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HABITAT MANAGEMENT FOR SAGEBRUSH-ASSOCIATED WILDLIFE SPECIES

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Pre-settlement Vegetation

Habitat requirements for the many wildlife species in sagebrush-grass communities differ by species, and for a given species may also vary by season (McAdoo and others, in press). Therefore, the vegetation differences of sagebrush habitats over area and time (spatial and temporal variability) become important in vegetation management considerations. Before European settlement, "spotty and occasional wildfire probably created a patchwork of young and old sagebrush stands across the landscape, interspersed with grassland openings, wet meadows, and other shrub communities" (Paige and Ritter 1999). However, based on journal accounts of early explorers, some fires were apparently quite large. In drier regions of the Great Basin where the "Wyoming" subspecies of big sagebrush dominates, fire had less influence than in upper elevations where the "mountain" subspecies of big sagebrush is more common. According to Miller and Eddleman (2001):

> "The Wyoming big sagebrush and low sagebrush cover types, with less frequent disturbance events but slower recovery rates, and the mountain big sagebrush cover type, with more frequent disturbance but faster recovery rates, created a mosaic of multiple vegetation successional stages across the landscape. In addition, fire patterns were patchy, leaving unburned islands, particularly in Wyoming big sagebrush cover types because of limited and discontinuous fuels. Plant composition ranged from dominant stands of sagebrush to grasslands."

The authors went on to say that much of the sagebrush steppe ecosystem during pre-settlement times was probably composed of open shrub stands with a substantial component of perennial grasses and forbs (wildflowers). In mountainous areas, similar mosaics would be caused by differences in slope and aspect, where the broken topography and variation in fuels would cause fires to leave unburned patches. Extreme weather conditions and insect outbreaks also have affected the historic patterns of vegetation composition in sagebrush habitats.

The wildlife sightings by early explorers were a function of landscape ecology, the explorers' season of travel, the time interval since the last fire, etc. Based on journal accounts, species like sage grouse seemed to be locally abundant, but regionally rare. According to Miller and Eddleman (2001), the range occupied by sage grouse is diverse over the area and changes dynamically over time. The same principle holds for other sagebrush-associated wildlife species. The potential of the habitat (based especially on soils and climate), combined with such variables as the mix of varying shrub height and canopy cover, along with herbaceous species composition and cover, influence the regional diversity of wildlife species, the distribution of these species over the landscape, and the local abundance of each species. Nothing, however, remains constant over time.

This is the second in a series of two fact sheets. The first (McAdoo and others 2003) discusses wildlife habitat diversity in sagebrush habitats. Both fact sheets are based primarily on a paper by McAdoo and others (in press).

What Is the Existing Situation on the Landscape?

According to Miller and Eddleman (2001), post-settlement disturbance factors have complicated the sagebrush mosaic pattern on Great Basin landscapes. These disturbance factors include altered fire frequencies, introduction of non-native plants, livestock grazing, cultivation, pesticides, water diversion, roads, mining, recreation, urban development, and the increase in atmospheric pollution. Of these, the combined impacts of the first two (fire and exotic species) have probably had the most widespread impacts on sagebrush habitats.

Millions of sagebrush-dominated acres in the Great Basin have burned in the last 10 years. Much of this area has been taken over by cheatgrass, an exotic annual species. Because it usually germinates before native species, this weed is highly competitive with desirable native perennial species for both moisture and soil nutrients. Cheatgrass is also highly flammable. Fires are now much more frequent (occurring every 2 to15 years) as compared with presettlement period fires (occurring every 20 to 100 years) in the same areas. Because of the fuel continuity of these solid cheatgrass stands, today's fires average much larger in size than historical fires. As native plant diversity has declined in the face of this self-perpetuating cycle, large areas in the Great Basin are in danger of further degradation from invasion by perennial noxious weeds. This situation presents an enormous challenge throughout much of the Intermountain West to: (1) prevent the loss of sagebrush and its perennial understory as a dynamic, but self-sustaining plant community, and (2) revegetate those large expanses of cheatgrass with sagebrush-grass-forb species that will support diverse wildlife communities.

In some portions of the Great Basin, pinyon and juniper have gradually encroached into adjacent sagebrush communities. This too has been caused by a change in fire frequency, but in this case, decades of fire control and the grazing of fine fuels have decreased the frequency of natural fires that historically kept pinyon and juniper restricted to comparatively "fire-safe" sites. Litter (dead plant material) accumulation, plant chemicals, and/or juniper's intensive year-round competition for soil moisture suppress the establishment of shrub and herbaceous species under tree canopies. This in turn reduces the plant diversity that supports sagebrush-associated wildlife species. This situation presents the challenge of restoring fire or some fire "surrogate" (like tree thinning or chaining) to re-create the dynamic tension among herbaceous plants, sagebrush, and scattered small trees in a resilient cycle.

Another habitat condition is perhaps being overshadowed by the cheatgrass and pinyon-juniper problems. Specifically, much of the Great Basin has large expanses of sagebrush habitat where shrub cover is so dominant that herbaceous species are almost absent, with only sparse populations of remnant native grasses and forbs (McAdoo and others, in press). To improve the plant diversity and productivity of these areas for seasonal use by high profile species like sage grouse, proposals have been made to reduce the cover of mature sagebrush cover on portions of these areas to facilitate the regeneration of young sagebrush and increase native herbaceous cover.

Can Wildlife Benefit from Sagebrush Habitat Management?

According to Klebenow (1969), reducing or thinning sagebrush cover in some areas can restore the balance of forbs and grasses, enhancing sage grouse habitat. Connelly and others (2000) maintain that treatments such as prescribed fire, prescribed livestock grazing, and mechanical treatments may be used to restore sagebrush habitats. However, they caution that improper use of these tools can also result in the degradation or loss of such habitats.

We can also draw some inferences from the effects of sagebrush-grass community alteration on songbirds. Research in northern and central Nevada

(McAdoo and others 1989) found that sagebrush removal from large blocks had initially negative impacts on shrub-nesting birds, especially sagebrush obligates (species requiring sagebrush) such as sage thrashers, sage sparrows, and Brewer's sparrows. In areas where crested wheatgrass was planted after shrub removal, a corresponding increase was observed in ground and grass nesting species like horned larks, western meadowlarks, and lark sparrows. However, as sagebrush gradually re-established over time through natural processes, shrub-nesting bird species returned and grass-nesting species remained. Bird species diversity increased as the complexity of the plant community increased (McAdoo and others1989).

Prescribed Habitat Management

Location and especially size of treatments must be carefully chosen, since wildlife species respond variously to scale of vegetation management. For example, bird species in general are affected at the population level by vegetation management treatments covering thousands of acres, at the home range level by management of vegetation "stands" from 1 to thousands of acres in size, and at the individual/pair level by treatments on areas from less than 1 to hundreds of acres (Paige and Ritter 1999). For sage grouse specifically, Klebenow (2001) does not recommend sagebrush eradication over large areas, but suggests thinning sagebrush to about 15 % cover to enhance forb and grass production. He also suggests that small burns in mountain big sagebrush can create a mosaic pattern to enhance forbs and increase sagebrush height diversity. Some managers have recommended the almost complete removal of sagebrush in small dispersed areas within a dense stand of sagebrush.

In lower elevation sites (dominated by the Wyoming subspecies of big sagebrush) where recovery of herbaceous vegetation is slower, fire should be used cautiously to reduce the threat of cheatgrass invasion. Some of these areas may require seeding with adapted perennial species to compete with cheatgrass, followed after establishment by interseeding of native shrubs, forbs, and grasses (Klebenow 2001). Connelly and others (2001) similarly recommend the seeding of "functional equivalents" (non-native plant species) where native forbs and grasses are unavailable. They also caution that prescribed fire (and fire surrogate treatments like herbicides) be used cautiously in Wyoming big sagebrush habitats, realizing that 30 years is the approximate recovery period for Wyoming big sagebrush stands. For populations of diverse bird species, Paige and Ritter (1999) recommend that prescribed burns to enhance vegetation diversity be kept relatively small (with patchy distribution), reseeded where necessary, and protected from livestock grazing until seeded species become established.

If such management strategies are properly implemented, a mosaic of herbaceous, herbaceous-shrub, shrub-herbaceous, and shrub-dominated habitats can be created. On a landscape scale, this would substantially benefit most wildlife species. The diverse habitat requirements of sagebrush-associated wildlife species would be present in varying amounts on a landscape scale (McAdoo and others, in press). In other words, creating a landscape mosaic with multiple-aged stands of sagebrush and varying degrees of herbaceous and shrub cover provides the vertical and horizontal vegetation components required to support diverse and abundant wildlife populations. The value of each landscape parcel for various wildlife species would change over time with the dynamics of the initial natural or prescribed disturbance, variability of natural plant establishment processes, and post-treatment management.

Where Do We Start?

"State and transition models" of vegetation relationships offer the best tool for analyzing vegetation management hazards and opportunities, and determining management options and priorities (Laycock 1991; West 1999; Bestelmeyer and others 2003). Simply put, state and transition models reflect the idea that rangeland vegetation exhibits several "states" (recognizable complexes of soil and vegetation structure that are resistant to change and resilient to impacts). These models also present the idea that the various states have ecological phases through which the states progress over time, by pathways consisting of changes in plant species composition or community structure. On the other hand, almost irreversible "thresholds" or boundaries between states can be crossed in gradually occurring "transitions." These transitions are reversible through reasonable management actions until an undesired threshold is crossed. Once such a threshold is crossed, change back toward a more desired state is irreversible unless extensive time, effort, and money are available to effect a change. For example, after a sagebrush-grass community has crossed the ecological threshold to dominance by cheatgrass or noxious weeds, the transition is virtually irreversible. But carefully built and easily understood state and transition models can help identify such ecological transitions at earlier stages, allowing appropriate changes in management actions to prevent the crossing of ecologically damaging thresholds.

The highest priorities for habitat treatments should be driven by the risk of crossing an undesired ecological threshold and maintaining the opportunity to apply an effective management treatment. Only adaptive management strategies (Macnab 1983) that follow up active vegetation management with repeated monitoring and adjustment of strategies, if necessary, will perpetuate a diverse and productive landscape. Success in establishing a diverse mosaic of perennial plant communities across a sagebrush landscape also complements sustainable rangeland management for multiple uses in addition to wildlife.

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