

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 (see box, “Managing Sagebrush Habitats on Different Scales”). This goal goes hand in hand with sustainable rangeland management. Because non-native grasses and agricultural conversion now dominate so much area in the Intermountain West, it is especially important to sustain remaining native plant communities in a healthy state to support native birds and other wildlife.

Managing a single site for all sagebrush wildlife species is not possible because practices that benefit some species may be detrimental to others. For example, the sage grouse and sage sparrow prefer areas of extensive sagebrush, but vesper sparrows in sagebrush steppe use stands with scattered shrubs mixed with short grassland. 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. First we give general management recommendations based on habitat components within sagebrush steppe. We then offer suggestions for habitat management under different land uses and management activities. These recommendations are based on our current knowledge of habitat requirements of sagebrush birds. Although we provide some ideas on specific vegetation management techniques, our main goal is to describe what birds need. Most of these suggestions will also benefit other wildlife species. A summary of these recommendations follows this section (see “Summary of Bird Management Goals and Recommendations”).

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.

Natural history accounts for bird species of concern in sagebrush steppe habitats are in Appendix I.

Each account briefly mentions conservation considerations for the individual species. Your local wildlife agency or State Natural Heritage Program can provide specific information about which species occur in your particular region.

MANAGING SAGEBRUSH HABITATS ON DIFFERENT SCALES

Wildlife species respond to their environment at different scales. In this document, we use the terms “landscape,” “stand,” and “patch” (Table 1). Some of our recommendations may seem contradictory. On one hand, we say we need large areas of continuous sagebrush habitat, then we say that we want a patchwork or mosaic of plant communities. Well, which is it? It’s both.

When you look across a landscape of sagebrush, you may see a monotonous and uniform shrubland, yet as you travel through the area, you notice a lot of variation from one spot to the next. A low swale that catches moisture has taller shrubs than the surrounding area, a knob may have a grassy opening, a burned area may have just a scattering of shrubs, a streamside adds willows and water to the landscape. 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.

General Sagebrush Habitat Management

We recommend no *net* loss of sagebrush steppe habitat in a landscape. No net loss does not preclude management activities (see the box, “No Net Loss”). Future habitat conversions should be mitigated by restoration elsewhere, and range managers should plan for a dynamic pattern of different aged stands across a landscape. A loss of sagebrush steppe habitat, both in amount and quality, is thought to be responsible for declines in sage grouse in Idaho (Idaho Sage Grouse Task Force 1997) and Brewer’s sparrow in the Interior Columbia River Basin (Saab and Rich 1997).

MANAGEMENT RECOMMENDATIONS

- Identify and protect those habitats that still have a thriving community of native understory and sagebrush plants. Those areas that have remained untouched by livestock grazing or habitat conversion, have not been grazed for many years, or otherwise have high biological integrity, might 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 non-native plants. Where major habitat conversion has occurred, even small parcels have value to wildlife and should be protected.

- Where possible, restore or rehabilitate degraded and disturbed sites to native plant communities. On severely damaged or degraded sites, the restoration of an entirely native plant community may be

Table 1. Different scales at which birds respond to their environment and how we want to direct management activities.

SCALE Size is Dependent on Species ^a	Birds are Affected at This Level:	Management Activities and Natural Processes Affect These:	Desired Conditions for Birds:
LANDSCAPE 1000s to 100,000s of acres ^b	Populations	The size, age, and distribution of stands and patches, including areas inhospitable to the species Spread of non-native plants Ability of populations to recover from large-scale events such as wildfire and drought	Large areas of continuous shrubsteppe habitat containing a mosaic of stands with different ages, species, and canopy cover to support bird populations
STAND 1 to 1000s of acres	Home ranges of individuals and pairs	Plant species composition Proximity of all resources and whether they are all present and accessible	All of the nesting, cover, and foraging resources for individuals and pairs are present (for grouse, this would include wintering resources)
PATCH <1 to 100s of acres	Specific needs of individuals and pairs (i.e., food, water, nest site, escape cover)	Height, density, and cover of vegetation within the patch Insect, other prey, seeds, and other food abundance	One or more of the resources needed by individuals and pairs are present

^a The smaller number might apply to Brewer’s sparrows, which have small home ranges, while the larger number might apply to sage grouse, which range over large breeding and wintering ranges.

^b 1 acre = 0.4 hectares

expensive, long-term, or nearly impossible, but it may be possible to restore the vegetative structure (e.g., variation in shrub heights, mosaic pattern) to benefit some bird species.

- To benefit area-sensitive species such as 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 130 ha (about a half-section). Sage grouse and sharp-tailed grouse need several thousand hectares of adequately connected habitat to maintain self-sustaining populations.
- Within extensive areas of sagebrush habitat, manage for a patchwork or mosaic of native plant communities across the local landscape. These patchworks or mosaics may include stands of young and old sagebrush, openings (ranging from bare ground to short vegetation to high grass density), wet meadows, seeps, healthy streamside (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 sage grouse, Brewer's sparrows, sage sparrows, black-throated sparrows, gray flycatchers, and sage thrashers. Shrubsteppe with small, grassy openings supports sage grouse, long-billed curlews, and burrowing owls. Broad-leaved shrub thickets and riparian areas provide winter habitat for sharp-tailed grouse. Forested streamsid es 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 (see Tables 2 and 3).
- Openings of short vegetation surrounded by sagebrush are particularly important for sage grouse leks (especially openings, knolls, and exposed ridges) and for ground foraging by sage thrashers, loggerhead shrikes, Brewer's sparrows, and sage sparrows. Openings of short vegetation (5 to 20 cm; 2 to 8 in) with wide visibility provide long-billed curlew and burrowing owl breeding habitat.
- Maintain remaining biological soil crust communities by minimizing sources of soil disturbance, such as off-road vehicle use or heavy grazing.
- Maintain seeps, springs, wet meadows, and riparian vegetation in a healthy state 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. Use buffers of 30 m (100 ft) or greater around these areas (Braun et al. 1977; Blaisdell et al. 1982).
- 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.

NO NET LOSS

Sagebrush habitats are dynamic communities influenced by patterns in rainfall, fire, and the movements and population fluctuations of grazing animals. A fire, for instance, may kill a large area of sagebrush shrubs, yet as long as the land has the potential to return to sagebrush, it is not lost—the area has just become part of the natural mosaic of habitats within the landscape. However, if non-native plants, like cheatgrass or medusahead, invade and become dominant or if sagebrush habitat is plowed under or paved over, then that area may be lost forever to the sagebrush wildlife community. Where habitat conversion fragments the landscape into isolated strips and islands of habitat, that conversion also reduces the remaining native habitat's capacity to support wildlife populations.

When we recommend “no net loss” of sagebrush steppe, we accept that natural forces and land management activities will alter the landscape. What we hope is that human-induced habitat conversion will be accompanied by habitat restoration and conservation elsewhere.

Sagebrush

Sagebrush plants provide nest sites and cover from wind and predators, harbor insects for insect-eating wildlife, and are the main food for sage grouse and pronghorn in the winter. Bird species of concern that nest in sagebrush shrubs include the sage thrasher, Brewer's sparrow, sage sparrow, green-tailed towhee, loggerhead shrike, gray flycatcher, and occasionally the Swainson's hawk. In addition, many of the ground nesters nest beneath sagebrush (Table 3).

- Avoid practices that permanently convert sagebrush shrubland to non-native grassland or farm land.
- Manage existing stands of sagebrush steppe for a balance between shrub and perennial grass cover,

Table 2. Habitat components used by 17 sagebrush shrubland bird species of concern.

Species	Tall, dense sagebrush	Open, patchy sagebrush	Grass cover for nests	Grassland	Short grass, bare ground	Seeps, wet habitat	Dry woodland	Riparian
SAGEBRUSH OBLIGATE SPECIES								
Sage grouse	✓	✓	✓	✓	✓	✓		
Sage thrasher	✓	✓	✓		✓			
Sage sparrow	✓		✓		✓			
Brewer's sparrow	✓	✓	✓		✓			
SHRUBLAND SPECIES								
Black-throated sparrow		✓	✓					
Green-tailed towhee	✓	✓	✓				✓	
Lark sparrow		✓	✓	✓			✓	
SHRUBLAND AND GRASSLAND SPECIES								
Swainson's hawk		✓		✓	✓	✓		✓
Ferruginous hawk		✓		✓	✓		✓	
Prairie falcon		✓		✓			✓	
Sharp-tailed grouse	✓	✓	✓	✓		✓		✓
Loggerhead shrike	✓	✓			✓		✓	✓
GRASSLAND SPECIES								
Long-billed curlew		✓		✓	✓	✓		
Burrowing owl		✓		✓	✓			
Short-eared owl		✓	✓	✓		✓		
Vesper sparrow		✓	✓	✓				
DRY WOODLAND SPECIES								
Gray flycatcher	✓						✓	

and for open to moderate shrub cover (5 to 25%) and multiple height classes.

- 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 (rather than broad-scale eradication) to re-establish a balance between shrub cover and perennial grass and forb cover. For example, it may be possible to thin sagebrush cover by clearing patches that can be reseeded naturally at lower

densities, by using prescribed fires that produce a patchy burn pattern, or by applying reduced rates of herbicide (see Carrithers and Halstvedt 1996 for an example using tebuthiuron on big sagebrush). Only use prescribed fire in areas not threatened by cheatgrass or medusahead invasion.

- In large disturbed areas, sagebrush and perennial grasses may need to be reseeded to shorten the recovery time and prevent dominance by non-native grasses and forbs.

Table 3. Nesting substrates for 17 sagebrush shrubland bird species of concern.

Species	Burrow	Ground	Shrub	Tree	Cliff
SAGEBRUSH OBLIGATE SPECIES					
Sage grouse		✓			
Sage thrasher		✓	✓		
Sage sparrow		✓	✓		
Brewer's sparrow			✓		
SHRUBLAND SPECIES					
Black-throated sparrow		✓			
Green-tailed towhee			✓		
Lark sparrow		✓			
SHRUBLAND AND GRASSLAND SPECIES					
Swainson's hawk			✓	✓	✓
Ferruginous hawk		✓		✓	✓
Prairie falcon					✓
Sharp-tailed grouse		✓			
Loggerhead shrike			✓	✓	
GRASSLAND SPECIES					
Long-billed curlew		✓			
Burrowing owl	✓				
Short-eared owl		✓			
Vesper sparrow		✓			
DRY WOODLAND SPECIES					
Gray flycatcher			✓	✓	

Understory Grasses and Forbs

Perennial bunchgrasses and native forbs provide food and cover for many sagebrush birds. Several species (e.g., 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 (see Tables 2 and 3). Also, there is experimental evidence that shrubsteppe birds prefer to eat native grass seeds rather than cheatgrass or medusahead (Goebel and Berry 1976; Kelrick et al. 1986).

MANAGEMENT RECOMMENDATIONS

- 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.



This *Agoseris*, or mountain-dandelion, is “sage grouse ice cream.” It’s one of many forbs that grouse and other wildlife eat.

- 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. In a recent review of defoliation effects on bluebunch wheatgrass, Anderson (1991) asserts that recovery from a single heavy spring grazing season (50% or more defoliation) can require over 8 years under the best management, and depends on the number of growing tips remaining, soil moisture, and degree of competition.
- 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.
- Where reseeding disturbed and degraded sites, try to use local, native genotypes that

are competitive with non-native 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 non-native perennials may be the only commercially available alternatives. On severely degraded sites, non-native forbs and perennial grasses may be preferable to monocultures of non-native annuals.

- Maintain native forb diversity. Although forb species may make up only a small portion of plant composition and cover in sagebrush habitats, they are extremely important to the diets of sage grouse broods, pronghorn, and other wildlife. Use practices that allow forb growth to continue through spring and summer, particularly in sage grouse breeding habitat (see “Grazing” below). Some forbs that are especially valuable to sage grouse are common dandelion,

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This native grass understory within big sagebrush is excellent nesting cover for sage grouse and other ground-nesting species. These birds use native grasses and forbs to construct their nests, shade them, and hide them from predators.

Paul D. Makela

yellow salsify, hawksbeard, prickly lettuce, mountain-dandelion, sweet-clover and other clover species (*Melilota* spp. and *Trifolium* spp.), buckwheat, and common yarrow (J. Connelly pers. comm.).

- 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% or more of the annual vegetative growth to remain through the following nesting season (Saab et al. 1995).

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.

- To maintain biological 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 (Cole 1990; Belnap 1993; Johansen et al. 1993).
- Where restoring biological soil crusts is the goal, use enclosures or non-fence methods to eliminate trampling. Inoculating disturbed soils with material from surrounding biological crusts can hasten recovery times (Belnap 1993).

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.

- Use stocking levels that stabilize or increase native perennial grass cover, reduce disturbance to biological soil crusts, and prevent sagebrush over-dominance or non-native grass and forb invasion.
- Grazing plans will depend on the current condition and plant composition of the range. Use grazing practices (seasons, stocking, kinds of stock, and distribution) that promote the growth of native grasses and forbs needed by birds for food and concealment. Options could include increasing rest cycles in rest-rotation, two-crop short rotation (early spring before boot stage and fall after seed-set), or deferred grazing. To maintain native bunchgrasses on a given unit, defer grazing until after crucial growth periods, waiting until grasses have begun to cure. Moderate to heavy spring grazing reduces or eliminates native bunchgrasses by preventing seed-set (but note that 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 (Young 1992; Vallentine and Stevens 1994).
- Where your goal is 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.
- Reduce stock, time grazing, or rotate pastures to reduce or eliminate trampling of ground nests and nestlings (from May through mid-July).
- 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 (Saab et al. 1995). For sage grouse, average grass height of at least 18 cm (7 in), measured in May and early June, provides adequate

herbaceous cover for successful nesting (Idaho Sage Grouse Task Force 1997). For sharp-tailed grouse, retain a residual cover of perennial grasses and forbs of at least 20 cm (8 in) to provide sufficient nesting cover.

- Consider temporarily removing livestock from an area that is damaged or otherwise needing protection. Livestock exclusion can be considered as a short- or long-term option for locally or regionally rare vegetation types, sites undergoing restoration, recently burned areas, wet sites (springs, seeps, wet meadows, streams—see “Water Developments” below), 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.
- Situations that concentrate livestock during the songbird breeding season (April through June) increase the influence of brown-headed cowbird brood parasitism on songbird breeding

success. Corrals, feedlots, and watering sites provide feeding sites for cowbirds. 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 radius of 6.5 km or 4 mi) breeding opportunity without high parasitism pressure.



Excessive grazing removes the grasses and forbs between and even under the shrubs. Grazers also trample the soil and occasionally a ground nest.

Bob Moseley, Conservation Data Center, IDFG

Water Developments

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. 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.



Springs, wet meadows, and riparian areas within sagebrush shrublands add diversity. They provide water, succulent forbs, and abundant insects for many wildlife species. Sage grouse rely on these areas in the brood-rearing period.

Terry Rich

- After evaluating the distribution and condition of natural water sources, 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. For information on managing riparian areas for birds, see *Riparian Riches: Habitat Management for Birds in Idaho* (available from the same source as this publication).
- 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 (Connelly and Doughty 1990).

- Exclosures 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 don't string fences across the water. Limiting grazing to the plants' dormant season (November to March) can help prevent damage to these areas (C. Merker pers. comm.).
- Livestock water developments can decrease stock concentrations and distribute grazing more evenly across the range to prevent degradation (Candelaria and Wood 1981). However, the tradeoff is that establishing new water developments can result in degradation of sites not previously grazed or only lightly grazed.
- Small birds sometimes drown in stock tanks and troughs. Provide escape ramps or floats to prevent drowning (Candelaria and Wood 1981).

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. 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 (Lockwood et al. 1988). 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 shrubsteppe 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 (McEwen 1982). Bird densities will likely decline as insect food sources decline (George et al. 1995). In the long term, insecticide applications that adversely affect insectivorous birds are counterproductive to pest control.

- Land managers concerned with maintaining productive bird populations should reduce insecticide use wherever possible.
- 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 (George et al. 1995), and using less toxic forms of insecticides.
- 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. Ulliman et al. (1998) recommend using chemicals that are least damaging to sharp-tailed grouse such as Sevin bran bait. 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 nontarget areas.
- Avoid applying pesticides to sharp-tailed and 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 (Ulliman et al. 1998).
- 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 sage grouse when aerially sprayed on croplands bordered by sagebrush habitat (Blus et al. 1989) 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 (King 1996).

Recreation

Recreation activities, such as camping, hiking, biking, and off-road driving, 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.

- 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 sage grouse leks and breeding habitat, or near raptor nest areas, such as outcrops, cliffs, and forested riparian zones (see “Mining and Oil/Gas Development” below).
- 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.
- 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.
- Limit the number of roads, and reclaim unused roadbeds with sagebrush and native grasses and forbs. This will reduce weed invasion, roadkills, and fragmentation (see “Habitat Fragmentation” below). On remaining roads, use annual weed and fire control to protect adjacent sagebrush habitat.
- 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 non-native 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. (See Hann et al. 1997 for a discussion of historic and current wildfire intensity and frequency in the Columbia River Basin). 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.

- Burns to create openings in continuous or dense sagebrush should be on a small scale and designed to allow gradual re-establishment of sagebrush from upwind stands or soil-banked seeds. This will provide multiple ages of sagebrush over area and time.
- 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. Midsummer fires also favor cheatgrass, which matures earlier than native grasses, and can increase erosion when the soil is exposed to severe rain storms. 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 (Blaisdell et al. 1982; West 1983, 1988; Young 1983; Rotenberry 1998). See Young (1983) for a summary of fire impacts on various grass and forb species and Blaisdell et al. (1982) for burning guidelines to minimize impacts on native species in sagebrush rangeland.
- Burns may require reseeding with native bunchgrass and forb species in order to stem the invasion of non-native annuals. Avoid reseeding with crested wheatgrass or other non-native species that create a continuous herbaceous cover and outcompete native species. However, crested wheatgrass may be appropriate in seed mixtures on severely degraded sites (Kaltenecker 1997) 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 (Blaisdell et al. 1982).

- In cheatgrass-dominated landscapes, “greenstripping” offers an option for slowing the spread of wildfire and reducing the size of range fires (Pellant 1994). Greenstrips are fuelbreaks of fire-resistant vegetation placed at strategic locations on the landscape. Greenstrips replace cheatgrass and other mat-like annual grasses with bunchgrasses or other plants that remain green, cure later than cheatgrass, or have a tufted (caespitose) growth-form

so they don’t carry fire as easily. However, because greenstrips fragment sagebrush habitat and can bring in more non-native weeds if the seeding is unsuccessful (J. Rotenberry pers. comm.), 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. For example, the Idaho Sage Grouse Management Plan—1997 (Idaho Sage Grouse Task Force 1997) recommends rating sage grouse wintering and nesting habitats as high priority for wildfire suppression.

The following activities convert sagebrush shrubland to other habitat types, replacing plants and wildlife with other (often non-native) species. Above, we recommended 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.

One option for restoring converted land back to a sagebrush steppe community is the Conservation Reserve Program (CRP), a federal set-aside program that pays landowners to plant agricultural lands with permanent cover, including native species. Although planned as temporary reserve lands, CRP plantings could provide important habitat to sagebrush birds, especially in areas suffering large losses of sagebrush shrublands. The CRP has had a major positive impact on sharp-tailed grouse populations in Idaho (Ulliman et al. 1998).

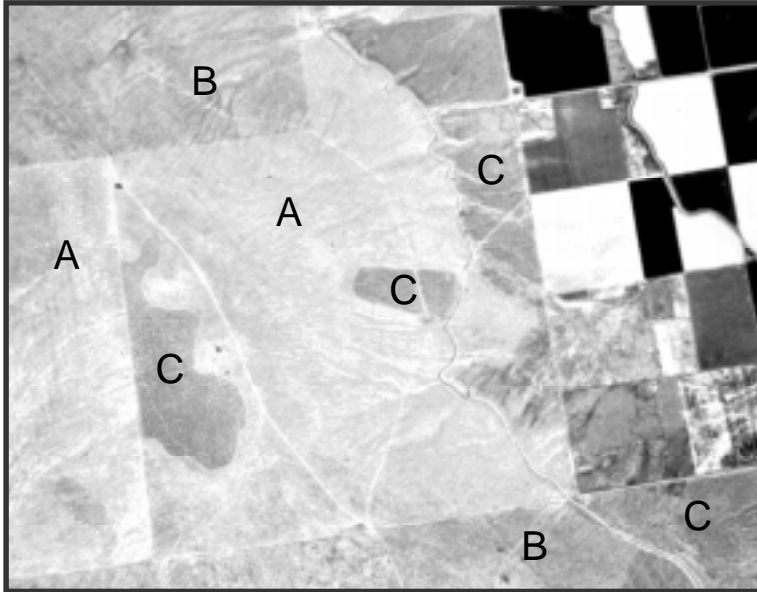
Habitat Fragmentation

Although not a management “activity,” 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. Sage grouse and long-billed curlews are not as productive in small stands of habitat as in large stands. Sagebrush-obligate songbirds (sage thrasher, sage sparrow, and Brewer’s sparrow) are also sensitive to fragmentation. These species prefer larger stands with high shrub cover and decline with increasing disturbance (Knick and Rotenberry 1995; Knick 1996). 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 (T. Rich pers. comm.).

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 (J. Rotenberry pers. comm.). M. Vander Haegan (pers. comm.), in a study in Washington, did not find sage sparrows on patches smaller than about 130 ha (1/2 section). J. Rotenberry (pers. comm.) suggests that patches should be that size or larger.

- 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 (see box, “No Net Loss”).

- 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.
- To benefit sage grouse and sharp-tailed grouse, maintain large expanses of sagebrush habitat.



BLM Stock Photo, Burley Field Office

Agricultural conversion (on the right) and rangeland seeding of crested wheatgrass (marked A and B, the latter also having sagebrush at low density) have fragmented this sagebrush shrubland in southern Idaho. Note the small, dark patches of Wyoming big sagebrush (marked C) in the middle of the photo and bordering the farmland. These patches are too small to support area-sensitive species such as the sage sparrow. The square containing the middle three sagebrush patches is 1.6 km x 1.6 km (1 mi x 1 mi).

Summer sage grouse home ranges vary from 3 to 7 km² (1 to 2.5 mi²) and may be larger in fragmented habitats. However, this area may be insufficient for year-long habitat use, and surveying the seasonal movements and winter habits of local sage grouse populations will better define a population's area requirements. Sage grouse winter home ranges may exceed 140 km² (53 mi²). Large expanses of sagebrush across a landscape with stands of 10% to >20% canopy cover and tall shrubs (25 to 30 cm; 10 to 12 in) provide winter habitat. Sharp-tailed grouse require thousands of hectares (acres) to support a self-sustaining population; large blocks of agriculture are not conducive to sharp-tail occupancy (Ulliman et al. 1998).

- 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.
- 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.
- 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 Non-native Grasses and Forbs

The invasion of non-native 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 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 document to provide a complete review of weed management.

- 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.
- Weed control with herbicides, biological agents, and

mechanical techniques should be followed by reseeded and restoration of native plant species to prevent the reinvasion of weeds (Larson et al. 1994). Controlling fall-germinating annuals can enhance survival of seeded fall-dormant perennials, which will better re-establish if annuals are not already

rooted and competing for moisture when the perennials germinate in spring (R. Hill pers. comm.).

- 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 (Vallentine and Stevens 1994). The U.S. Bureau of Land Management in

Idaho is using the herbicide sulfometuron-methyl (tradename Oust) to control cheatgrass after fires. It is applied in late fall/early winter or in the early spring prior to seeding and rehabilitation efforts (M. Pellant pers. comm.).

- 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 (Young 1992).

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.

- 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. The burrowing owl and short-eared owl, and to a lesser extent the ferruginous hawk and prairie falcon, all use agricultural areas during winter for foraging (Young 1987).
- 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 30 m (100 ft) around springs, seeps, wetlands, and riparian habitats. Even small-scale habitat protection can provide important habitat features for many birds during breeding, wintering, and migration.
- 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 (Ivey 1995), depending on the area.
- Reduce or eliminate insecticide use to prevent poisoning birds, reducing insect prey, or eliminating beneficial insects (see “Insecticides” above).
- To avoid harm to other wildlife, check that fences meet specifications designed to protect deer and pronghorn. Avoid fencing small, scattered sagebrush patches in agricultural areas as this may encourage, rather than discourage, trespass grazing.
- 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 (see discussions under “General Sagebrush Habitat Management” and “Habitat Fragmentation”).

- Avoid placing mines, oil and gas drill sites, sand or gravel pits, geothermal sites, and roads in or next to sensitive habitats such as grouse lek, breeding, or wintering habitat; raptor nest sites on cliffs and outcrops; or riparian areas, springs, and other wetland habitats.
- The impact of construction and operations on raptor nest sites can be effectively reduced through buffers

and timing restrictions. These will vary based on time of year, type and duration of activities, intervening topography, and other factors. Contact state or federal wildlife agencies for local advice on appropriate buffers and timing.



John Erickson, Wyoming Dept. of Environmental Quality

This shrub reestablishment area at the Skull Point Mine in Wyoming is contoured to blend in with the native habitat. Variation in topography will result in a mosaic similar to what occurs in an unmined area. Sagebrush can be reestablished from wind-blown seeds, seeds stored in topsoil, a seed mix, or transplanting shrubs. This site is about 7 years old.

- Protection of grouse leks from disturbance during the mating season is important for successful reproduction. Ulliman et al. (1998) and the Idaho Sage Grouse Task Force (1997) recommend no developments within 365 m (400 yd) of a lek and avoiding physical, mechanical, and loud noise disturbances within 800 m (0.5 mi) 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.
- Prepare fire and weed control plans to protect both reclamation and adjacent sagebrush habitat.
- Ponds containing mining wastes should be netted, fenced, or otherwise closed off to exclude birds, bats, and other wildlife attracted to the water.
- Reclaim areas as soon as possible after completion of activities. This reduces the amount of habitat converted at any one time and speeds up the recovery to sagebrush habitat.
- Avoid planting monocultures. Carefully plan for a complex of vegetation that reflects the diversity of plant species and habitats in the surrounding area (Karr 1980). Reseed with local genetic seed stock if available, and avoid using non-native 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. Providing topography similar to the surrounding area will provide microsites that promote a mosaic pattern.
- 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 (Richardson et al. 1986.)
- Fencing may be necessary to protect a site from both livestock and wild grazers, such as jackrabbits, until vegetation is well established (Richardson et al. 1986; Romney et al. 1990). However, because of hazards posed by fences, determine their necessity on a case-by-case basis.

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.

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

Concluding Remarks

We have produced this publication out of concern for the birds, other wildlife, and plants of sagebrush country. Now it's up to you to put these recommendations to work, to turn the tide for the wildlife and plants of the sagebrush sea.

“ . . . We have modified this ocean of sagebrush just as surely as we have transformed tall-grass prairie with the plow. . . . Unlike pristine wilderness, it requires management. . . . The challenge: juggling a billion acres worth of ecologic, economic, and political realities with deftness, wisdom, farsightedness, and tolerance. We should wish ourselves luck.”



SUMMARY OF BIRD MANAGEMENT GOALS AND RECOMMENDATIONS

Summary of bird management goals and recommended actions to meet those goals for different activities that occur in sagebrush shrublands. For more details and for general recommendations for sagebrush shrublands, sagebrush shrubs, understory grasses and forbs, and biological soil crusts, see the section “How to Help Birds in Sagebrush Habitats.”

Activity	Bird Management Goal	Recommended Action
Grazing	Promote growth of native grasses and forbs.	Use proper stocking levels and grazing plans such as rest-rotation two-crop short rotation, or deferred grazing.
	Protect/restore biological soil crusts.	Limit grazing to wet periods and winter months.
	Avoid trampling ground nests.	Reduce stock, time grazing, or rotate pastures to avoid the nesting season.
	Maintain herbaceous nesting cover.	Protect current season's growth through the nesting season and manage for at least 50% of annual vegetative growth to remain. Maintain adequate grass height for grouse nesting cover.
	Restore degraded sagebrush shrublands. Reduce cowbird parasitism.	Temporarily remove livestock. Minimize livestock concentrations; rotate livestock use in alternate years spatially or temporally.
Water developments	Maintain water quality and vegetation in springs, seeps, and riparian areas.	Retain natural water flow. Protect and enhance growth of native forbs. Use exclosures or non-fencing methods to keep livestock out. Limit grazing to the plants' dormant season. Develop livestock watering facilities away from sensitive wet areas.
	Reduce bird mortality.	Provide escape ramps or floats.
Insecticides	Reduce bird mortality.	Include birds in integrated pest management programs. Avoid insecticide use during grouse brood-rearing season. Use insecticide baits and natural pathogens instead of broad-spectrum insecticides. Avoid broadcast spraying; use ground applications rather than aerial spraying. Restrict use to the minimum application rates on croplands bordering sagebrush shrublands.

Recreation	Reduce impact on bird habitat.	Avoid placing recreation sites near sage grouse and sharp-tailed grouse breeding habitat or raptor nests. Protect springs and wetlands from recreation use. Encourage use of established sites, including keeping vehicles on established trails and roads. Limit the number of roads; reclaim excess roadbeds with native vegetation.
	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.
Prescribed fire and wildfire	Allow reestablishment of sagebrush and native grasses and forbs.	Keep burns to a small scale and patchy distribution. Burn late in early spring or fall to take advantage of native grasses' adaptations to late season fires and to discourage cheatgrass. Reseed burns with native bunchgrass and forb species. Keep cattle off recovering sites until native grasses become established. Use green-stripping if needed.
	Prevent large-scale wildfires that will result in cheatgrass invasion or will destroy high-value sagebrush sites.	
Habitat fragmentation	Maintain large areas of sagebrush for area-sensitive species.	Manage for no <i>net</i> loss of sagebrush habitat. Avoid designs and practices that create or increase the amount of edge. Maintain large expanses of sagebrush habitat. Minimize sagebrush conversion to annual grasslands or croplands. Suppress range fires that threaten to eradicate large, continuous areas of sagebrush. Restore sagebrush and perennial bunchgrass communities. Limit the number of roads; rehabilitate old roads.
Invasion of non-native grasses and forbs.	Maintain existing sites that are relatively free from non-native invaders.	Maintain the vigor of native species. Control livestock stocking levels. Avoid large-scale disturbances. Minimize habitat fragmentation.
	Restore native species following weed control.	Reseed native plant species and control fall-germinating annuals. Use heavy spring grazing to reduce cheatgrass and prepare a unit for reseeding with perennial grasses.

Activity	Bird Management Goal	Recommended Action
Farming	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. Reduce or eliminate insecticide use.
Mining	Protect sensitive wildlife habitats.	Avoid developing near grouse breeding or wintering habitat, raptor nest sites, or riparian and wetland areas. Use buffers and timing restrictions to protect raptor nest sites and grouse leks.
	Protect reclamation and adjacent habitat from wildfires and non-native forb and grass invasion.	Prepare fire and weed control plans.
	Reduce wildlife mortality.	Exclude birds, bats, and other wildlife from mining waste ponds and oil pits using netting, fences, or other methods.
	Restore sagebrush habitat.	Reclaim disturbed sites using a diversity of plant species and local genetic stock. Avoid using non-native species. Protect newly reclaimed sites from livestock and wild grazers.
Residential and urban development	Provide nesting and foraging habitat within and adjacent to developments.	Retain native vegetation in open spaces. Use tax incentives to maintain open space. Use native plant species in landscaping to provide foraging opportunities, nest sites, and migration stopover habitat.
	Reduce impacts of development on adjacent habitat.	Confine construction-related disturbance to the immediate construction area. Restore disturbed areas using native plant species.
	Reduce bird mortality.	Avoid or minimize use of insecticides. Landscape with native plants to encourage the presence of birds, bats, and beneficial insects that control pest insects. Keep cats indoors and don't allow cats and dogs to run free in adjacent sagebrush habitat. Discourage other predators by covering garbage and reducing other food sources (i.e., pet food).