

## **Shrubland Habitat Group**

### ***Shrub-steppe***

#### **1) Describe the habitat:**

**a) Historic conditions:** Dominated by sagebrush, greasewood, saltbush, and rabbitbrush on a landscape scale; can include a grass component. Topographic heterogeneity is greater in this habitat type than shortgrass prairie habitat. Fire frequency varied depending on the species of sagebrush present and the moisture regime. In a shrub-dominated community, fire frequency was probably lower than in a grass-dominated community.

**b) Present conditions:** Dominated by sagebrush, greasewood, saltbush, and rabbitbrush, and includes a grass component, although the grass species present today are somewhat different and now include exotics such as cheatgrass. Topographic heterogeneity is still greater in this habitat type than shortgrass prairie habitat. Fire suppression has resulted in more sagebrush and a more decadent, larger, older structure. A change in the scale of disturbance from historic conditions is evident due to fire suppression. Characterized by a more uniform structure within the stand and loss of diversity of seral stages within a stand.

#### **2) Identify the issues:**

**a) Use:** Setting back succession of sagebrush stands to create more forage (grass), farming and ranching, oil and gas extraction, mining operations, off-road vehicle (ORV) travel, urbanization, recreation, and feral horses.

**b) Access:** Much of this habitat type is in public land ownership and access is less limited; more recreation in this habitat type has created more two-track roads. Far more year-round use is occurring now, rather than the seasonal use of the past, especially with oil and gas operations that increase access and use where typically there were none.

**c) Problems:** Fire suppression; prairie dog control; mineral extraction and associated roads, spills, weed encroachment, open oil pits, habitat fragmentation, and the potential for increased extraction; urbanization; increased incompatible recreation, such as ORV use; exotic species (weed spread such as knapweed, thistles, and leafy spurge; cheatgrass; yellow sweetclover; crested wheatgrass; feral and domestic cats; feral horses; and European Starlings and House Sparrows); incompatible livestock grazing (depending on the avian species); land conversion to cropland; and a checkerboard pattern of land ownership that affects the consistency of land management over large areas.

**d) What has been the cause of change to the habitat:** Fragmentation of ownership; habitat has been broken into different, often checkerboard, ownerships, and with this comes different management approaches and lack of management consistency over large areas. Fire suppression has resulted in more sagebrush and a more decadent, larger, older structure. Sagebrush stands are characterized by a more uniform structure within the stand and loss of diversity of seral stages within a stand. Livestock use is less intensive but more regular today than historically when buffalo moved through an area (i.e. less rest for habitat than historically). Chemical and mechanical sagebrush control is occurring. Water developments have changed the concentration of livestock versus historic buffalo use. Conversion of sheep allotments to cattle allotments has changed the type of grazing.

### **3) Priority bird species in Shrub-steppe habitat in Wyoming:**

**Level I:**

Ferruginous Hawk  
Greater Sage-Grouse  
Mountain Plover  
Brewer's Sparrow  
Sage Sparrow  
McCown's Longspur

Sage Thrasher  
Vesper Sparrow  
Lark Sparrow  
Lark Bunting  
Grasshopper Sparrow

**Level II:**

Black-chinned Hummingbird  
Loggerhead Shrike

**Level III:**

Common Poorwill  
Say's Phoebe

## *Best Management Practices*

### **Wyoming Partners In Flight Best Management Practices for Shrub-steppe to Benefit Birds In Wyoming. (Excerpted from “Birds in a Sagebrush Sea”, Paige and Ritter 1999.)**

#### Introduction

Sagebrush country symbolizes the wild, wide-open spaces of the West. While the first impression may be 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, 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.

Sagebrush habitats across the West have been greatly altered by a century of settlement, livestock grazing, agriculture, weed invasion, and changes in wildfire frequency. Across the United States, 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. The lack of quantitative information on many species' habitat needs reflects a severe shortage of ecological studies in sagebrush habitats. Thoughtful land management can help rejuvenate native sagebrush habitats and reverse the declines of sagebrush-dependent species.

These Best Management Practices have one purpose: to help anyone who is a steward of sagebrush shrublands include management practices that help support a thriving community of wild birds. Not all of the suggestions in this document will be appropriate in all places, depending on local conditions and management needs, but birds can benefit even if only a few suggestions are adopted.

#### Ecology of Sagebrush Habitats

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. Summer storms are brief and intense, and most summer rain runs off or evaporates.

The entire sagebrush region covers approximately 155.5 million acres (63 million ha) of the West. 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 and grasses are few and sparse [44.5 million acres (18 million ha)]. 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, but the species big sagebrush predominates, and has five known subspecies. 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.

A wide variety of vegetation community types exist within the sagebrush landscape due to differences in soil, climate, topography, and other physical processes, and natural and human-induced disturbances. 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 bluegrass, Thurber needlegrass, needle-and-thread grass, bottlebrush squirreltail, or Indian ricegrass. Forbs, such as phlox, milkvetch, 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% 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, winterfat, and spiny hopsage. Other shrub communities often occur adjacent to sagebrush shrublands, especially at higher elevations, such as those dominated by serviceberry, mountain mahogany, ceanothus, and snowberry. Grassy openings, springs, seeps, moist meadows, riparian streambanks, juniper woodlands, stands of aspen, and rock outcrops also add to the sagebrush mosaic, and these habitats help attract a diversity of birds and wildlife.

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 under appreciated. This crust 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. 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 slow the spread of wildfire.

Approximately 100 bird species and 70 mammal species can be found in sagebrush habitats. Some of these are sagebrush obligates (restricted to sagebrush habitats during the breeding season or year-round) or near obligates (occur in both sagebrush and grassland habitats). Sagebrush obligates include the Sage Sparrow, Brewer's Sparrow, Sage Thrasher, Greater Sage-Grouse, pygmy rabbit, sagebrush vole, sagebrush lizard, and pronghorn antelope.

### Changes in Sagebrush Country

Early explorers of the Intermountain West encountered a landscape dominated by shrubs and found grasslands chiefly limited to hillsides and moist valley bottoms. Sagebrush was widespread and dominant, and the boundaries of sagebrush habitats before European settlement were about the same as they are today.

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. Evidence also suggests that fire suppression and heavy grazing have contributed to the invasion of junipers and other conifers in some sagebrush areas.

Explorers' reports of abundant and widespread sagebrush probably indicate that fires were relatively infrequent in sagebrush habitats. 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. After a fire, big sagebrush must be reestablished by wind-dispersed seed or seeds in the soil. Depending on the species, sagebrush can reestablish itself within 5 years of a burn, but a return to pre-burn densities can take 15 to 30 years. 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.

Since presettlement times, sagebrush communities have suffered severe degradation and loss. 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.

The arrival of cattle and sheep in the Great Basin in the late 19<sup>th</sup> century triggered a rapid change in sagebrush plant communities. Sites may have lost their native perennial grasses less than 15 years after livestock introduction. In addition, settlers

burned off sagebrush to produce more grass for horses, sheep, and cattle and to clear the land for farming. 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. Sagebrush steppe can take time to recover from excessive grazing, especially on drier sites.

The effect of grazing in any region depends on season of use, intensity, type of livestock, and the plant species themselves. 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. 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.

Excessive grazing in the 19<sup>th</sup> and early 20<sup>th</sup> centuries also likely reduced crust communities throughout the Intermountain West, and it is difficult now to piece together their original extent and role in sagebrush habitats.

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 “nest 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 pressure. Cowbird parasitism may be a significant factor in the decline of some songbird populations.

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 nonnative perennial bunchgrass, to provide forage. In addition to the thousands of acres where nonnative grasses are mixed with sagebrush, approximately 10% of native sagebrush steppe has now been completely replaced by invasive annuals or by intentionally seeded nonnative grasses. Another 10% of the sagebrush steppe has been converted to dryland or irrigated agriculture.

The greatest change to sagebrush plant communities came with the invasion of nonnative annual grasses and forbs. Inadvertently introduced in the late 19<sup>th</sup> 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. Today, cheatgrass threatens to dominate 62 million acres (25 million ha)—more than half of the West’s sagebrush region.

Cheatgrass readily invades and rapidly colonizes disturbed sites and is a persistent resident, replacing native species. Other non-native species, such as medusahead, yellow star-thistle, knapweed, tumble mustard, and halogeton, are also becoming increasing problems. The presence of these invasive weeds also affects biological soil crusts.

Cheatgrass invasion fundamentally alters fire and vegetation patterns in sagebrush habitats by creating 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 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. Cheatgrass dominance eventually creates a uniform annual grassland perpetuated by large, frequent fires and void of remaining patches of native plant communities. Native shrubs, perennial grasses, and forbs can reestablish on a cheatgrass-dominated site over the course of several years if fire is suppressed, rainfall is low, and there is a seed source for native species.

### How to Help Birds in Sagebrush Habitats

The maintenance and restoration of sagebrush bird habitats depend on our ability to provide a mosaic of native plant communities across the landscape. This goal goes hand-in-hand with sustainable rangeland management.

Wildlife species respond to their environment at different scales—“landscape”, “stand”, and “patch”. The size of a landscape can be thousands to hundreds of thousands of acres, a stand can be one acre to thousands of acres, and a patch can be less than one acre to hundreds of acres. Each habitat patch provides some of the resources needed by individual birds, from feeding to nesting sites. Combined into stands, these habitat patches provide enough total habitat for a pair to survive and raise its young. Many stands across a landscape can support a population of a particular species. The exact size of patches, stands, and landscapes depends on the needs of each species. Thus, changes to a patch can affect the specific needs of individuals and pairs (food, water, shelter, nest site, and escape cover); changes to a stand can affect the home ranges of individual birds and pairs of birds; and changes to a landscape can affect entire populations of birds.

Managing a single site for all sagebrush wildlife species is not possible because practices that benefit some species may be detrimental to others. Management for a particular site will depend on that site's potential. The idea is to strike a balance so that all habitats originally occurring (such as young and old sagebrush stands, grassland openings, wet meadows, springs, and riparian habitat) are represented across a large area.

The following management recommendations are voluntary and are meant to aid the land manager in enhancing habitat for sagebrush birds. These are based on our current knowledge of habitat requirements of sagebrush birds. Our main goal is to describe what birds need. Most of these suggestions will also benefit other wildlife species. 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 implement only a few of the recommendations, you can help improve habitat for birds.

### General Sagebrush Habitat Management

We recommend no net loss of sagebrush steppe habitat on a landscape scale. No net loss does not preclude management activities. Future habitat conversions should be mitigated by restoration or conservation elsewhere, and range managers should plan for a dynamic pattern of different aged stands across a landscape.

- 1) Identify and protect those habitats that still have a thriving community of native understory and sagebrush plants. These may be managed as conservation easements (which do not necessarily exclude economic land uses), refuges, protected areas, sanctuaries, or research areas. Management should focus on restoring natural disturbance processes, such as fire, and removing invasive nonnative plants.
- 2) Where possible, restore or rehabilitate degraded and disturbed sites to native plant communities.
- 3) To benefit area-sensitive species such as Greater Sage-Grouse, Sharp-tailed Grouse, and Sage Sparrows, maintain sagebrush in large, continuous areas composed of a mosaic of open to moderate shrub densities (5 to 20%) and multiple age and height classes. An area-sensitive species is one that requires a large block of unfragmented habitat to successfully breed and survive. For Sage Sparrows, continuous areas should be greater than 320 acres (130 ha).
- 4) Within extensive areas of sagebrush habitat, manage for a patchwork or mosaic of native plant communities across the local landscape. This may include stands of young and old sagebrush, openings (ranging from bare ground to short vegetation to high



grass density), wet meadows, seeps, healthy riparian vegetation, and other interspersed shrub and woodland habitats. Mosaics support many bird species with different needs. Young, sparse stands support Vesper Sparrows and Lark Sparrows. Older, denser stands benefit Greater Sage-Grouse, Long-billed Curlews, and Burrowing Owls. Broad-leaved shrub thickets and riparian areas provide winter habitat for Sharp-tailed Grouse. Forested streambanks 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.

5) Openings of short vegetation surrounded by sagebrush are particularly important for Sage-Grouse leks and for ground foraging by Sage Thrashers, Loggerhead Shrikes, Brewer's Sparrows, and Sage Sparrows. Openings of short vegetation [2 to 8 inches (5 to 20 cm)] with wide visibility provide Long-billed Curlew and Burrowing Owl breeding habitat.

6) Maintain remaining biological soil crust communities by minimizing sources of soil disturbance, such as off-road vehicle travel or heavy grazing.

7) Maintain seeps, springs, wet meadows, and riparian vegetation in a healthy state for young Greater Sage-Grouse and other species that depend on the forbs and insects available in moist places.

8) Maintain ground squirrel and prairie dog colonies to provide nesting burrows for Burrowing Owls, and maintain small mammal populations as prey for many bird and mammal predators.

9) Regularly monitor birds to see how the management plan is working, and redirect efforts if necessary (with special emphasis for species that seem to be declining). Implement shrub-steppe habitat monitoring programs to establish baseline data and identify changes in habitat quality (both positive and negative) through time. Use standardized methods to monitor the habitats and sensitive species in an area, before and at several-year intervals after treatments are applied, to aid in making proper land management decisions in the future.

### Sagebrush

1) Avoid practices that permanently convert sagebrush shrubland to nonnative grassland or farmland.

2) Manage existing stands of sagebrush steppe for a balance between shrub and perennial grass cover and for open to moderate shrub cover (5 to 25%) and multiple height classes.

3) Extensive, overly dense, and crowded sagebrush stands that have lost much of the native herbaceous understory and plant diversity may require selective removal of shrubs to reestablish a balance between shrub cover and perennial grass and forb cover. Only use prescribed fire in areas not threatened by cheatgrass or medusahead invasion.

4) In large disturbed areas, sagebrush and perennial grasses may need to be reseeded to shorten the recovery time and prevent dominance by nonnative grasses and forbs.

5) Use Tables 12 and 13 below to determine the sagebrush habitat components needed and nesting substrates used by sagebrush shrubland bird species of concern. These tables can help guide landowners and land managers in efforts to provide necessary habitat characteristics for sagebrush obligate and dependent species on patch, stand, and landscape scales.

Table 12. Habitat components used by 17 sagebrush shrubland bird species of concern.

<b>Species</b>	<b>Tall, dense sagebrush</b>	<b>Open, patchy sagebrush</b>	<b>Grass cover for nests</b>	<b>Grassland</b>	<b>Short grass, bare ground</b>	<b>Seeps, wet habitat</b>	<b>Dry woodland</b>	<b>Riparian</b>
<b><i>Sagebrush</i></b>								
<b><i>Obligate</i></b>								
<b><i>Species</i></b>								
Sage Grouse	X	X	X	X	X	X		
Sage Thrasher	X	X	X		X			
Sage Sparrow	X		X		X			
Brewer's Sparrow	X	X	X		X			
<b><i>Shrubland</i></b>								
<b><i>Species</i></b>								
Black-throated Sparrow		X	X					
Green-tailed Towhee	X	X	X				X	
Lark Sparrow		X	X	X			X	
<b><i>Shrubland and</i></b>								
<b><i>Grassland</i></b>								
<b><i>Species</i></b>								
Swainson's Hawk		X		X	X	X		X
Ferruginous Hawk		X		X	X		X	
Prairie Falcon		X		X			X	
Sharp-tailed Grouse	X	X	X	X		X		X
Loggerhead Shrike	X	X			X		X	X
<b><i>Grassland</i></b>								
<b><i>Species</i></b>								
Long-billed Curlew		X		X	X	X		
Burrowing Owl		X		X	X			
Short-eared Owl		X	X	X		X		
Vesper Sparrow		X	X	X				
<b><i>Dry Woodland</i></b>								
<b><i>Species</i></b>								
Gray Flycatcher	X						X	

Table 13. Nesting substrates for 17 sagebrush shrubland bird species of concern.

<b>Species</b>	<b>Burrow</b>	<b>Ground</b>	<b>Shrub</b>	<b>Tree</b>	<b>Cliff</b>
<b><i>Sagebrush</i></b>					
<b><i>Obligate</i></b>					
<b><i>Species</i></b>					
Greater Sage-Grouse		X			
Sage Thrasher		X	X		
Sage Sparrow		X	X		
Brewer's Sparrow			X		
<b><i>Shrubland</i></b>					
<b><i>Species</i></b>					
Black-throated Sparrow		X			
Green-tailed Towhee			X		
Lark Sparrow		X			
<b>Shrubland and</b>					
<b><i>Grassland</i></b>					
<b><i>Species</i></b>					
Swainson's Hawk			X	X	X
Ferruginous Hawk		X		X	X
Prairie Falcon					X
Sharp-tailed Grouse		X			
Loggerhead Shrike			X	X	
<b><i>Grassland</i></b>					
<b><i>Species</i></b>					
Long-billed Curlew		X			
Burrowing Owl	X				
Short-eared Owl		X			
Vesper Sparrow		X			
<b><i>Dry</i></b>					
<b><i>Woodland</i></b>					
<b><i>Species</i></b>					
Gray Flycatcher			X	X	

## Understory Grasses and Forbs

Perennial bunchgrasses and native forbs provide food and cover for many sagebrush birds. Several species (e.g. Greater Sage-Grouse, Sharp-tailed Grouse, and Sage Sparrow) are more common and more productive where perennial grasses in sagebrush steppe are tall, dense, and healthy, and many species that nest on the ground or low in woody shrubs rely on grasses for nesting cover (Tables 12 and 13). Also, there is experimental evidence that shrub-steppe birds prefer to eat native grass seeds rather than cheatgrass or medusahead.

- 1) Wherever perennial bunchgrasses and native forbs persist, choose practices that stabilize or increase native grass and forb cover in balance with open to moderate (5 to 25%) sagebrush cover.
- 2) To maintain bluebunch wheatgrass vigor (its capacity for growth and reproduction), avoid grazing during the growing season until plants begin to cure. Bluebunch wheatgrass, one of the most widespread of native bunchgrasses, is particularly sensitive to heavy grazing during the growing season.
- 3) Rehabilitating sites depleted of native grasses and forbs may require seeding native species, temporarily eliminating or reducing livestock grazing, conducting appropriate fall-winter grazing, thinning sagebrush stands, creating small clearings, or other strategies.
- 4) Where reseeding disturbed and degraded sites, try to use local, native genotypes that are competitive with nonnative weeds, and use seed priming and enhancement techniques that increase germination rates. Where native plant community restoration is the goal, land managers may need to use contractors to collect and propagate local seed to produce enough seed for a project site, or may need to transplant from adjacent sites. The availability and cost of native seeds remain the greatest obstacles to revegetation with native species, and using native generalist species or nonnative perennials may be the only commercially available alternatives. On severely degraded sites, nonnative forbs and perennial grasses may be preferable to monocultures of nonnative annuals.
- 5) Maintain native forb diversity. Forbs are extremely important to the diets of Greater Sage-Grouse broods, pronghorn antelope, and other wildlife. Use practices that allow forb growth to continue through spring and summer, particularly in Greater Sage-Grouse breeding habitat. Some forbs that are especially valuable to Sage-Grouse are common dandelion, yellow salsify, hawksbeard, prickly lettuce, mountain dandelion, sweetclover and other clover species, buckwheat, and common yarrow.

6) Allow herbaceous cover to conceal nests through the first incubation period for birds that nest on the ground or low in shrubs. Maintain the current season's growth through mid-July, and manage for 50% cover or more of the annual vegetative growth to remain through the following nesting season.

### Biological Soil Crusts

Although not used directly by birds, biological soil crusts are thought by some biologists to promote soil development and productivity in sagebrush habitats, and therefore benefit the native plant community.

1) To maintain soil crusts, minimize soil disturbances. Crusts are sensitive to trampling by hikers, livestock, and vehicles. There is considerable debate over recovery times for biological soil crusts, from a few years for visual recovery of the crust structure to several decades for full community recovery; recovery times depend on the site and degree of disturbance.

2) Where restoring biological soil crusts is the goal, use exclosures or non-fence methods to eliminate trampling. Inoculating disturbed soils with material from surrounding biological crusts can hasten recovery times.

### Grazing

There are many possibilities for harmonizing grazing practices with habitat management for birds. No single grazing strategy is appropriate for all sagebrush habitats, and grazing management should be tailored to the condition and potential of 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 elk and deer, and their influence on vegetation.

1) Use stocking levels that stabilize or increase native perennial grass cover, reduce disturbance to biological soil crusts, and prevent sagebrush over-dominance or nonnative grass and forb invasion.

2) Grazing plans will depend on the current condition and plant composition of the range. Use grazing practices (i.e. seasons, stocking, kinds of stock, and distribution) that promote the growth of native grasses and forbs needed by birds for food and concealment. To maintain native bunchgrasses on a given unit, defer grazing until after crucial growth periods, waiting until grasses have begun to cure so seed-set can happen. However, deferred grazing can favor cheatgrass unless perennial grasses are a

significant component of the vegetation. In stands where cheatgrass and native perennial grasses are mixed, grazing during the dormant period may favor perennial species.

3) To protect or recover biological soil crusts, limit grazing to wet periods and winter months. Crusts are more sensitive to damage in dry months and can better tolerate the impact of hooves when wet or frozen.

4) Reduce stocking level, change timing of grazing, or rotate pastures to reduce or eliminate trampling of ground nests and nestlings (from May through mid-July for most songbirds).

5) Maintain herbaceous cover for nest concealment by protecting the current season's growth through the nesting season and by managing for at least 50% of annual vegetative growth to remain through the following nesting season. For Greater Sage-Grouse, average grass height of at least 7 inches (18 cm), measured in May and early June, provides adequate herbaceous cover for successful nesting. For Sharp-tailed Grouse, retain a residual cover of perennial grasses and forbs of at least 8 inches (20 cm) to provide sufficient nesting cover.

6) Consider temporarily removing livestock from an area that is damaged or otherwise needing protection. Livestock exclusion can be a short- or long-term option for locally or regionally rare vegetation types, sites undergoing restoration, recently burned areas, wet sites (e.g. springs, seeps, wet meadows, and streams), and other areas that are easily degraded. By itself, removing livestock may not reverse the condition of severely damaged habitats and often must be combined with reseeding and other rehabilitation methods to restore site condition.

7) Situations that concentrate livestock during the songbird breeding season (April through July) increase the influence of Brown-headed Cowbird brood parasitism on songbird breeding success. Where possible, consider rotating livestock use in order to rest units from cowbird concentrations in alternate years and to give local songbird populations [within a breeding radius of 4 miles (6.5 km)] and opportunity to breed without high parasitism pressure.

### Water Developments

We cannot overstate the importance of healthy plant communities around streams, rivers, ponds, lakes, springs, seeps, wet meadows, and wetlands to birds and other wildlife, especially in arid country. 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 wells 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.

- 1) Avoid practices that degrade or destroy natural water flow or the vegetation in and around wetland habitats. Restore and enhance natural riparian and aquatic habitats wherever possible.
- 2) Greater Sage-Grouse are attracted to wet areas more for the availability of succulent forbs and associated insects than for the free water. Protect and enhance the growth of native forbs around natural and constructed water developments. Enhance water developments for grouse by placing them in known summer ranges and migration routes.
- 3) Enclosures or non-fencing methods of controlling livestock around riparian habitats, seeps, springs, ponds, and catchments will protect shoreline and wetland vegetation and benefit birds. However, fences can be hazardous to birds and mammals. If they are necessary, use smooth wires on top and bottom, and do not string fences across water. Limiting grazing to the plants' dormant season (November to March) can help prevent damage to these areas.
- 4) Livestock water developments can decrease stock concentrations and distribute grazing more evenly across the range to prevent degradation. However, the tradeoff is that establishing new water developments can result in degradation of sites not previously grazed or only lightly grazed.
- 5) Small birds sometimes drown in stock tanks and troughs. Provide escape ramps or floats to prevent drowning (Figure 10).



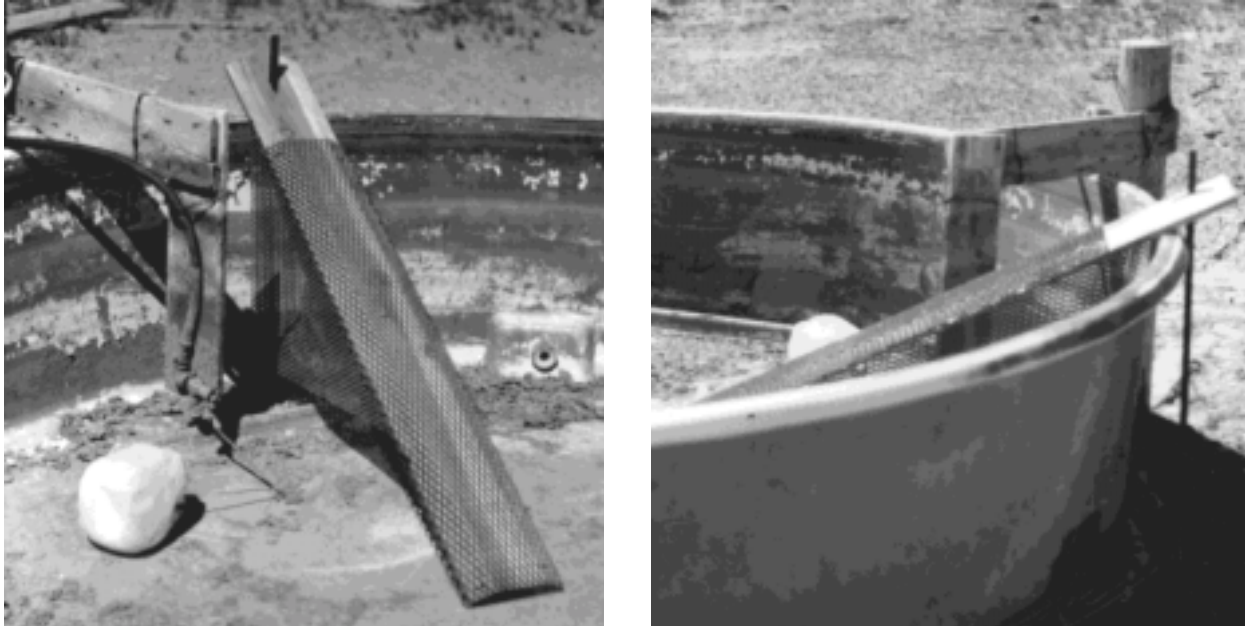


Figure 10. Escape ramps placed in stock tanks and troughs to prevent drowning of small birds and mammals (photographs courtesy of Mark Gorges, Bureau of Land Management).

### Insecticides

Although 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, although the full impacts are 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 insecticide control programs that eliminate grasshoppers, as well as beneficial insects, 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. Grasshoppers stimulate plant growth by feeding on them and contribute to nutrient cycling by producing leaf litter, and grasshoppers themselves are a major protein-rich food source for many shrub-steppe and grassland birds in summer and early fall. Although birds cannot control large pest outbreaks once they have erupted, as predators 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.

- 1) Land managers concerned with maintaining productive bird populations should reduce insecticide use wherever possible.
- 2) Include birds in Integrated Pest Management plans for grasshopper and other insect control, along with natural pathogens, suitable crop and grazing practices, pest-resistant crop strains, minimal use of insecticides, and using less toxic forms of insecticides.
- 3) Reduce or avoid the direct toxic effects of insecticides on birds by using insecticide baits and natural pathogens (such as *Nosema locustae* for grasshoppers) instead of broad-spectrum insecticides. Target pest control toward key problem areas, and time applications to be effective in minimum doses. Avoid broadcast spraying. Use ground applications rather than aerial spraying to prevent drift into non-target areas.
- 4) Avoid applying pesticides to Sharp-tailed Grouse and Greater Sage-Grouse breeding habitat during the brood-rearing season (mid-May through mid-July) to reduce the loss of food supply to chicks and avoid the chance of secondary poisoning.
- 5) Restrict use of insecticides to the minimum application rates on croplands that border sagebrush habitat. Organophosphate insecticides (dimethoate and methamidophos at maximum rates) have been shown to cause die-offs and sickness in Greater Sage-Grouse when aerially sprayed on croplands bordered by sagebrush habitat and may affect many other species. Burrowing Owls and other species attracted to agricultural areas by high densities of small mammals are also at risk from agricultural chemicals.

### Recreation

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

- 1) Design recreation sites so they reduce impact on native vegetation and do not contribute to erosion or contaminate water. Protect springs and wetlands. Encourage use of established sites and minimum-impact recreation ethics. Avoid placing recreation sites near Sharp-tailed and Greater Sage-Grouse leks and breeding habitat, or near raptor nest areas, such as rock outcrops, cliffs, and forested riparian zones.

2) Driving vehicles off-road across sagebrush habitats destroys vegetation and biological soil crusts, contributes to soil erosion, and can destroy nests and nestlings. Keep all vehicles on established roads and trails or confined within areas established specifically for off-road recreation.

3) In sensitive areas, hikers, mountain bikers, and horseback riders can damage vegetation and biological soil crusts and contribute to soil erosion. Reduce impacts by keeping these users to established trails.

4) Limit the number of roads, and reclaim unused roadbeds with sagebrush and native grasses and forbs. This will reduce weed invasion, roadkills, and fragmentation. On remaining roads, use annual weed and fire control to protect adjacent sagebrush habitat.

5) Restrict target practice to established shooting and archery ranges to avoid irresponsible or inadvertent killing of living targets.

### Prescribed Fire and Wildfire

Burning over large areas to eradicate sagebrush is detrimental to birds in sagebrush habitats because it removes shrub cover. More alarmingly, it promotes the vegetation communities' conversion to nonnative annuals such as cheatgrass. Historically, small, patchy fires at frequencies of 25 to 100 years appear to have been the norm in some sagebrush shrublands, while larger fires at lower frequencies occurred in other 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 to subsequent increase in fire frequency and loss of sagebrush. Prescribed fire can be used to fulfill fire's natural role where needed.

1) Burns to create openings in continuous or dense sagebrush should be on a small scale and designed to allow gradual reestablishment of sagebrush from upwind stands or soil-banked seeds. This will provide multiple ages of sagebrush over area and time.

2) Burns should be timed to consider the development and susceptibility of desired plants. Mid-summer burns can devastate native perennial grasses and forbs because they destroy plants before they have reached maturity. Mid-summer fires also favor cheatgrass, and can increase erosion when the soil is exposed to severe rainstorms. Early spring and late fall burns when the soil is moist and grasses are dormant (before growth begins or after maturity) have less impact on native bunchgrasses and forbs.

3) Burns may require reseeding with native bunchgrass and forb species in order to stem the invasion of nonnative annuals. Avoid reseeding with crested wheatgrass or other nonnative species that create a continuous herbaceous cover and out-compete

native species. However, crested wheatgrass may be appropriate in seed mixtures on severely degraded sites and may provide some structure valuable to birds. It is preferable to the more aggressive cheatgrass and medusahead. Keep cattle off recovering sites for one to two growing seasons; grazing after a burn can seriously damage soil and native perennials, delaying recovery.

4) In cheatgrass-dominated landscapes, greenstripping (placing fuelbreaks of fire-resistant vegetation at strategic locations on the landscape) offers an option for slowing the spread of wildfire and reducing the size of range fires. However, because greenstrips fragment sagebrush habitat and can bring in more nonnative weeds if the seeding is unsuccessful, only use greenstripping in areas where there is a high threat of invasion of annual grasses and where there is a real threat to high-value sagebrush sites.

The following activities convert sagebrush shrubland to other habitat types, replacing plants and wildlife with other (often nonnative) species. Above, we recommend no net loss of sagebrush steppe habitat. Where habitat conversions do occur, we recommend the following practices to help reduce impacts to adjacent sagebrush habitat or to provide some of the requirements of sagebrush birds, such as a prey base.

### Habitat Fragmentation

Habitat fragmentation can result from land conversion to annual grassland or tilled cropland, mining, and development. These activities break sagebrush communities into small, and sometimes isolated, stands. Habitat fragmentation threatens sagebrush obligate species that evolved in a vast, continuous landscape of sagebrush habitat. Sagebrush obligates are not as productive in small stands of habitat as in large stands, and their numbers decline with increasing disturbance. Nest predation and cowbird nest parasitism may also play a role in reducing bird productivity in fragmented sagebrush habitat, but have been studied very little. But how big is big enough? Unfortunately, the minimum or optimum sizes of habitat patches required to sustain populations of birds and other wildlife species are still largely unknown. In a study in Washington, Sage Sparrows were not found on patches smaller than about 320 acres (130 ha), so it is suggested that patches should be that size or larger.

1) The safest approach to the habitat fragmentation issue is to manage for no *net* loss of sagebrush steppe habitat and to maintain native vegetation communities in large and continuous stands wherever possible.

2) Maintain existing larger stands of sagebrush and continuity between stands wherever possible. Avoid designs and practices that create or increase the amount of edge between sagebrush habitat and converted or highly altered land. These edges support

cowbirds, nest predators, and invasive grasses and forbs, and they expose wildlife to insecticides, shooting, collisions with vehicles, and other hazards.

3) To benefit Greater Sage-Grouse and Sharp-tailed Grouse, maintain large expanses of sagebrush habitat. Summer Sage-Grouse home ranges vary from 1 to 2.5 mile<sup>2</sup> (3 to 7 km<sup>2</sup>), and may be larger in fragmented habitats. Sage-Grouse winter home ranges may exceed 53 mile<sup>2</sup> (140 km<sup>2</sup>). Large expanses of sagebrush across a landscape with stands of 10 to >20% canopy cover and tall shrubs [10 to 12 inches (25 to 30 cm)] provide winter habitat. Sharp-tailed Grouse require thousands of acres or hectares to support a self-sustaining population; large blocks of agriculture are not conducive to Sharp-tailed Grouse occupancy.

4) To benefit sagebrush obligate songbirds, maintain large continuous areas of sagebrush with multiple height classes and variable shrub cover. Prevent sagebrush conversion to annual grasslands or croplands. Suppress range fires that threaten to eradicate large areas of sagebrush.

5) Some landscapes may require restoration of sagebrush and perennial bunchgrass communities to augment remaining sagebrush habitat and to avoid further fragmentation by wildfire carried by annual grasses.

6) Roads also fragment sagebrush communities and play a role in the spread of noxious weeds. Limit the number of roads and consider closing and rehabilitating old roads.

### Invasion of Nonnative Grasses and Forbs

The invasion of nonnative grasses and forbs is a major threat to remaining sagebrush habitats and in some areas overshadows all other concerns. Controlling these invaders is perhaps the most difficult and perplexing problem facing range managers. Once established, cheatgrass, medusahead, and other nonnatives 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 document to provide a complete review of weed management.

1) Where stands contain a community of native grasses and forbs, reduce the likelihood of weed invasion by maintaining the vigor of native species, controlling livestock stocking levels, avoiding large-scale soil disturbances, and minimizing habitat fragmentation.

2) Weed control with herbicides, biological agents, and mechanical techniques should be followed by reseeding and restoration of native plant species to prevent the reinvasion of weeds. Controlling fall-germinating annuals can enhance survival of

seeded fall-dormant perennials, which will better reestablish if annuals are not already rooted and competing for moisture when the perennials germinate in spring.

3) In cheatgrass-dominated units, managers may have only two options—manage the unit as an annual grassland, or intensively control cheatgrass and reseed. Deferred grazing plans may favor cheatgrass if perennial grasses are not a significant component of the unit. Where cheatgrass dominates, heavy spring grazing before seed production may reduce cheatgrass and prepare a unit for reseeding with desirable perennial grasses.

4) Although not yet a problem in Wyoming as it is in Idaho, medusahead control appears particularly difficult. Mechanical means of control often do not work on the soils or topography where medusahead invades; herbicidal sprays may be more effective. There is some indication that a few perennial grass species can eventually establish themselves on medusahead-infested sites.

### Farming

Tillage fragments and completely alters sagebrush habitat to the detriment of sagebrush birds. However, even remnant sagebrush patches have value to some species. Certain practices can be adopted to reduce farming's impacts on birds.

1) Minimum till and no-till systems maintain vegetative cover through the non-breeding season and provide habitat for small mammals and wintering songbirds. This, in turn, benefits raptors.

2) Maintain riparian woodlands, unplowed borders and edges, and vegetated waterways to provide nest and roost sites for raptors and shrikes and foraging habitat for many songbirds. Provide an unplowed buffer of at least 100 feet (30 m) around springs, seeps, wetlands, and riparian habitats. Even small-scale habitat protection can provide important habitat features for many birds during breeding, winter, and migration.

3) Haying often destroys nests of Short-eared Owls, Vesper Sparrows, Sharp-tailed Grouse, and other ground-nesting birds, and decreases cover for mammalian prey. If possible, delay haying until ground-nesting birds have fledged. Most will have fledged by late July, depending on the area.

4) Reduce or eliminate insecticide use to prevent poisoning birds, reducing insect prey, or eliminating beneficial insects.

5) To avoid harm to other wildlife, check that fences meet specifications designed to protect deer and pronghorn antelope.

6) Sites with unsuitable soils or slopes too steep for farming should be kept in native vegetation as “habitat stepping stones”.

### Mining and Oil/Gas Development

Mining and oil/gas development should only be a short-term habitat conversion. Land reclamation, initiated concurrently with mining operations, can restore sagebrush habitat for birds.

1) Avoid placing mines, oil and gas drill sites, sand or gravel pits, geothermal sites, and roads in or next to sensitive habitats such as Greater Sage-Grouse leks, nesting, or wintering habitat; raptor nest sites on cliffs and outcrops; or riparian areas, springs, and other wetland habitats.

2) Reduce the impact of construction and operations on raptor nest sites through buffers and timing restrictions. Contact state or federal wildlife agencies for local advice on appropriate buffers and timing.

3) For successful grouse reproduction, Ulliman et al. (1998) and the Idaho Sage Grouse Task Force (1997) recommend no developments within 400 yards (365 m) of a lek and avoiding physical, mechanical, and loud noise disturbances within ½ mile (800 m) of a lek during the breeding season (March through May for Sage-Grouse, March through June for Sharp-tailed Grouse) from one hour before sunrise to three hours after sunrise. Avoid placing well pads, roads, and any other facilities requiring human presence within 825 feet (250 m) of raptor nests to prevent flushing adults from the nest. This buffer zone should be expanded in areas where prey are scarce, as raptors must spend more time searching for prey and may be less tolerant of disturbances. If necessary, implement mitigation measures to decrease continuous noise levels. For example, enclose compressor engines with buildings and install additional suppression around muffler exhausts. Noise barriers can be constructed at drilling and testing operations, and noise dampening around engines should be considered (including foam insulation around drilling rigs).

4) Prepare fire and weed control plans to protect both reclamation and adjacent sagebrush habitat.

5) Ensure that ponds containing mining wastes are closed off to exclude birds, bats, and other wildlife attracted to the water. Flagging, reflectors, and strobes are not effective because animals become habituated to these deterrents. It is necessary to employ a technique, such as complete covering with metal or polypropylene mesh or eliminating ponds, that will reduce or eliminate the possibility of wildlife entering disposal pits.

- 6) Reclaim areas as soon as possible after activities are completed. This reduces the amount of habitat converted at any one time and speeds up the recovery of the sagebrush habitat.
- 7) Avoid planting monocultures. Carefully plan for a complex of vegetation that reflects the diversity of plant species and habitats in the surrounding area. Reseed with local genetic seed stock, if available, and avoid using nonnative plant species that compete with native species. Big sagebrush will grow from soil-banked seeds, so saving topsoil is an excellent way to reestablish this species. Provide topography similar to the surrounding area to provide microsites that promote a mosaic pattern.
- 8) Grasses and forbs compete with young shrubs, but a mixture of shrubs and herbaceous species can be established at lower seeding rates if they are seeded in separate strips.
- 9) Fencing may be necessary to protect a site from both livestock and wild grazers, such as jackrabbits, until vegetation is well-established. However, because of hazards posed by fences, determine their necessity on a case-by-case basis.
- 10) Enhance habitat for birds and other wildlife by placing suitable rocks on reclaimed mined land. Rock should be placed in piles of varying sizes up to 6 feet (2 m) in height; rocks and rock piles should be grouped, as opposed to evenly scattered, over large areas with approximately 4 rock piles per acre (9 per hectare) taller than 3 feet (1 m); the minimum area to include outcrop habitats should be about 2.5 acres (1 ha); and shrub species should be planted in and around piles to encourage establishment of unique plant communities.

### Residential and Urban Development

Developments generally eliminate sagebrush habitat entirely by totally converting shrublands to buildings, asphalt, lawns, and landscaped parks. Residential areas also harbor animals that prey on birds or eggs, such as domestic cats, crows, ravens, skunks, 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.

- 1) Large-scale planning should promote and maintain “open space” of native habitats as public parks and commons. Manage land use to maintain these openings as native vegetation communities.
- 2) When designing open space of native habitats, plan for large areas to increase interior habitat, minimize fragmentation, and reduce edges and ecotones between native and nonnative habitats. Design open spaces so they connect with surrounding native



habitats. Avoid creating small patches or narrow strips of habitat except as possible corridors between larger habitat patches. Wide habitat corridors are better than narrow ones, but the ideal width is unknown.

3) On a local scale, design housing developments, shopping areas, industrial parks, and other developments so that homes and buildings are in clusters and preserve large commons of native vegetation. Design subdivision of ranchlands so that native habitats in each subdivided lot are next to one another, reducing habitat fragmentation. Where possible, locate developments in peripheral areas, not interior portions of sagebrush stands. Use tax incentives, such as conservation easements, to maintain wildlife open space in sagebrush habitat.

4) Confine all construction-related disturbance to immediate construction areas to avoid destroying adjacent sagebrush habitat. Restore areas disturbed by construction, using native plant species.

5) Use native plant species in landscaping for parks, homes, shopping areas, and other developments. Although not a substitute for native habitat, such plantings can provide foraging opportunities, nest sites for some bird species, and migration stopover habitat.

6) Avoid or minimize insecticide and herbicide use on lawns and gardens. As alternatives, landscape with native plants, and encourage birds, bats, and beneficial insects to help control insect pests.

7) Residents can help protect native birds by keeping their cats indoors and by not allowing cats and dogs to run free in adjacent sagebrush habitat. Residents should also avoid attracting other predators by covering garbage and not leaving out food for pets.

### Information and Education

1) Establish public education goals and implement programs to inform users of public lands and owners of private lands of the value, sensitivity, and importance of shrub-steppe to resident and Neotropical migratory birds and other species. This could range anywhere from interpretive signs on public lands, to distribution of Best Management Practices to landowners, to presentations at local grade schools, etc.

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