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BIRDS IN A SAGEBRUSH SEA

To many of us, sagebrush country symbolizes the wild, wide-open spaces of the West, populated by scattered herds of cattle and sheep, a few pronghorn antelope, and a loose-knit community of rugged ranchers. When you stand in the midst of the arid western range, dusty gray-green sagebrush stretches to the horizon in a boundless, tranquil sea. Your first impression may be of sameness and lifelessness—a monotony of low shrubs, the over-reaching sky, a scattering of little brown birds darting away through the brush, and that heady, ever-present sage perfume.

Michael Mancuso, Idaho Conservation Data Center

Although sagebrush may appear to stretch on in an endless sea, a closer look reveals a mosaic of openings, wet and dry areas, a variety of plant species, and varying ages of shrubs.

But a closer look reveals just how complex and variable sagebrush landscapes can be. From shrublands to grasslands, wet meadows, and woodland edges, a mosaic of habitats supports an abundance of birds, animals, and native plants, some specially adapted to these semi-deserts. Far from pristine, however, sagebrush habitats across the West have been greatly altered by a century of settlement, livestock grazing, agriculture, weed invasion, and changes in wildfire frequency.

This booklet presents land management recommendations to help bird communities in sagebrush habitats. It was prepared for the Western Working Group of Partners in Flight, a partnership of private citizens, industry groups, government agencies, universities, nongovernment organizations, and others interested in bird conservation.

Why are we concerned about birds in sagebrush habitats? Nationally, grassland and shrubland birds show the most consistent population declines over the last 30 years of any group of bird species. Across the U.S., the populations of 63% of shrubland and shrub-dependent bird species and 70% of grassland species are declining. In the Intermountain West, more than 50% of grassland and shrubland species show downward trends (Sauer et al. 1996). A recent broad-scale assessment of the Columbia River Basin identified sagebrush steppe as the highest priority habitat for conservation based on trends in bird populations and habitat (Saab and Rich 1997).

Although the variety of bird species found in sagebrush habitats is far less than in a lush forest, many sagebrush birds, such as sage grouse, live nowhere else. The birds in these shrublands not only add to the West's diversity of wildlife, they are important to the sagebrush ecosystem itself, providing crucial services such as dispersing seeds and preying on insects and rodents. Other wildlife species, including pronghorn, sagebrush lizard, sagebrush vole, and pygmy rabbit, also depend on healthy sagebrush habitat.

Thoughtful land management can help rejuvenate native sagebrush habitats and may turn the tide for the birds of the sagebrush sea. The recommendations presented here are not regulations or policies. **This document has one purpose: to help anyone who is a steward of sagebrush shrublands include management practices that help support a thriving community of wild birds. These recommendations are entirely voluntary.** Whether you manage public lands or private, and whether your goal is livestock production, farming, mining, recreation management, wildlife conservation, or a combination of these, we hope this document will help you combine your management goals with steps to enrich habitat for sagebrush birds. Not all of the suggestions in this document will be appropriate in all places, depending

We hope this document will help you combine your management goals with steps to enrich habitat for sagebrush birds.

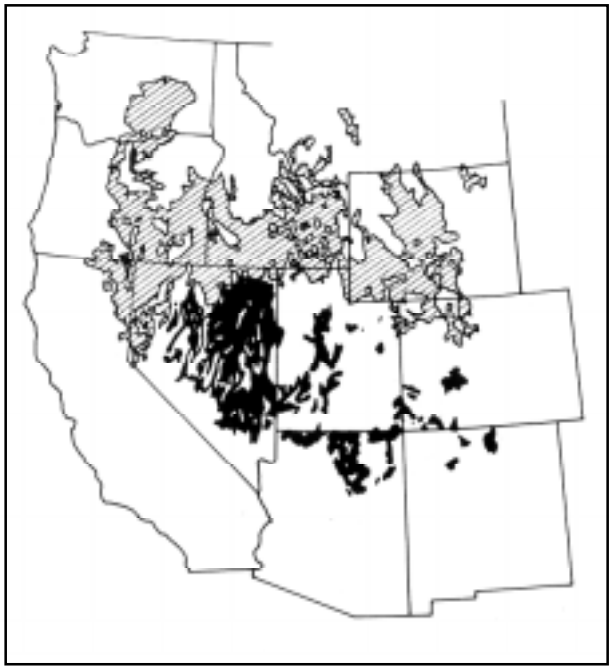
on local conditions and management needs, but even if you adopt only a few of the suggestions, you can give a boost to birds. In addition, we believe these recommendations will result in a healthy, diverse shrubsteppe ecosystem.

Sagebrush bird communities are not well studied, with the exception of the work by Wiens and Rotenberry and many studies on raptors and grouse (see "Literature Cited"). The lack of quantitative information on many species' habitat needs reflects a severe shortage of ecological studies in sagebrush habitats—often even major life history details are known only from anecdotal accounts. We prepared this document with the best information currently available.

ECOLOGY OF SAGEBRUSH HABITATS

Climate

Sagebrush occurs in cold semi-deserts across the Intermountain West. In much of this region, winters are long, summers are hot and dry, and winds are persistent. In these semi-deserts, most of the annual precipitation comes as snow and early spring rain. This winter precipitation recharges soil moisture, and the short growing season follows snow-melt. Summer storms are brief and intense, and most summer rain runs off or evaporates in hot winds, relatively little of it penetrating the soil and captured for plant growth. All in all, only about half the annual precipitation becomes available for plant growth (West 1988). Annual precipitation in the northern portion of the Intermountain Region averages 246 mm (9.6 in; West 1983, 1988). From the Great Basin southward, annual precipitation is more variable, ranging from 158 to 419 mm (6.2 to 16.4 in; West 1983, 1988).



From West 1988, reprinted with permission from Cambridge University Press.

Map of the sagebrush steppe and the Great Basin sagebrush types (adapted from Küchler 1970). Some sagebrush vegetation in California is not shown.

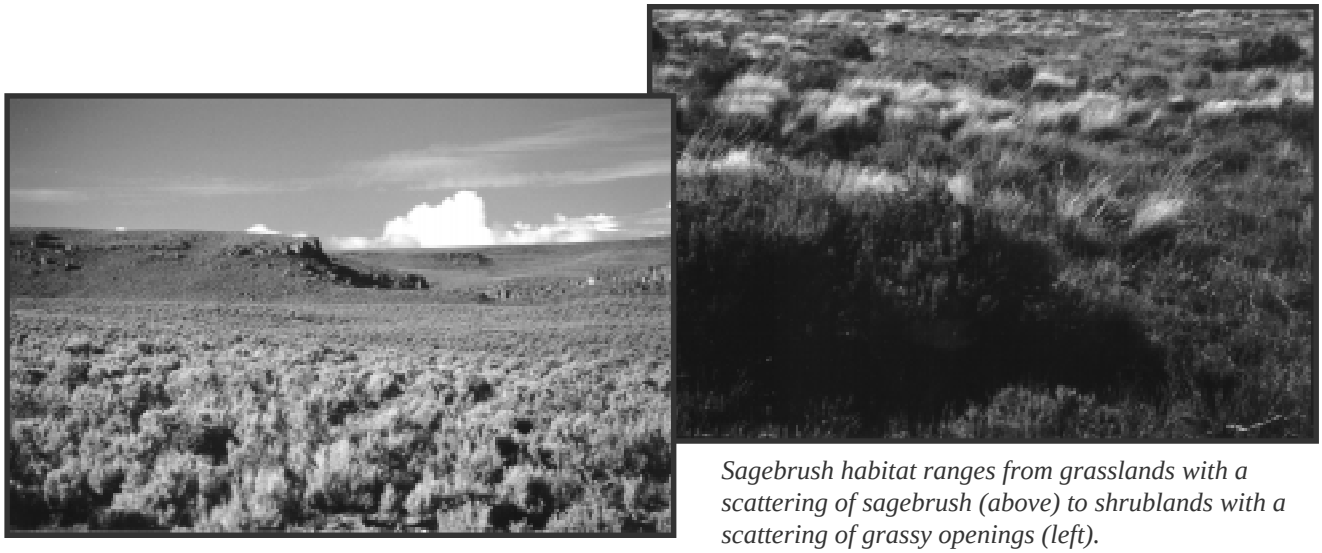
▨ = Sagebrush steppe ■ = Great Basin sagebrush

Vegetation

The entire sagebrush region covers approximately 63 million ha (155.5 million ac) of the West (see map to left). Sagebrush covers much of the Great Basin and Wyoming Basin, and reaches into the Snake River Plain, Columbia Basin, southwestern Montana, the Colorado Plateau, southwestern Colorado, and northern New Mexico. This broad zone is divided into two general vegetation types. The true "sagebrush steppe" type covers the northern portion of the Intermountain region, where sagebrush is co-dominant with perennial bunchgrasses (about 45 million ha or 111 million ac; West 1996). From the Great Basin southward, in the much drier "Great Basin sagebrush" vegetation type, sagebrush is dominant and grasses are few and sparse (18 million ha or 44.5 million ac; West 1988).

The focus of this booklet is on sagebrush habitats in general. We use "sagebrush habitat" and "sagebrush shrubland" as general terms covering the sagebrush region. "Sagebrush steppe" or "shrubsteppe" includes a significant component of native grass. However, there are no clear dividing lines. Across the sagebrush region, sagebrush habitat ranges from semi-arid grasslands with a scattering of sagebrush to arid sagebrush-dominated shrublands with few grasses.

Several species and subspecies of sagebrush grow in the west, from semi-desert lowlands to subalpine meadows (species' scientific names are in



Terry Rich

Sagebrush habitat ranges from grasslands with a scattering of sagebrush (above) to shrublands with a scattering of grassy openings (left).

Appendices I and II). The species big sagebrush predominates, and has five known subspecies (West 1988; Kartesz 1994). It is often important to differentiate between sagebrush species and subspecies in order to classify rangeland types; understand site potential, palatability to livestock and wildlife, and response to fire; and manage vegetation. However, for many birds the species of sagebrush is less important than its height, density, cover, and patchiness. In this booklet we use "sagebrush" generally, usually referring to the species big sagebrush, and focus on the variables important to birds. The only other distinction made here is between low and tall life forms—two broad categories that separate the species (Appendix II). *The management recommendations presented here may need to be modified to local sagebrush types.*

There is a wide variety of vegetation community types within the sagebrush landscape—the result of differences in soil, climate, topography, and other physical processes (Tisdale and Hironaka 1981; West 1988). Natural and human-induced disturbances also play a role. Usually a single species of sagebrush is dominant in a community, but communities differ widely in understory plants. Understories are usually dominated by one or more perennial bunchgrasses, such as bluebunch wheatgrass, Idaho fescue, Sandberg's bluegrass, Thurber needlegrass, needle-and-thread, bottlebrush squirreltail, or Indian ricegrass. Forbs, such as phlox, milk-vetch, and fleabane, are less common, but can be abundant in moist areas.

Stands of sagebrush may be dense, patchy, or sparse. In tall sagebrush types, sagebrush cover may range from 5% to 30% (Dealy et al. 1981) or greater on some sites. Stands may vary from expanses of single species to multi-species mosaics where sagebrush is intermixed with other shrubs, most commonly rabbitbrush and antelope bitterbrush, but also greasewood, shadscale, Mormon tea, winter fat, and spiny hopsage. Other shrub communities often occur adjacent to sagebrush shrublands, especially at higher elevations, such as those dominated by serviceberry, mountain-mahogany, wild cherry, ceanothus, and snowberry. Grassy openings, springs, seeps, moist meadows, riparian streamsides, juniper woodlands, copses of aspen, and rock outcrops also add to the sagebrush mosaic, and these habitats help attract a broad diversity of birds and wildlife.

Diane Ronayne, IDFG

Most of the denser shrubland types have, or should have, grasses between and under the shrubs. Here is an ungrazed sagebrush area with abundant bunchgrasses.

Biological soil crust is an integral and usually overlooked component of sagebrush shrublands. It creates a rough crust on the soil surface in semi-arid habitats. Biological soil crust (also known as "cryptobiotic crust," "microbiotic crust," or "cryptogamic soil") is a fragile microfloral community composed of blue-green algae, bacteria,

fungi, mosses, and lichens. The diversity and function of crust communities has been little understood and underappreciated (St. Clair et al. 1993; J. Kaltenecker pers. comm.). Many biologists think these crust communities may play an important role in dry regions by stabilizing soils from wind and water erosion, contributing to soil productivity, influencing nutrient levels, retaining moisture, altering soil temperature, and aiding seedling establishment (Belnap 1993, 1994; St. Clair and Johansen 1993; Kaltenecker 1997). Where crust communities are well established in a healthy shrubland, they help prevent the invasion of cheatgrass, and because crusts do not provide much fuel, they also slow the spread of wildfire (Kaltenecker 1997).

Wildlife Dependence on Sagebrush

Approximately 100 bird species and 70 mammal species can be found in sagebrush habitats (Braun et al. 1976; Trimble 1989). Some of these are sagebrush obligates (restricted to sagebrush habitats during the breeding season or year-round) or near-obligates (occurring in both sagebrush and grassland habitats). Sagebrush obligates include the sage sparrow, Brewer's sparrow, sage thrasher, sage grouse, pygmy rabbit, sagebrush vole, sagebrush lizard, and pronghorn.

Sagebrush itself and the native perennial grasses and forbs of the shrubsteppe are important sources of food and cover for wildlife (Dealy et al. 1981). During winter, the evergreen foliage of sagebrush often provides the only available green vegetation, and its protein level and digestibility are higher than most other shrubs and grasses (Peterson 1995). Pronghorn, pygmy rabbits, and sage grouse may eat exclusively sagebrush in winter, and sagebrush also becomes a major portion of mule deer and elk diets. Taller sagebrush provides cover for mule deer and sage grouse (Dealy et al. 1981), and the crowns of sagebrush break up hard-packed snow, making it easier for animals to forage on the grasses beneath (Peterson 1995). Throughout the rest of the year, sagebrush provides food for pygmy rabbits and sage grouse; protective cover for fawns, calves, rabbits, and grouse broods; and nesting sites for many shrub-nesting birds. The sage thrasher, Brewer's sparrow, sage sparrow, and sage grouse most frequently nest in or beneath sagebrush.

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The pronghorn is one of several species that must have sagebrush to survive. These species are called "sagebrush obligates" and are unique to the West.

THE SAGEBRUSH LANDSCAPE BEFORE EUROPEAN SETTLEMENT

Early explorers of the Intermountain West encountered a landscape dominated by shrubs and found grasslands chiefly limited to hillsides and moist valley bottoms (Vale 1975). In presettlement times, the Snake River Plain was a landscape of open-canopied, low-growing shrubs dominated by big sagebrush. Winterfat, antelope bitterbrush, rabbitbrush, greasewood, and shadscale were also abundant. Forbs and perennial bunchgrasses grew lushly in the understory beneath shrubs, including balsamroot, bluebunch wheatgrass, Idaho fescue, Indian ricegrass, Sandberg's bluegrass, bottlebrush squirreltail, Thurber needlegrass, green needlegrass, and needle-and-thread. When the sagebrush steppe was burned or trampled, leaving bare ground, complete revegetation of the community took about 10 years. Snakeweed was an early colonizer, followed by short-lived perennial grasses such as bottlebrush squirreltail and Sandberg's bluegrass, and eventually sagebrush seedlings, large-culmed perennial grasses, and perennial broad-leaved herbs (Yensen 1980, 1981).

Conditions were different in the Great Basin of Nevada. Reading over 100 old newspapers and 175 diaries of early settlers in Nevada, Robert McQuivey, Nevada Division of Wildlife, found that in the Great Basin of Nevada early settlers and travelers reported very tall sagebrush (approximately 2 to 2.5 m; 6-8 ft) with very little grass understory. Grass areas were usually restricted to areas along rivers and streams (R. McQuivey pers. comm.).

For many decades, range scientists believed that grasslands originally dominated the Intermountain West, and that sagebrush invaded because of heavy grazing. More recently, it has become evident that sagebrush was widespread and dominant, and that the boundaries of sagebrush habitats were about the same as they are today. Reports of areas that were once grassland, but are now covered in sagebrush, may have

been a result of repeated burning and mowing for hay in the early days of settlement (Tisdale and Hironaka 1981). Over time, many areas of sagebrush steppe have become more densely packed with sagebrush as livestock eliminated understory grasses and wildfires were suppressed, tipping the competitive advantage toward shrubs (Tisdale and Hironaka 1981; West 1988). Evidence also suggests that fire suppression and heavy grazing have contributed to the invasion of junipers and other conifers in some sagebrush areas (Tisdale and Hironaka 1981).

Biologists theorize that the native plant communities in sagebrush steppe west of the Rockies did not evolve under pressure from large numbers of grazing ungulates and are not adapted for concentrations of large herbivores (Tisdale and Hironaka 1981; Mack and Thompson 1982). The earliest historical accounts of exploration in the Intermountain West suggest that large native grazers were relatively rare and localized in the region. Bison were limited to the northeastern Great Basin, and the only large ungulate found throughout the region was the pronghorn. In southern Idaho's Snake River Plain, mule deer may have been abundant, and mule deer and elk were reported to winter in the Raft River Valley (Yensen 1980). Many explorers of the Great Basin commented on an abundance of forage for their stock and a lack of large game (Tisdale and Hironaka 1981).

Jackrabbits, cottontails, and rodents may have been the major herbivores in the region. The cyclic population explosions of jackrabbits, which can locally deplete range plants, may have had a periodic but influential impact on vegetation ecology (Yensen 1980; Young 1994). Sage grouse were also important grazers on sagebrush and understory plants. Periodic infestations of grasshoppers and crickets could decimate the shrubsteppe (Yensen 1980).

Wildfire Patterns

Explorers' reports of abundant and widespread sagebrush probably indicate that fires were relatively infrequent in sagebrush habitats. Big sagebrush does not resprout after a fire and even "cool" burns may be enough to kill these plants. In wetter areas, where fuels are more abundant, low severity fires may have been more common, and on some sites burns must have been frequent enough to prevent the invasion of juniper and conifers (Tisdale and Hironaka 1981). Because bunchgrasses generally do not provide a continuous fuel layer to carry fire long distances, fires in presettlement times were probably patchy and small except in very dry years. Presettlement fire intervals have been estimated at 20 to 25 years in wetter regions, and 60 to 110 years in the arid sagebrush steppe of southern Idaho (Tisdale and Hironaka 1981; Whisenant 1990). McQuivey (pers. comm.) concluded that the prevalence of tall sagebrush and lack of a grass understory in the Great Basin sagebrush of Nevada indicate that fire was not an important influence on this vegetation.

After a fire, big sagebrush must be re-established by wind-dispersed seed or seeds in the soil. Most sagebrush seeds fall within 1 m (3 ft) of the shrub canopy, although wind can disperse seeds up to 30 m (90 ft; Meyer 1994), so the rate of big sagebrush recolonization in a burn depends on the distance from a seed source and the amount and condition of seed in the soil. Depending on the species, sagebrush can re-establish itself within 5 years of a burn, but a return to pre-burn densities can take 15 to 30 years (Bunting 1984; Britton and Clark 1984). Eventually sagebrush seedlings, large-culmed perennial grasses, and perennial broad-leaved herbs become established (Yensen 1980, 1981). Often rabbitbrush, perennial bunchgrasses, and forbs present before a fire resprout vigorously soon afterwards, and some greenup of perennial bunchgrasses can occur soon after fall rains, depending on the fire's severity (P. Makela pers. comm.).

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Fire was, and still is, an important part of the sagebrush shrubland ecosystem. Part of the mosaic pattern in sagebrush is due to fires, which tend to burn in patches, creating stands of sagebrush of varying ages.

Before European settlement, then, 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. In drier regions, such as Nevada, fire likely had less of an influence.

CHANGES IN SAGEBRUSH COUNTRY

Sagebrush communities have suffered severe degradation and loss, and the future for remaining sagebrush steppe in particular is bleak. The ecology, natural disturbance patterns, and vegetation communities have been altered by agricultural conversion, invasion of non-native plants, extensive grazing, development, sagebrush eradication programs, and changes in fire regimes. Within the Interior Columbia River Basin, for example, sagebrush and bunchgrass cover types experienced greater losses than any other habitat and will probably continue to decline with the cumulative impacts of present land uses (Saab and Rich 1997, citing Hann et al. 1997).

Influence of Livestock Grazing

The arrival of cattle and sheep in the Great Basin in the late 19th century triggered a rapid change in sagebrush plant communities (Yensen 1981; Dobkin 1994). Observers of the time indicated that sites may have lost their native perennial grasses less than 15 years after livestock introduction. By 1900, some range managers judged that livestock had already exceeded the grazing capacity of the Intermountain rangelands, and they recommended changes to restore range productivity (Young 1994; West 1996). In addition, settlers burned off sagebrush to produce more grass for horses, sheep, and cattle and to clear the land for farming (R. McQuivey pers. comm.). Today, grazing pressure has decreased considerably compared to the early 1900s. However, less than 1% of the sagebrush steppe remains untouched by livestock; roughly 20% is lightly grazed, 30% is moderately grazed and has remnants of native herbs, and 30% is heavily grazed with the native understory replaced by introduced annuals (West 1988, 1996).

As cattle graze sagebrush steppe, they first select grasses and forbs and avoid browsing on sagebrush,

Terry Rich

Grazing pressure from livestock has decreased since the late 19th century, a period when rapid changes took place in the sagebrush plant communities. Today, good land managers recognize the importance of properly grazing their land to maintain its health.

which can have a toxic effect on the microorganisms in their rumen (Young 1994). Even light grazing can put pressure on the herbaceous plants favored by livestock (West 1996), but the effect of grazing in any region depends on season of use, intensity, type of livestock, and the plant species themselves (Tisdale and Hironaka 1981). In the Great Basin, for example, perennial bunchgrasses must grow quickly to set seed over the short growing season, so intensive spring grazing prevents the plants from reproducing, eventually eliminating the palatable native bunchgrasses (Mack and Thompson 1982). Where grazing removes the herbaceous understory altogether, the balance is tipped in favor of shrubs, allowing sagebrush to spread and creating overly dense sagebrush stands with a sparse understory of annuals and unpalatable perennials (Tisdale and Hironaka 1981). This situation ultimately discourages livestock use, and throughout this century range managers have employed fire, herbicides, chaining, and other methods to remove dense sagebrush stands and re-establish grass forage, often reseeding with introduced grass species.

Livestock also trample and damage biological soil crusts. Excessive grazing in the 19th and early 20th centuries likely reduced crust communities throughout the Intermountain West, and it is difficult now to piece together their original extent and role in sagebrush habitats (Mack and Thompson 1982; St. Clair et al. 1993). Recovery that includes a well-developed crust community can take a decade or more, depending on the type of disturbance, presence of inoculants from nearby crust communities, and occurrence of invasive weeds (Belnap 1993; St. Clair and Johansen 1993; Kaltenecker 1997).

Sagebrush steppe can take time to recover from excessive grazing, especially on drier sites. A study on Idaho National Engineering and Environmental Laboratory grounds found that 25 years after the heavily depleted range had been closed to cattle and sheep grazing, both perennial grass and big sagebrush cover had nearly doubled, but the most rapid recovery of grasses occurred after a lag period of 15 years (Anderson and Holte 1981). Even if livestock are removed, the presence of invasive weeds, an overly dense stand of sagebrush, or heavy browsing by rodents and rabbits can inhibit recovery of grasses and forbs (Tisdale and Hironaka 1981).

As well as affecting vegetation, grazing can influence bird communities in another way. The presence of livestock (particularly cattle and horses) creates feeding habitat for the brown-headed cowbird, a "brood parasite" that lays its eggs in the nests of other

songbirds for the host parents to raise. This reduces the number of young that the host species population can produce in a year. Cowbirds feed on insects stirred up by grazing herbivores and parasitize nests in nearby shrublands and woodlands. A native of the Great Plains, the brown-headed cowbird adapted to follow the herds of migratory bison. With settlement and the spread of livestock throughout the West, the cowbird's range expanded, exposing new populations and species of songbirds to brood parasitism for the first time. Where cowbird populations are high and there is no year-to-year relief from parasitism pressure, cowbird parasitism may be a significant factor in the decline of some songbird populations.

Non-native Grasses and Sagebrush Habitat Conversion

From the 1930s through the 1960s, and to a much lesser extent today, land managers controlled sagebrush on degraded rangeland by burning, plowing, chaining, disking, and spraying herbicides to increase livestock forage on sites where the native grasses had been lost. Many areas were seeded with crested wheatgrass, a non-native perennial bunchgrass, to provide forage. In addition to the thousands of hectares where non-native grasses are mixed with sagebrush, approximately 10% of native sagebrush steppe has now been completely replaced by invasive annuals or by intentionally seeded non-native grasses (West 1988, 1996). Another 10% of the sagebrush steppe has been converted to dryland or irrigated agriculture (West 1988, 1996). In eastern Washington, only 40% remains of 4.2 million ha (10.4 million ac) of shrubsteppe that existed before the arrival of settlers (Dobler et al. 1996).

The greatest change to sagebrush plant communities came with the invasion of non-native annual grasses and forbs, particularly cheatgrass. Inadvertently introduced in the late 19th century, cheatgrass spread like an epidemic across the Intermountain West along transportation corridors and in the wake of grazing and agriculture, and reached its present geographic range by about 1928 (Mack 1981; Yensen 1981). Cheatgrass readily invades disturbed sites as livestock churn up soil and biological soil crusts and graze native bunchgrasses. Today, cheatgrass threatens to dominate 25 million ha (62 million ac)—more than half of the West's sagebrush region (Rich 1996). Cheatgrass is a rapid colonizer of disturbed sites and a persistent resident, replacing native species (Mack 1981; Yensen 1981; Whisenant 1990). Other non-native species, such as medusahead, yellow star thistle, knapweed, tumble mustard, and halogeton, are also becoming increasing problems (Yensen 1980; West 1996).

Cheatgrass invasion fundamentally alters fire and vegetation patterns in sagebrush habitats. Unlike native bunchgrasses, cheatgrass creates a bed of continuous, fine fuel that readily carries fire. Where cheatgrass dominates the understory, it carries fire over great distances, and the range burns far more frequently—at intervals of 3 to 5 years. Cheatgrass also matures and dries earlier than native bunchgrasses, increasing the chance of fire earlier in the season (Young and Evans 1978; Whisenant 1990; Knick and Rotenberry 1997).

Because sagebrush may take several years to mature before producing seed, repeated, frequent fires can eliminate sagebrush entirely. As the fire cycle escalates, cheatgrass persists and on some sites is eventually replaced by medusahead and other non-native annuals, causing a downward spiral toward permanent dominance of non-native species and deterioration of the site. Cheatgrass dominance eventually creates a uniform annual grassland perpetuated by large, frequent fires and void of remaining patches of native plant communities (Whisenant 1990). Restoring native plants is then extremely difficult if not impossible (West 1988). There is some indication, however, that native shrubs, perennial grasses, and forbs can re-establish on a cheatgrass-dominated site over a course of several years if fire is suppressed, rainfall is low (Hosten and West 1994), and there is a seed source for native species.

The presence of invasive weeds also affects biological soil crusts. In the western Great Basin, Young (1992) noted that communities dominated by medusahead lack biological soil crusts, and in the Snake River Plain, Kaltenecker (1997) found that where cheatgrass and medusahead invaded, biological soil crusts were shaded out.

Terry Rich

Of all the changes that have occurred in sagebrush shrublands, the invasion of non-native cheatgrass is probably the most harmful. This photo, taken in June, shows the almost continuous fuel chain created by cheatgrass.