Keeping birds in the sagebrush sea

article by Sharon A. Ritter and Christine Paige

photography by Francis Bergquist, Jeff Vanuga, Lee Kline, LuRay Parker, Wendy Shattil, Bob Rozinski, Brian E. Small, Matt Vander Haegen, and Terry Rich

To many of us, sagebrush symbolizes the wild, wide-open spaces of the West. When you stand in this arid country, dusty gray-green sagebrush stretches to the horizon in a boundless, tranquil sea. Your first impression may be sameness—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.

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, other animals, and native plants, some of them specially adapted to these semi-deserts.

Many sagebrush birds such as the sage grouse, sage thrasher, Brewer's sparrow, sage sparrow, and several other birds of the sage live nowhere else. The birds in these shrublands not only add to the West's wildlife diversity, 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 antelope, sagebrush lizard, sagebrush vole, and pygmy rabbit, also depend on healthy sagebrush habitat.

A century of settlement has altered sagebrush habitats across the West and affected the wildlife that depend on these habitats. Nationally, grassland and shrubland birds show the most consistent population declines over the last thirty years of any group of birds. In the Intermountain West, the populations of more than fifty percent of grassland and shrubland bird species are declining.

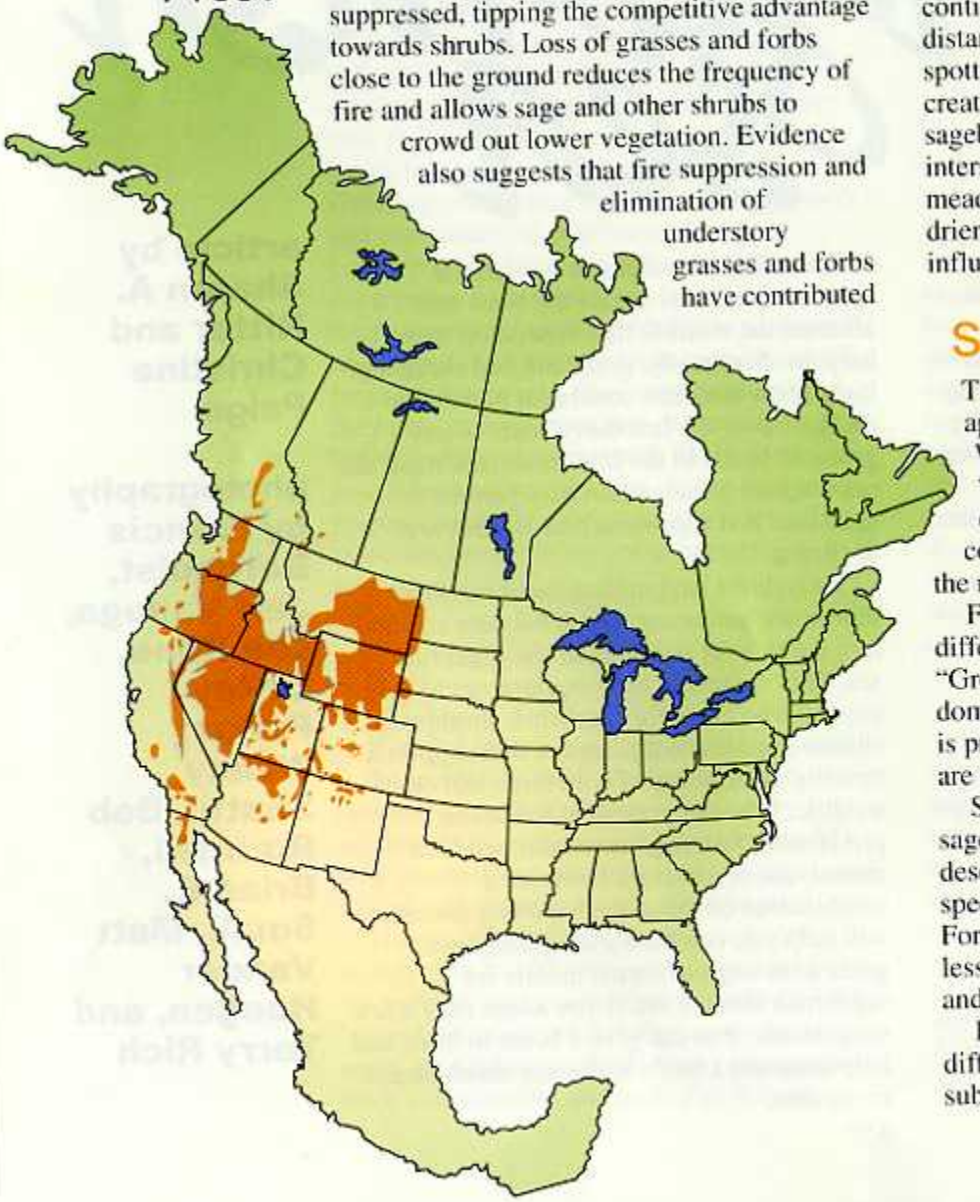
Thoughtful land management can help rejuvenate native sagebrush habitats and may turn the tide for the birds of the sagebrush sea. This document has one purpose: to help anyone who cares for sagebrush shrublands choose management practices that support a thriving community of wild birds and other wildlife. Whether your goal is livestock production, farming, recreation, wildlife conservation, making a home, or a combination of these, we hope this document will help you combine *your* management goals with steps to enrich habitat for sagebrush birds. Even if you adopt only a few suggestions, you can give a boost to birds and help maintain a healthy, diverse shrub-steppe ecosystem.

sagebrush before settlement

For many decades, range scientists believed that grasslands originally dominated the Intermountain West and that sagebrush invaded after the grass had been opened by heavy grazing. More recently, it has become evident that sagebrush was widespread and dominant before European settlement and that the distribution of sagebrush habitat was about the same as it is today. However, the acreage of sagebrush steppe in North America has declined since settlement as sagebrush has been lost to other land uses, particularly farming and suburban development.

Over time, many areas of sagebrush steppe have become more densely packed with sagebrush as heavy grazing eliminated understory grasses and wildfires were suppressed, tipping the competitive advantage towards shrubs. Loss of grasses and forbs close to the ground reduces the frequency of fire and allows sage and other shrubs to crowd out lower vegetation. Evidence also suggests that fire suppression and elimination of understory grasses and forbs have contributed to the invasion of junipers and other conifers in some sagebrush areas.

big sagebrush in the modern West



Fires probably were relatively infrequent in sagebrush habitats. Presettlement fire intervals have been estimated at twenty to twenty-five years between fires on wetter sagebrush sites and sixty to 110 years in the more arid sagebrush steppe. Big sagebrush does not resprout after a fire and even "cool" burns may be enough to kill big sagebrush plants. In wetter areas where fuels are more abundant, low-severity, less lethal fires may have been more common, and on some sites, burns were frequent enough to prevent the invasion of juniper and conifers.

In presettlement times, fires were probably patchy and small except in very dry years. There were two reasons for this: since fires were more common before settlement, the amount of fuel available was regularly reduced and was patchy itself. And native bunchgrasses generally didn't provide a continuous layer of fuel to carry fire long distances. So, 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. In drier regions, fire may have had less influence.

sagebrush ecology

The entire sagebrush region covers approximately 155.5 million acres of the West. The true "sagebrush steppe" or "shrubsteppe" type, where sagebrush is co-dominant with perennial bunchgrasses, covers approximately 111 million acres of the northern part of the Intermountain West.

From the Great Basin south, a slightly different sagebrush association exists. In this "Great Basin sagebrush" type, sagebrush is dominant and grasses are sparse. However, it is primarily the sagebrush steppe type that we are addressing here.

Several species and subspecies of sagebrush grow in the West, inhabiting semi-desert lowlands to subalpine meadows. The species called big sagebrush predominates. For many birds, the *species* of sagebrush is less important than its *height, density, cover,* and *patchiness*.

However, it is often important to differentiate between sagebrush species and subspecies to classify rangeland types,

manage vegetation, and understand site potential, palatability to livestock and wildlife, and response to fire. Here, we use "sagebrush" generally, usually referring to the species big sagebrush, and we focus on the structural features important to birds.

There is a wide variety of vegetation community types within the sagebrush landscape because of differences in soil, climate, topography, and other physical processes. Natural and human-induced disturbances, such as fire and livestock grazing, also play a role in shaping sagebrush habitats. A single species of sagebrush usually dominates a community, but communities differ widely in the plants that occur under or between shrubs.

Understories are usually dominated by one or more of the perennial bunchgrasses. Forbs, or broad-leaved non-woody plants, are less common but can be abundant in moist areas and are an essential part of sagebrush communities.

In tall sagebrush types, the amount of the area covered by the crowns of shrubs may range from five percent to thirty percent or even more on some sites. Stands may vary from expanses of single species to multi-species mosaics where sagebrush is intermixed with other shrubs.

Other shrub communities often occur next to sagebrush shrublands, especially at higher elevations. 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 other wildlife.

Biological soil crust— a fragile microfloral community composed of blue-green algae, bacteria, fungi, mosses, and lichens— is also an integral component of sagebrush shrublands. The diversity and function of crust communities have been little understood and underappreciated, but they are thought to promote soil development and productivity, which benefits the native plant community and, ultimately, many wildlife species.

Big sagebrush bears two sets of leaves. One set grows during the spring to take advantage of the wettest part of the year and drops off in late summer. The second set of smaller persistent leaves remain in the plant through the winter, allowing it to carry on some photosynthesis during warm spells and early spring run-off. Both sets are covered with tiny gray hairs to reduce water loss. A sagebrush plant also has two sets of roots, a deep taproot that may reach fifteen feet into the soil in search of water and a network of shallow lateral roots that absorb water from snowmelt and thunderstorms. Volatile oils in sagebrush leaves make sagebrush hard for many animals to digest, but the plant still provides important forage for pronghorns, sgebrush voles, pygmy rabbits, and sage grouse. (Big sage by Jeff Vanuga)

wildlife in the sage

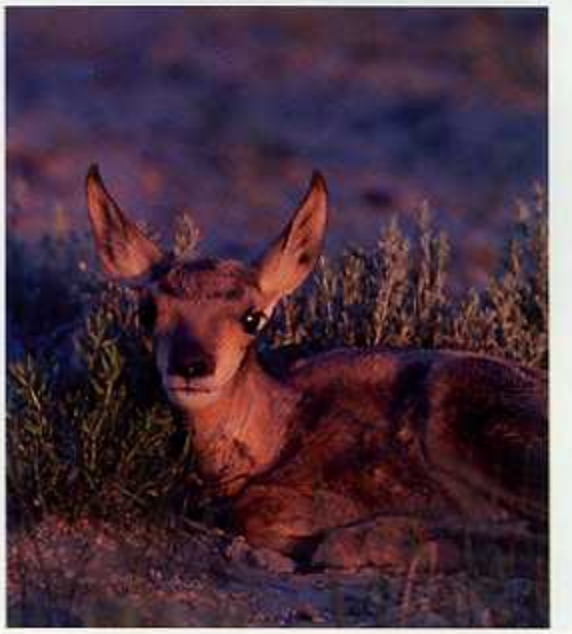
Approximately 100 bird species and seventy mammal species can be found in North American sagebrush habitats. Some of these are sagebrush obligates, meaning they depend on sagebrush habitats during the breeding season or year-round. Others are near-obligates, using both sagebrush and some other habitat. Sagebrush obligates include the sage sparrow, Brewer's sparrow, sage thrasher, sage grouse, pygmy rabbit, sagebrush vole, sagebrush lizard, and pronghorn antelope.

Sagebrush and the native perennial grasses and forbs associated with it are important

The pygmy rabbit (right) is found only in the sagebrush of southwestern Wyoming, Idaho, Utah, Nevada, Oregon and eastern California. It needs dense stands of sagebrush for cover and depends almost entirely on sage for food. The same can be said of the sage grouse (bottom left), North America's largest grouse and a native of sagebrush habitats. The grasshopper mouse (bottom right) is a strange denizen of the sagebrush and Great Plains— a mouse that eats insects! (Pygmy rabbit by Lee Kline; sage grouse by Francis Bergquist; mouse by LuRay Parker)

sources of food and cover for wildlife. 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 at this time of year. During the winter, pronghorns, pygmy rabbits, and sage grouse may eat nothing but sagebrush, and the shrub is also a major portion of the winter diets of mule deer and elk.

Taller sagebrush provides cover for mule deer and sage grouse, and the crowns of sagebrush break up hard-packed snow, making it easier for animals to forage on the grasses beneath. Through 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 nest most frequently in or beneath sagebrush shrubs.



The ferruginous hawk (left) has become rare in many parts of its range on the American grasslands, but it is still common in sagebrush country. This pronghorn fawn (bottom right) will learn to depend on sagebrush as a crucial source of forage and will use its speed in the open country of the sagebrush basins as protection from predators. Most of the antelope left in the world reside in the sagebrush basins of Wyoming. The eastern short-horned lizard or horny toad (bottom left) is a common resident of the sagebrush desert and the shortgrass prairie of the High Plains. (Hawk by Jeff Vanuga; pronghorn by Lee Kline; horned lizard by Francis Bergquist)

how to help

The following recommendations and those on the table to the right, are based on current knowledge of what sagebrush birds need. *Our main goal is to describe for you what birds need.* You may find that certain recommendations are not appropriate for your situation, depending on your management goals, vegetation types, site potential, costs, and opportunities. But even if you can carry out only a few of the recommendations, you can help improve habitat for birds.

for starters

Keeping birds in the sagebrush sea depends on providing a patchwork of native plant communities of different ages within extensive areas of sagebrush. These may include stands of young and old sagebrush, openings ranging from bare ground to short vegetation to dense stands of tall native grasses, wet meadows, seeps, healthy streamside (riparian) vegetation, and other interspersed shrub and woodland habitats.

These habitat mosaics support many bird species with different needs. Young sparse stands support vesper sparrows and lark sparrows. Older, denser stands benefit sage grouse, Brewer's sparrows, sage sparrows, black-throated sparrows, gray flycatchers, and sage thrashers.

Shrub-steppe with small, grassy openings is good for sage grouse, long-billed curlews, and burrowing owls. Broad-leaved shrub thickets and riparian areas provide winter habitat for sharp-tailed grouse. Forested streamsides provide nest sites for Swainson's hawks, and interspersed juniper woodlands supply nesting areas for loggerhead shrikes, gray flycatchers, ferruginous hawks, and green-tailed towhees.

Seeps, springs, wet meadows, and riparian vegetation that are in a healthy state are important for young sage grouse and other species that depend on the forbs and insects available in moist places. Wetlands and riparian zones also provide habitat for prey species and foraging opportunities for other sagebrush birds.

Because non-native grasses and agricultural conversion now dominate so much area in the Intermountain West, it is especially important to identify and manage those habitats that still have a thriving community of native understory and sagebrush plants. Even small parcels can have value to wildlife, especially where major habitat conversion has occurred.

Stands of sagebrush steppe should contain both shrubs and perennial grasses, with open to moderate shrub cover (five to twenty-five percent) and shrubs of varying heights. Extensive, overly dense, and crowded sagebrush stands that have lost much of their native herbaceous understory and plant diversity may require selective removal of shrubs (rather than broad-scale eradication) to reestablish a balance between shrub cover and perennial grass and forb cover. For example, it may be possible to thin sagebrush cover by selectively applying herbicides, by clearing patches that can be reseeded naturally at lower densities, or by using controlled fires that produce a patchy burn pattern. Use prescribed fire only in areas not threatened by cheatgrass or medusahead invasion.

Perennial bunchgrasses and native forbs provide food and cover for many sagebrush birds. Several species (such as sage grouse,

Your first sighting of a sage sparrow may be a frustrating glimpse of a little brown bird running between shrubs. Occasionally, you'll spot it perched on a branch of sage, singing its song of short, musical buzzes. Its song is made up of elements that can be heard well over the nearly constant wind. Adults return to the same spot to year after year to nest. (Photo by Matt Vander Haegen)

how to keep birds in the sagebrush sea

If you want to turn the tide for birds in the sagebrush sea, what can you do? In this table, we give bird management goals--what we're trying to do for birds--followed by our recommendations. For more details and background information, please see *Birds in a Sagebrush Sea: Managing Sagebrush Habitats for Bird Communities* (listed in Selected Readings)

grazing strategies

BIRD MANAGEMENT GOAL	RECOMMENDATIONS
Promote the growth of native grasses and forbs for food and cover.	Use proper stocking rates and grazing plans such as rest-rotation, two-crop short rotation, or deferred grazing. For bluebunch wheatgrass, avoid grazing during the actively growing season.
Protect/restore biological crusts.	Limit grazing to winter months and to periods when crusts are not dry. Avoid areas with intact soil crusts.
Avoid trampling ground nests.	Reduce stocking rates and schedule grazing or rotate pastures to avoid sagebrush during the nesting season.
Maintain herbaceous nesting cover.	Protect the current season's growth through the nesting season and manage for at least fifty percent of the annual vegetative growth to remain. Maintain adequate grass height for grouse nesting cover (four to seven inches).
Restore degraded sagebrush shrublands	Remove livestock for one to four years or more, if necessary. Reseed with local, native shrubs, grasses, and forbs.
Reduce cowbird parasitism	Minimize livestock concentrations and/or rotate livestock use in alternate years either spatially or temporally.
Provide burrows for burrowing owls and prey for other predators	Maintain ground squirrel and prairie dog colonies to provide burrows for burrowing owls and prey for raptors and other predators.

water strategies

BIRD MANAGEMENT GOAL	RECOMMENDATIONS
Maintain water quality and quantity and desirable native vegetation in springs, seeps, and riparian areas. Important for grouse nesting, broods, and feeding areas.	Retain natural water flow.
	Protect and enhance the growth of native forbs.
	Use exclosures or non-fencing methods to keep livestock out.
	Limit grazing to the plants' dormat season.
	Develop livestock watering facilities away from sensitive wet areas.
Reduce bird mortality.	Provide escape ramps or floats on any manufactured water developments.

invasion of exotic plants

Maintain existing sites that are relatively free from invasion of exotic plants.	Maintain the vigor of native species.
	Control livestock stocking levels.
	Avoid large-scale disturbances.
	Minimize habitat fragmentation.
Restore native plants following weed control.	Reseed native plant species and control fall-germinating annuals.
	Where cheatgrass dominates, use heavy spring grazing to reduce cheatgrass and prepare a unit for reseeding with perennial grasses.

habitat fragmentation

BIRD MANAGEMENT GOAL	RECOMMENDATIONS
Maintain large areas of sagebrush habitat mosaic across the landscape	Manage for no net loss of sagebrush habitat.
	Avoid designs and practices that create or increase the amount of edge between sagebrush and non-sagebrush patches.
	Maintain large expanses of sagebrush habitat (thousands of acres, if possible).
	Suppress range fires that threaten to eradicate large, continuous areas of sagebrush.
	Restore sagebrush and perennial bunchgrass communities by reseeding.
	Limit the number of roads; rehabilitate unnecessary roads.

farming strategies

Provide prey for raptors.	Use minimum till and no-till systems to maintain vegetative cover through the non-breeding season.
Maintain nesting and roosting sites for raptors and shrikes and foraging areas for songbirds.	Protect riparian woodlands, unplowed borders and edges, and vegetated waterways.
Reduce bird mortality.	Delay haying until after ground-nesting birds have fledged (late July in most areas).

insecticides

Reduce bird losses, provide food for insect-eating birds.	Reduce or eliminate insecticide use.
Reduce bird losses, provide food for insect-eating birds (continued)	Include birds in integrated pest management programs to reduce reliance in insecticides.
	Avoid insecticide use during grouse and songbird brood-rearing seasons.
	Use insecticide baits and natural pathogens instead of broad-spectrum insecticides.
	Avoid broadcast spraying; use ground spraying instead of aerial spraying to avoid drift.
	Restrict use to the minimum application rates on croplands bordering sagebrush.
	For carbamate insecticides, maintain a buffer of at least 800 feet from burrowing owl nesting areas.

controlled burns and wildfire

Prevent large-scale wildfires that will cause invasion of aggressive exotic plants or will destroy high-value sagebrush sites.	Use green-stripping (strips of fire-resistant vegetation) or other firebreaks in areas heavily overgrown with cheatgrass
Allow reestablishment of sagebrush, native grasses, and forbs.	Keep burns small and patchy. Burns should be small enough that sagebrush can reestablish itself from upwind stands and soil-banked seeds.
	Burn in early spring or late fall to take advantage of native grasses' adaptations to late-season fires and to discourage cheatgrass. Late fall burns avoid nesting season mortality.

BIRD MANAGEMENT GOAL	RECOMMENDATIONS
Allow reestablishment of sagebrush, native grasses, and forbs.	Reseed burns with local, native species when desirable species do not come back naturally.
	Avoid grazing on recovering sites for one to four years or more until native grasses are established.
Reduce impacts on bird habitat.	Use sulfometuron-methyl herbicide (tradename Oust) to control cheatgrass after fires.
recreation	
Reduce impacts on bird habitat	Avoid placing recreation sites near sage grouse and sharp-tailed grouse breeding habitat or raptor nests.
	Protect springs and wetlands from recreational use.
	Encourage the use of established sites, including keeping vehicles on established roads and trails.
	Limit the number of roads; reclaim closed roadbeds with native vegetation.
	Minimize soil disturbance off trails and roads to protect soil crusts.
Reduce bird mortality	Keep vehicles on established trails and roads to prevent harm to nests and nestlings.
	Restrict target practice to established shooting and archery ranges.
	Keep dogs and cats under control.
	In sensitive sage grouse habitat, do not build roads or vehicle trails between nesting and brood-rearing habitats; limit vehicle traffic during nesting and brood-rearing seasons.

residential strategies	
BIRD MANAGEMENT GOAL	RECOMMENDATIONS
Reduce habitat fragmentation and provide nesting and foraging habitat within and adjacent to housing developments.	Design new buildings and driveways to maintain as much open, continuous sagebrush habitat as possible and so that open habitat remains contiguous with adjacent habitat.
	Retain native vegetation in open spaces.
	Take advantage of the Conservation Reserve Program to restore native sagebrush habitat.
	Take advantage of tax incentives available for conservation easements.
	Use native plants in residential landscaping to provide forage, nest sites, and migration stop-over habitat.
Reduce impacts of housing developments on adjacent habitat.	Restrict construction disturbance to the immediate construction area.
	Restore disturbed areas using native plants.
Reduce bird mortality.	Avoid or minimize use of insecticides.
	Landscape with native plants to encourage birds, bats, and beneficial insects that control pest insects.
	Keep cats indoors and keep domestic pets out of nearby natural habitats.
	Discourage other predators by covering garbage and reducing other food sources such as pet food.

selected readings on sagebrush birds and their needs

Burleigh, Thomas D., 1972. *Birds of Idaho*. Caxton Publishers, Caldwell, ID. 467 pp.

Call, Mayo D. and Chris Maser, 1985. "Wildlife habitats in managed rangelands: the Great Basin of southeastern Oregon." Northwest Forest & Range Experiment Station, U.S. Forest Service, Portland, OR. 30 pp.

Champlin, Mark, 1983. *Big sagebrush ecology & management with emphasis on controlled burning*. 136 pp.

Dobkin, David S., 1994. *Conservation and Management of Neotropical Migrant Landbirds in the Northern Rockies and Great Plains*. U. of Idaho Press, Moscow, ID. 220 pp.

Greer, Rich. "Sage grouse habitat requirements and development." Habitat Extension Bull. 31, Wyo-ming Game and Fish Dept., Cheyenne, WY. 6 pp.

Jewett, Stanley Gordon, 1953. *Birds of Washington State*. U. of Washington Press, Seattle, WA. 767 pp.

Knight, Dennis, 1994. *Mountains and Plains: The Ecology of Wyoming Landscapes*. Yale U. Press, New Haven, CT. 338 pp.

Lukas, David, 1999. *Watchable Birds of the Great Basin*. Mountain Publishing, Missoula, MT. 162 pp.

National Geographic Society, 1983. *Field Guide to the Birds of North America*. National Geographic Society, Washington, D.C. 464 pp.

Patterson, Robert L., 1952. *The Sage Grouse in Wyoming*. Sage Books, Inc., Denver, CO. 341 pp.

Poole, A. and F. Gill, editors. *The Birds of North America*. Academy of Natural Sciences, Philadelphia, PA, and the American Ornithologists' Union, Washington, D.C.

Paige, C. and S.A. Ritter. 1999. *Birds in a Sagebrush Sea: Managing Sagebrush Habitats for Bird Communities*. See ordering information below.

Ryser, F. 1985. *Birds of the Great Basin*. U. of Nevada Press, Reno, NV. 604 pp.

Stubbendieck, James, Stephan L. Hatch, and Charles H. Butterfield, 1992. *North American Range Plants*. U. of Nebraska Press, Lincoln, NE. 493 pp.

Taylor, Ronald J., 1992. *Sagebrush Country: A Wildflower Sanctuary*. Mountain Press Publishing Company, Missoula, MT. 211 pp.

Trimble, Stephen. 1989. The sagebrush ocean. U. of Nevada Press, Reno, NV.

funding provided by these agencies and organizations (alphabetically):

American Bird Conservancy
Idaho Department of Fish and Game
Idaho Fish and Wildlife Foundation
Montana Department of Fish, Wildlife and Parks
National Audubon Society
National Fish and Wildlife Foundation
Point Reyes Bird Observatory
Ravenworks Ecology
The Nature Conservancy, Idaho and Washington
USDA Forest Service, Regions 1 and 4
USDI Bureau of Land Management, Oregon and Idaho state offices
USDI Bureau of Reclamation, Montana and Idaho
USDI Fish and Wildlife Service, Region 1
Washington Department of Wildlife
Wyoming Game and Fish Department

Many people provided advice and reviews of "Birds in a Sagebrush Sea: Managing Sagebrush Habitats for Bird Communities"; their names are listed in that publication. In addition, the following reviewers provided helpful comments on this version: Gary Butler, Andrea Cerovski, Katy Duffy, Frank Fink, Doc Hatfield, Gary Herron, Aaron Holmes, and Charlotte Reid.

For additional copies or to order copies of the report, "Birds in a Sagebrush Sea: Managing Sagebrush Habitats for Bird Communities," contact the nongame program manager, Idaho Department of Fish and Game, Box 25, Boise, ID 83707; (208) 334-2920

The Brewer's sparrow is one of the most abundant birds in the sage during the spring and summer. Although the Brewer's is well camouflaged, its song brings a dash of color to sage basins. One ornithologist has described it as a "buzzy trill, ascending and descending." While some songs may last just a few seconds, a Brewer's sparrow will occasionally sing nonstop for up to ten minutes. (Photo by Brian E. Small)

sharp-tailed grouse, and sage sparrows) are more common and more productive where perennial grasses in sagebrush steppe are tall, dense, and healthy. Many species that nest on the ground or low in woody shrubs rely on grasses for nesting cover. Also, there is experimental evidence that shrub-steppe birds prefer to eat native grass seeds rather than cheatgrass or medusahead.

Although forb species may make up only a small portion of plant composition and cover in sagebrush habitats, they are extremely important to the diet of sage grouse broods, pronghorn antelope, and other wildlife. Use management practices that allow forb growth to continue through spring and summer, particularly in sage grouse breeding habitat.

Some forbs that are especially valuable to sage grouse are common dandelion, yellow salsify, hawksbeard, prickly lettuce, mountain dandelion, sweet clover, and other clover species (*Melilota* spp. and *Trifolium* spp.), buckwheat, and common yarrow. In seed mixes, native species make the best choice.

grazing

There are many possibilities for harmonizing grazing practices with habitat management for birds. As cattle graze sagebrush steppe, they first select grasses and forbs and avoid browsing on sagebrush, which can have a toxic effect on the microorganisms in their rumens.

The effect of grazing in any particular region depends on season and duration of use, intensity, type of livestock, and the plant species themselves. Where grazing reduces or removes the herbaceous understory without adequate time for recovery, 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. This situation ultimately discourages livestock use and reduces the value of the area to wildlife.

No single grazing strategy is appropriate for all sagebrush habitats, and grazing management should be tailored to each grazing unit. In general, sagebrush birds will benefit if grazing plans promote a mosaic of different amounts of shrub cover, perennial grass and forb cover, and openings of bare ground, short grass, or high grass density.

Proper seasonal grazing management can also ensure nesting cover and provide protection from trampling of nests or broods during the nesting season. Management plans also need to consider other grazers, such as

***Agoseris* or mountain dandelion (left) is "sage grouse ice cream." The lark sparrow (center) nests in grasslands and shrublands. The black-throated sparrow (right) is a desert shrub species whose range barely reaches into southern Wyoming, Idaho, and Oregon. (*Agoseris* by Terry Rich-BLM; lark sparrow by Francis Bergquist; black-throated sparrow by Wendy Shattil and Bob Rozinski)**

elk and deer, and their influence on vegetation.

water development

We cannot overstate the importance of healthy plant communities around streams, ponds, springs, seeps, wet meadows, and wetlands to birds and other wildlife, especially in arid country. Kept in good condition, these areas provide water, abundant insects and forbs for eating, and grasses and forbs for cover.

Water developments for livestock or wildlife can use water that is already available (such as springs and seeps) or harvest water that is otherwise unavailable (such as well and catchments). Be sure to evaluate the benefit of water developments against their effect on aquatic and riparian vegetation, the water table, and potential for attracting undesirable animals or plants.

invasion of exotic plants

The invasion of non-native grasses and forbs is a major threat to many sagebrush habitats, and in some areas overshadows all other habitat threats. One of the greatest changes to sagebrush plant communities came with the invasion of non-native annual grasses and forbs, particularly cheatgrass. Inadvertently introduced in the late nineteenth century, cheatgrass spread like an epidemic across the Intermountain West and reached its present geographic range by about 1928. Today, cheatgrass threatens to dominate 62 million acres.

Cheatgrass is a rapid colonizer of disturbed sites and a persistent resident, replacing native species. Other non-native species, such as medusahead, yellow star thistle, knapweeds, tumble mustard, and halogeton, are also becoming increasing problems.

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, the grass carries fire over great distances and the range burns far more frequently— at intervals of three to five years. Cheatgrass also matures and dries earlier than native bunchgrasses, increasing the chance of fire earlier in the season.

Because sagebrush may take several years to mature before producing seed, repeated, frequent fires can eliminate sagebrush entirely. As the number and intensity of fires increase, cheatgrass persists and on some sites

The rock wren (left) typically nests in abandoned gopher burrows, crevices, or rock piles. The sage thrasher (center) depends on sagebrush for its nesting cover. Springs, wet meadows, and riparian areas (right) provide water, succulent forbs, and abundant insects for many wildlife species, especially sage grouse broods. (Rock wren by Wendy Shattil and Bob Rozinski; sage thrasher by Francis Bergquist; wet meadow by Terry Rich-BLM)

The ferruginous hawk (above), typically nests on cliffs or rocky points. This field of cheatgrass (below) shows the almost continuous fuel chain created by this exotic plant. The inset shows a cheatgrass head. (Hawk by Francis Bergquist; cheatgrass by Terry Rich-BLM)

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. Restoring native plants is then extremely difficult if not impossible.

Controlling these invaders is perhaps the most difficult and perplexing problem facing range managers. Once established, cheatgrass, medusahead, and other non-natives change the vegetation ecology of sagebrush habitats. There are no simple prescriptions for eliminating these noxious weeds, and it is far beyond the scope of this article to provide a complete review of weed management.

habitat fragmentation

Development, mining, and converting land to annual grassland or tilled cropland fragments natural habitats. These activities break sagebrush communities into small and sometimes isolated stands. From the 1930s through the 1960s, and to a much lesser extent today, land managers controlled sagebrush on rangeland to increase livestock forage on sites where the native grasses had been lost. Many areas then were seeded with crested wheatgrass, a non-native perennial bunchgrass, to provide forage.

In addition to the thousands of acres where non-native grasses are mixed with sagebrush, approximately ten percent of native sagebrush steppe has now been completely replaced by invasive annuals or by intentionally seeded non-native grasses. Another ten percent of the sagebrush steppe has been converted to dryland or irrigated agriculture. In eastern Washington, only forty percent remains of

A shorebird called the mountain plover (left) nests in short grass and sagebrush habitats. This bird has come on hard times recently. Fragmentation (below) due to agricultural conversion, housing development, and rangeland seeding creates patches too small to support some species such as the sage sparrow (the square near the middle is 1 square mile). (Plover by Francis Bergquist; Aerial photo by BLM-Burley, Idaho)

10.4 million acres of shrubsteppe that existed before the arrival of settlers.

Habitat fragmentation threatens sagebrush obligate species that evolved in the vast sage landscape. Sage grouse and long-billed curlews are not as productive in small stands of habitat as in large stands. Sagebrush-dependent songbirds (sage thrasher, sage sparrow, and Brewer's sparrow) also are sensitive to fragmentation. These species favor larger stands with high shrub cover and decline with increasing habitat disturbance. Nest predation and cowbird brood parasitism may also play a role in reducing bird productivity in fragmented sagebrush habitat but have not been studied much.

But how big a habitat patch is big enough? The minimum or optimum sizes of habitat patches required to sustain populations of sagebrush birds and other wildlife are still largely unknown. During a study in Washington, researchers did not find sage sparrows on patches smaller than about a half-section (320 acres). Patches should be that size or larger. This doesn't mean that small stands aren't useful to some species.

farming

Tillage fragments and completely alters sagebrush habitat to the detriment of sagebrush birds; however, even remnant sagebrush patches between fields have value

to some species. Certain practices can be adopted to reduce farming's impacts on birds.

insecticides

Although the withdrawal in the U.S. of many organochlorine insecticides, including DDT, eliminated the massive bird die-offs caused by these chemicals, many migratory birds are still exposed to these insecticides on their wintering grounds in other countries. Incorrect applications of legal insecticides in birds' breeding ranges also continue to cause direct mortality, sickness, behavioral changes, and reduced survival in many species. The full impact of insecticides on bird behavior and survival is still largely unknown.

In sagebrush shrublands, grasshoppers are traditionally viewed as a major pest, and poor range condition, drought, and certain weather patterns can lead to grasshopper outbreaks. Intensive insecticidal control programs that eliminate beneficial insects as well as grasshoppers can trigger a rapid resurgence in pest species and actually increase the probability and duration of economically damaging grasshopper outbreaks. However, at low, endemic levels, grasshoppers play a major role in rangeland ecosystems. Grasshopper feeding stimulates plant growth and contributes to nutrient cycling by producing leaf litter. Grasshoppers themselves are a major protein-rich food source for many shrubsteppe and grassland birds in summer and early fall. Although birds cannot control large pest outbreaks once they have erupted, they play an important role in preventing pest buildups. Bird densities will likely decline as insect food sources decline. In the long term, insecticide applications that adversely affect insectivorous birds are counterproductive to pest control.

controlled burning and wildfire

Burning *large areas* to eradicate sagebrush is detrimental to birds in sagebrush habitats because it removes shrubs so necessary for nesting, food, and cover. More alarmingly, it may promote the conversion of the vegetation to non-native annuals such as cheatgrass.

Historically, small, patchy fires every twenty-five to 100 years appear to have been the norm in many sagebrush shrublands while larger fires occurred less frequently in some areas, depending on the climate, topography, plant composition, and aridity of the site. Wildfire suppression is the best management prescription in areas prone to cheatgrass invasion and a subsequent increase in fire frequency and loss of sagebrush. Where needed and appropriate, we can set fires to fulfill fire's natural role in promoting and maintaining sagebrush steppe habitats. The difference between wildfire and controlled burning is relatively simple— a controlled burn is planned by people with a detailed understanding of local ecology, the effects of fire on local vegetation, and the techniques that can be used to control fire.

recreation

Recreation activities, such as camping, hiking, biking, and off-road driving, also can degrade sagebrush habitats. Recreationists may trample plants and biological soil crusts, and increase the incidence of fire, weed invasion, and roadkills. Humans also may disrupt breeding activities, causing nest failures or decreased production of young.

residential development

Dense residential developments generally eliminate sagebrush habitat entirely by totally converting shrublands to buildings, asphalt, lawns, and landscaped parks. More dispersed residential developments, consisting of five- to twenty-acre parcels, also fragment sagebrush habitat, but the degree depends on how willing landowners are to maintain this special community. In addition to converting sagebrush shrublands or fragmenting them, residential areas harbor animals that prey on birds, such as domestic cats, crows, ravens, and raccoons. However, careful planning can conserve native habitats even within and near developed landscapes. The kinds and abundance of wildlife such areas can support will depend on their size and proximity to other native habitats.

concluding thoughts

We produced this publication out of concern for the wildlife and plants of the sage. Now, it's up to you to put these recommendations to work on your land, to turn the tide for the wildlife communities of the sagebrush sea.

This article originally appeared in a slightly different form in the Wyoming Wildlife, March 2000 issue. Text written and researched by Sharon A. Ritter, Idaho Partners in Flight, and Christine Paige, Ravenworks Ecology.

Printed by Joslyn & Morris Inc. • Boise, Idaho