expand, sage grouse habitat will decline, especially in mountain big sagebrush habitat below 7,000 ft.

Figure 32. Changes in avian composition across successional stages from grassland to shrub-steppe to juniper woodland. Avian species richness (total number of species) is greatest in Phase I and early to mid-Phase II. Illustration is based on Reinkensmeyer 2000, Noson 2002, and EOARC unpublished data. Dashed line indicates presence but declining use by the species.



## Old-growth woodlands

Densities of tree and cavity nesting species were 20 percent higher in old-growth western juniper woodlands compared to western juniper-sagebrush-bunchgrass communities in Phases I and II (Reinkensmeyer 2000). Both tree- and cavity-nesting species accounted for 67 percent of the total bird density and 66 percent of the number of species present in the old-growth western juniper type. The increase in cavity-nesting species in old-growth stands maintained the relatively high species richness, diversity, and evenness of avian populations. Tree cavity-nesting species, including red-breasted nuthatches (*Sitta canadensis*), American kestrels (*Falco sparverius*), ash-throated flycatchers (*Myiarchus cinerascens*), mountain bluebirds, mountain chickadees, and northern flicker (*Colaptes auratus*), were found in greater numbers in old-growth than in post-settlement woodlands (Reinkensmeyer 2000; EOARC, unpublished data). However, there was considerable overlap in tree foliage and cavity-nesting species between the young developing woodlands and old-growth western juniper woodlands. Shrub- and ground-nesting species were absent or scarce in old-growth stands.

## Small Mammals

The bushy-tailed (*Neotoma cinerea*) and dusky-footed (*N. fuscipes*) woodrats are commonly associated with western juniper (Verts and Carraway 1998). The bushy-tailed woodrat is found throughout the range of western juniper but is most common in old-growth stands where it nests in hollow tree trunks. The dusky-footed woodrat builds stick houses for nesting, often located at the base of western juniper trees but occasionally in the tree canopy. On the east side of the Cascades, the dusky-footed woodrat is primarily found in Klamath and south Lake counties in Oregon, and Modoc and Lassen counties in California. Woodrats, cottontails, black-tailed jackrabbits (*Lepus californicus*), and porcupines (*Erethizon dorsatum*) utilize western juniper foliage for food during portions of the year (Maser and Gashwiler 1978). During summer drought, 25 percent of the Nuttall's cottontail (*Sylvilagus nuttallii*) diet was composed of western juniper foliage (Verts and Hundermard 1984). Western juniper female cones are consumed by deer mice (*Peromyscus maniculatus*), yellow-pine chipmunks (*Tamias amoenus*), and golden-mantled ground squirrels (*Spermophilus lateralis*). Deer mice open up the nutlets to consume the seeds. They are also known to cache seeds for later consumption (Vander Wall 1990).

Few studies have evaluated the relationships between small mammal populations and western juniper dominance. Possibly the greatest impact of western juniper on small mammal populations

is via indirect effects on understory plant species (Miller et al. 2000). Reductions in the shrub layer would impact populations of the Great Basin pocket mouse (*Perognathus parvus*), yellow-pine chipmunk, and desert cottontail (*Sylvilagus audubonii*). Greater numbers of Great Basin pocket mice were captured in Phase II western juniper woodlands that contained a shrub understory than in an old-growth stand with less than one percent shrub cover (Willis and Miller 1999). However, equal numbers of white-footed deer mice (*Peromyscus leucopus*) were found in both communities. Elmore (1984) reported twice as many species and a 60 percent increase in deer mice, piñon mice (*Peromyscus truei*), and Ord's kangaroo rats (*Dipodomys ordii*) in thinned compared to unthinned western juniper stands. Several studies in the Intermountain West have shown small mammal numbers generally increase when western juniper is either thinned or completely cut, provided that the slash remains (Kundaeli and Reynold 1972, O'Mera et al. 1981, Elmore 1984, Severson 1984, Willis and Miller 1999). Thinning or removing western juniper improves food and cover for small mammals by increasing shrub and herbaceous recruitment and seed production (Bates et al. 2000, 2002).

## Management Considerations

Western juniper can be an important element in the habitat for many wildlife species, but at densities that allow a healthy understory of shrubs and grasses (Miller 2001). We know of no data suggesting there are juniper-obligate species, or species that require dense, closed western juniper woodlands. Maintaining low densities of western juniper on portions of the landscape increases the abundance, diversity, and richness of avian and small mammal populations in the shrub-steppe. However, as western juniper dominance increases, wildlife abundance, species richness, and diversity decline. This will also occur as the proportion of area dominated by western juniper at the landscape level increases. Noson (2002) concluded that although fire had an immediate negative impact on several shrub-nesting species, periodic burning was important in limiting western juniper encroachment into shrub-steppe communities. Wall et al. (2001) also concluded that fire was an important factor in preventing the conversion of aspen stands to western juniper woodlands. Maintaining small, scattered stands of dense western juniper may be desirable to provide thermal cover from severe winter conditions for large ungulates. However, management strategies that maintain a balance of grasslands, shrub-steppe, and open western juniper woodlands will provide the greatest abundance and diversity of wildlife populations at the landscape level. Old-growth woodlands that provide valuable habitat for cavity-nesting birds should be maintained.