Grassland Habitat Group

Shortgrass Prairie

1) Describe the habitat (Udvardy 1958; Mengel 1970; Knopf 1988, 1994; Askins 2000):

a) Historic conditions: Native grasslands represent the largest vegetative region of North America; almost 580,000 miles^2 (1,500,000 km^2) of eastern tallgrass grasslands and western shortgrass prairie grasslands historically covered the continent on the Great Plains. However, only 5% of all North American bird species are believed to have evolved within the Great Plains; 12 species are endemic to the grasslands (Ferruginous Hawk, Mountain Plover, Long-billed Curlew, Marbled Godwit, Wilson's Phalarope, Franklin's Gull, Sprague's Pipit, Cassin's Sparrow, Baird's Sparrow, Lark Bunting, McCown's Longspur, and Chestnut-collared Longspur), and 25 others are considered to be secondarily evolved to grasslands (Mississippi Kite, Swainson's Hawk, Northern Harrier, Prairie Falcon, Greater Prairie-chicken, Lesser Prairie-chicken, Sharp-tailed Grouse, Greater Sage-Grouse, Upland Sandpiper, Burrowing Owl, Short-eared Owl, Horned Lark, Sage Thrasher, Eastern Meadowlark, Western Meadowlark, Dickcissel, Green-tailed Towhee, Savannah Sparrow, Grasshopper Sparrow, Henslow's Sparrow, Vesper Sparrow, Lark Sparrow, Sage Sparrow, Brewer's Sparrow, and Clay-colored Sparrow).

Buffalo, prairie dogs, and fire were crucial factors in maintaining grassland habitat. Historically, the Great Plains grasslands consisted of a complex pattern of distinct patches of grasses and forbs. These patches were created by events, often referred to as "disturbances", like intense grazing or vigorous wallowing by large herds of migratory buffalo, steady cropping of grass and digging by prairie dogs, wildfires, or water collection in low spots. Each type of disturbance created a subtly different habitat patch, and each patch changed slowly as it recovered from the disturbance. The result was a "shifting mosaic" of habitat patches across the prairie landscape. The scenario might have looked like this: when areas were grazing-free, fuel was able to build up, which was the catalyst for large prairie fires. (Although grasslands evolved with regular and expansive prairie fires, fire played a smaller role in the shortgrass prairie than in the more lush grass systems found to the east.) Native North American Indians also used fire, although the extent is unknown. Buffalo likely migrated to the recently burned areas after green-up to take advantage of increased nutrients. The location of prairie dogs created a distinctive habitat required by many other species, and probably influenced the fire regimes. Prairie dog towns were more dynamic based on buffalo disturbance (buffalo moved in and disturbed an area, then the prairie dogs moved in to the disturbed area). Grazing by buffalo was the major force in the system; however, elk, pronghorn antelope, mule deer, and bighorn sheep herds had some influence as well. The key factors that maintained this system were periodic disturbance of unknown frequency and intensity and periodic rest from disturbance. Many grassland bird

species evolved to live in particular types of habitat patches, so they ultimately depend on the disturbances that create their preferred habitats.

b) Present conditions: The most extensive grasslands in Wyoming occur east of the Rocky Mountains on the western Great Plains and in several intermountain basins. The Laramie Plains and the area east of the Pole Mountain/Laramie Range to Douglas, and north to Newcastle and the Black Hills area is the typical or true shortgrass prairie. Shortgrass prairie grasslands are dominated by two low-growing, warm-season grasses—blue grama and buffalo grass—that thrive in clay soils, flourish under intensive grazing pressure by reproducing both sexually and by tillering, and remain highly digestible and retain their protein content when dormant. Other species include wheatgrass, needle-and-thread grass, fescue, bluestem, fringed sage, and mixed grass species in localized areas.

2) Identify the issues:

a) Use: Farming and ranching, oil and gas extraction, off-road vehicle travel, urbanization, and recreation are the major uses.

b) Access: May be limited due to private ownership; however, access has increased by paying customers, as well as the general public where boundaries and access are state owned or federally administered and access is difficult to monitor. In areas of public ownership, use and access have increased. Public use of and access to public areas was previously limited to hunting and other seasonal uses; now there is more recreation occurring, and season-long use for off-road vehicles, horseback riding, mountain biking, etc.

c) Problems: Fire suppression; prairie dog control; oil and gas extraction and its associated roads, spills, weed encroachment, open oil pits, habitat fragmentation, and the potential for increased extraction; urbanization; habitat conversion; shrub and tree encroachment; increased incompatible recreation, such as off-road vehicle use; exotic species (weed spread, such as knapweed, thistles, and leafy spurge; cheatgrass; yellow sweetclover; crested wheatgrass; feral and domestic cats; European Starlings; and House Sparrows); incompatible livestock grazing (depending on the avian species); and increased predation and cowbird nest parasitism. As a group, populations of endemic bird species of the grasslands have declined more than others (including Neotropical migrants) in the last quarter century, while simultaneously (and independently) alien and exotic species have dramatically increased. Unlike forest species that winter in the Neotropics, most birds that breed on the grasslands of North America also winter on the continent; thus, problems driving declines in grassland species are associated almost entirely with North American actions.

d) What has been the cause of change to the habitat: Both western shortgrass prairie and eastern tallgrass grasslands that make up the Great Plains have been altered by removing native grazers, plowing sod, draining wetlands, and encouraging growth of woody vegetation. The presence and persistence of water in the uplands is more widespread due to water developments (e.g. stock ponds and reservoirs, guzzlers, and stock tanks). Tree plantings, cultivation, and urbanization have allowed some non-grassland birds, such as the Common Grackle, to expand their ranges into shortgrass prairie habitat. Shelterbelt planting and fire suppression have allowed trees and shrubs to encroach on or replace prairie habitat. This has added a different component to the prairie. Generalist predatory species like the Great Horned Owl and American Crow are now able to nest on the prairie. The predator community has changed from wolves and swift foxes to coyotes, red foxes, skunks, and raccoons. Land uses have changed or increased including oil and gas extraction, urbanization, off-road vehicle use, prairie dog control, farming, ranching, and different grazing regimes between bison and domestic livestock (although grazing can be used as a management tool to meet the needs of birds based on species objectives). A change in native species composition has occurred via planting and grazing to specifically encourage the taller grasses (e.g. needlegrass) and decrease the shorter grasses (e.g. fescue). Fencing has changed the way the land is being used. Row crops and livestock management that results in mostly mid to low seral conditions are the most probable causes of grassland bird declines.

3) Priority bird species in Shortgrass Prairie habitat in Wyoming:

Level I:
Ferruginous Hawk
Mountain Plover
Upland Sandpiper
Long-billed Curlew
Burrowing Owl
Short-eared Owl
Baird's Sparrow
McCown's Longspur

Level II:
Lark Bunting
Grasshopper Sparrow
Chestnut-collared Longspur
Dickcissel
Bobolink

Best Management Practices

Wyoming Partners In Flight Best Management Practices for Grasslands to Benefit Birds in Wyoming.

Introduction

It is challenging to establish clear-cut guidelines for managing grasslands for birds because of the diversity of requirements for the various bird species and "species suites" that use grasslands (Figure 8). (A "species suite" is a group of species with similar or overlapping habitat requirements that respond similarly to habitat conditions and management actions.) Some, like the Mountain Plover, prefer areas with very short vegetation. Others, like the Dickcissel, prefer dense grasses. There are some species that evolved with shortgrass prairie, the predominant grassland type in Wyoming. Other species that are also native to Wyoming use mixed grasslands or grass-shrub complexes.

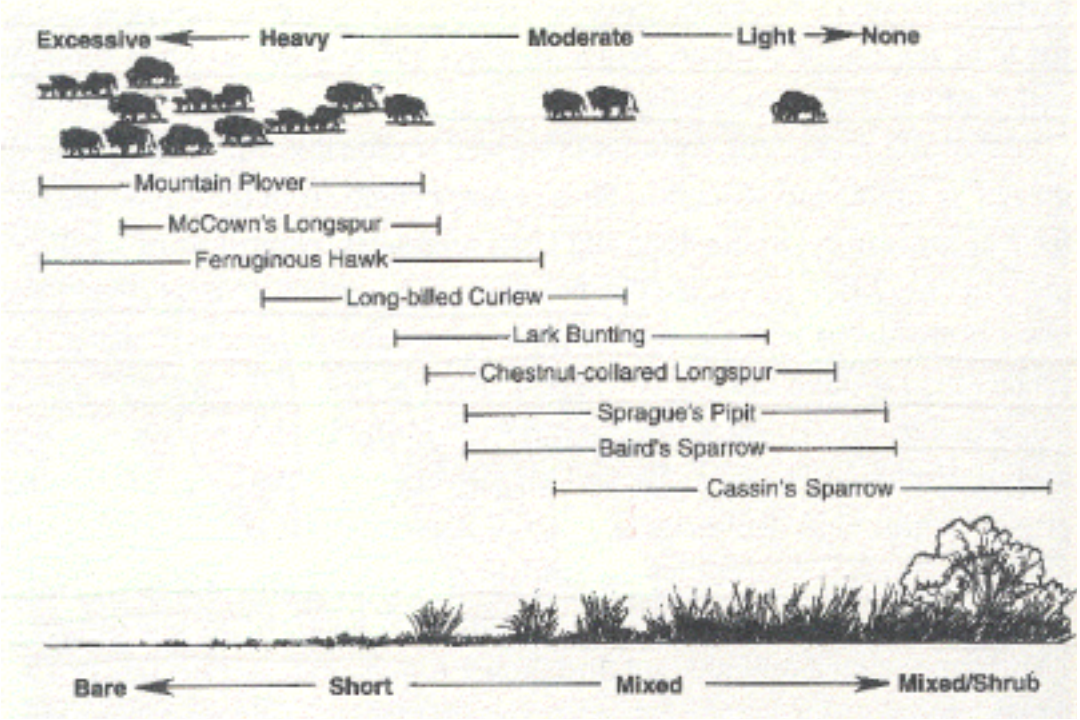

Figure 8. Distribution of different species of prairie birds across grasslands subject to different intensities of grazing (from Sampson and Knopf 1996).

A simple set of guidelines for grassland management in Wyoming will not work for all species of birds using those habitats. A variety of habitat conditions under different or rotating management schemes may be the best strategy within an ecological region, or ecoregion, that encompasses public lands and diverse private lands, and may even cross state boundaries. The efforts of land managers and private landowners are critical to the survival of these birds. Landowners and land managers can take a variety of simple and inexpensive actions to improve habitat for birds and help them nest successfully. By maintaining and restoring habitat for grassland birds, many other wildlife species will also benefit. Some management activities may also improve watershed health by reducing soil erosion and increasing water retention.

As a landowner or land manager, the actions you take will depend on your goals, resources, and commitment, as well as the physical characteristics of your property, such as soil type, topography, and existing vegetation. The following Best Management Practices (BMPs) should provide some reasonable guidelines for managing grassland habitats to benefit a wide variety of resident and Neotropical migratory birds in Wyoming.

Many of the Best Management Practices for grasslands fall into major categories of land use such as Grazing, Forestry, Engineering, Recreation, etc. The recommended BMPs are broken out into categories for convenience, although some are general enough to cross into other categories.

General

1) Decisions to control prairie dog towns should be made on an ecoregional basis. Prairie dogs are often considered “keystone species”. An entire community of organisms depends on a keystone species directly or indirectly, including Mountain Plovers, which require short vegetation and open ground; Ferruginous Hawks, which prey on prairie dogs; and Burrowing Owls, which require burrows for shelter, nesting, and raising their young. Removal of a keystone species can result in a cascade of changes and a rapid decline in species diversity. Prairie dog burrowing and grazing creates an expanse of close-cropped grass dotted with patches of bare earth surrounding burrow entrances. Since grass grows from the base of the stem rather than the stem tip, it can quickly grow back after the top is nipped off by a grazer. The new growth is more nutritious and more easily digested than older vegetation, and is typically shorter and denser. This results in more energy and nutrition per bite, an important advantage for grazers that must process large amounts of vegetation each day to meet their food requirements. Thus, the act of grazing, if it is not too intense, can improve conditions for grazers. Also, recently excavated earth provides extensive habitat for annual forbs that could not compete where grass is already established.

2) Use a combination of grazing and prescribed burning to maintain a short grass structure in areas where Mountain Plovers occur. Since most pastures are managed to promote the growth of taller grasses, improved range management practices on existing grasslands have negatively affected the Mountain Plover, which prefers short grass.

3) To benefit area-sensitive birds, plots should be no smaller than 125 acres (51 ha), and preferably 250 acres (101 ha) or more. Fifty acres (20 ha) or less will benefit birds that are the least sensitive to area size (e.g. Dickcissel).

4) If plots smaller than 50 acres (20 ha) are the only option, they should be as numerous as possible and no further apart than 1 mile (1.6 km).

5) To help maintain grasslands, monitor grass height and eliminate woody vegetation that grows higher than the native grasses. Other techniques can be used to enhance shrub or shrub-grass complexes.

6) In non-riparian habitat, plant shrubby hedgerows that are low growing and sparse (rather than dense, continuous hedgerows) to reduce encroachment of woody vegetation into grassland habitat.

7) Eliminate or limit tree planting in the shortgrass prairie ecoregion. Tree planting in shortgrass prairie habitats increases nest parasitism by cowbirds, as well as predation by crows, grackles, and jays.

8) If pest control is necessary, follow the principles of Integrated Pest Management (IPM) to determine the best course of action. The use of pesticides for insect and grasshopper control can greatly reduce the food base of many bird species by killing far more than just the target species.

9) In suitable Mountain Plover range, consider fixing leaking or overflowing livestock water tanks. Overflow areas promote use by Killdeer and discourage use by nesting Mountain Plovers.

10) 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 grassland 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.

Grazing

Historically, the species associated with tall, mixed, and shortgrass prairies evolved alongside large native grazers like bison, and grazing was integral to the ecology of grassland ecosystems. The large areas of native prairie that remain today are what is left of the great continental grassland that once supported herds of more than 30 million bison. The remaining grasslands must be properly managed to simulate these missing disturbances or the prairie species that depend on disturbances will eventually disappear. Therefore, livestock grazing and preservation of biological diversity are not necessarily incompatible (unless grazing becomes too intensive for too long a time over too large an area). From a management perspective, vegetation is usually the component over which the manager has the most control, that is the easiest to manipulate, and that responds the fastest to human influences. Choice and timing of management tools such as grazing and prescribed burning will be influenced by specific characteristics of the region (e.g. cool season grasses grow in the spring, mature by late spring or early summer, become dormant during the summer, resume growth in the fall, and become dormant when temperatures become cold, whereas warm season grasses grow in the late spring and summer, and become dormant from late summer into fall). The recommendations below focus on Best Management Practices that can be applied to different ecoregions.

1) On a landscape scale, use livestock grazing practices that allow large acreages of grasslands to go to a climax successional stage for those species that require it (e.g. Long-billed Curlew, Short-eared Owl, Upland Sandpiper, Dickcissel, Chestnut-collared Longspur, Grasshopper Sparrow, and Bobolink).

2) On a landscape scale, use livestock grazing as a tool to maintain areas of short grass and open ground for those species that require these habitat characteristics (e.g. Mountain Plover, McCown's Longspur, Long-billed Curlew, Short-eared Owl, and Burrowing Owl).

3) On a landscape scale, use livestock grazing and fire together to produce a mosaic of habitat patches to benefit a variety of grassland species.

4) Nest survival of grassland birds is often only 30% or less due to numerous hazards like predation, inclement weather, farm equipment, and cattle trampling. Grazing intensity affects vegetation structure, which, in turn, affects the appeal of the grazed habitat to certain species, the makeup of the bird community, and nest survival. To help increase grassland bird nest survival, manage for a "nesting refuge", which modifies the current practice of deferring grazing in some pastures for hay production. Nesting refuges can produce more young birds per acre than rotational grazing because of more nesting pairs and greater nest survival. Those able to defer grazing in any portion of their pasture system for six weeks or more in May and June can significantly

increase the productivity of the grassland bird community on their land. Recommended guidelines for managing nesting refuges are as follows.

a) Set aside a contiguous area up to 1/3 of the total pasture area, at least 10 to 20 acres (4 to 8 ha) in size, that is not disturbed between May 15th and June 30th (when most grassland bird nests are active), while the remaining acreage is rotationally grazed.
b) Locate refuge pastures away from trees, buildings, and crop fields to minimize disturbance and reduce the potential for predation and cowbird nest parasitism.
c) In some areas, refuge pastures may be grazed lightly before May 15th.
d) Defer grazing for six weeks or more between mid-May and early July.
e) Graze or mow as desired no earlier than July 1st through the end of the grazing season.

5) Changing grazing systems and/or fencing may be effective in maintaining or improving water flow within existing drainages, which will benefit plant production.

6) Develop water and shade in upland areas to help spread grazing pressure. Keep in mind, however, that small birds can drown when they fall into stock tanks and troughs while drinking. Provide escape ramps to prevent drowning (Figure 9).

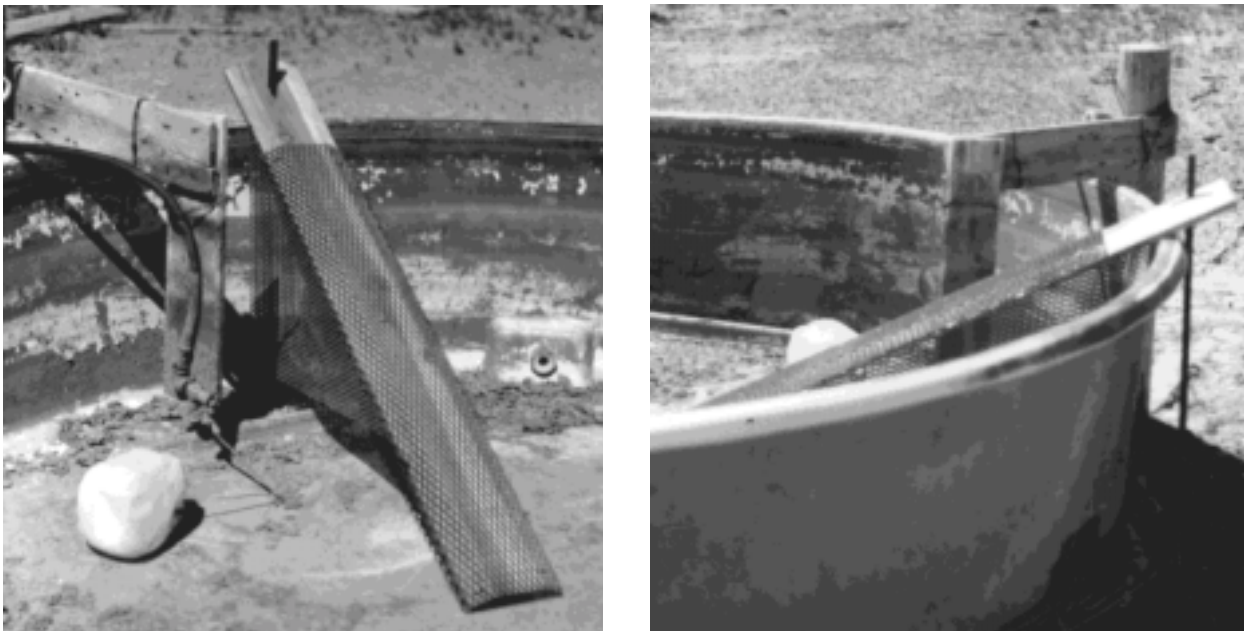

Figure 9. Escape ramps placed in stock tanks and troughs to prevent drowning of small birds and mammals (photographs courtesy of Mark Gorges, Bureau of Land Management).

7) Develop conservation partnerships between landowners, land managers, and private organizations. While landowners need to derive income from the land, this can often be compatible with maintaining regional biological diversity, depending on how the land is used and what land management tools are employed. Identify the habitat needs of the birds in the area and the economic needs of the landowner so a baseline need is established. Combine core preserves and buffer areas to maximize habitat size across the landscape. When possible, manage core preserves (e.g. national parks, national forests, national grasslands, wilderness areas, etc.) strictly for biological diversity. Surround core preserves with buffer areas, like ranches, where some areas of natural vegetation can be sustained. Although buffer areas are used for livestock grazing and other land uses, they establish and protect large areas of habitat across the landscape. Also, important habitat on ranches can be protected with conservation easements. In some cases, ranchers can derive income from hunters, birders, and naturalists who visit the region.

Farming

While our nation's people are largely urban, our nation's land remains largely agricultural. About 70% of the United States (excluding Alaska) is privately owned, with half [907 million acres (367 million ha)] in private cropland, pastureland, and rangeland [382 million acres (155 million ha), 126 million acres (51 million ha), and 399 million acres (161 million ha), respectively]. Conversion of native habitats to agricultural land has caused local loss of many bird species; however, agriculture can also create habitat features favored by some birds for breeding, feeding, and migratory stopover sites, such as hedgerows, uncultivated areas, and edge habitat. Farmers, ranchers, and wildlife and habitat managers have an opportunity to develop partnerships to share resource knowledge and attain mutual resource goals. Structuring farmland and cropland production to benefit birds will also benefit agricultural operations by reducing soil erosion, water pollution, chemical use and associated costs, and energy costs from fewer tillage operations, while increasing soil fertility and favorable microclimates for crop growth. The recommended Best Management Practices below can help direct successful farming operations.

1) Match use and management of the land to the soil's capability. Soil supports plant growth and routes water, nutrients, and energy through the ecosystem. Maintain soil quality so it is capable of performing these beneficial functions over the long-term.

2) Retain crop residue on the soil surface. Use reduced tillage and no-tillage agricultural methods, and refrain from burning crop residue. Residue sustains populations of arthropods that are food for a variety of birds, and it provides cover for foraging and nesting birds.

3) Use Integrated Pest Management (IPM) to control undesirable weeds and insects. IPM will reduce destruction of non-target arthropods that are food for many species of birds and minimize exposure of birds to harmful chemicals. Most species of grasshoppers require bare ground to lay and hatch eggs; using minimum or no-till practices will reduce the need for insecticides.

4) Limit activity in the field during the breeding season (April 15th through July 15th), minimize the number of field operations that destroy nests, and, where possible, use farming methods that destroy fewest nests, such as subsurface tillage or no-tillage.

5) In hayfields, delay spring mowing as long as possible (preferably until nesting ends in late July), avoid night time mowing, and space mowings as widely as possible in time to allow the greatest probability of successful nesting. (However, even haying after July 15th may not protect late nesters such as the Dickcissel, Bobolink, Grasshopper Sparrow, and Short-eared Owl.) Consider growing alfalfa for seed or use late maturing legumes instead of traditional alfalfa management; this would allow cuttings to be delayed.

6) Mow or plow a pasture or field starting in the middle, then proceed toward the outside so skulking birds will not concentrate in the center of the pasture and get run over by farm machinery; this will give them a chance to flee instead.

7) If you flush adult birds while working in your fields, slow your equipment down to give flightless young a chance to escape.

8) Apply inorganic fertilizers based on measured soil requirements because their excessive use can harm soil organisms that are food for many species of birds.

9) In uncultivated areas, such as fencerows or grassed waterways, avoid mowing and spraying with herbicides wherever possible. Necessary field operations, such as thinning woody plant growth in fencerows or mowing grassed waterways, should be carried out either before April 15th or after July 15th (the main avian breeding season) to prevent destruction of nests.

10) Preserve uncultivated edges (e.g. grassy strips) and allow them to develop a natural vegetation structure. Complex strip vegetation is used by many species of birds; it also reduces soil erosion and movement of agricultural chemicals off of fields.

11) Maintain the Conservation Reserve Program (CRP) by planting plots with native species and, rather than plowing to plant annual crops, use the lands for haying (after nesting) or compatible livestock grazing. Whenever possible, cluster CRP fields to create larger expanses of native habitat.

12) Maintain or enhance farmland diversity. This can be done in several ways.

a) Maintain unmowed grassed strips within fields for grassland birds that do not nest near edges. Grassy strips would also be refuges for arthropods, which are food sources for birds.
b) Increase crop diversity by adding to the number of crops rotated.
c) Create or increase the size of planted or "weedy" fallow fields; this is a good alternative for areas that are difficult to access or have low productivity.
d) Reduce cultivated field sizes by using land removed from production; e.g. CRP land could be allocated to strip cover within fields or along field edges to reduce field sizes.
e) Preserve and protect actual or potential wetlands by encircling them with broad buffer zones of natural vegetation.
f) Provide small, randomly placed scrapes [15 to 30 feet^2 (4 to 8 m^2)] in fields or grasslands 10 to 20 acres (4 to 8 ha) or larger to expose bare ground for nesting, foraging, and dust bathing sites.

13) Avoid conversion of grasslands to cropland, especially in areas too dry to farm without irrigation. Center-pivot irrigation has recently increased the conversion of native habitat to agriculture in many areas, causing a landscape loss of grassland habitat. In addition, irrigating in arid and semiarid regions can concentrate salts in soil and water, causing severe production and environmental problems (about 30% of the contiguous United States has potential for soil and water salinity problems).

14) Use soil-conserving practices where cropland erosion is a concern, such as crop residue management, contour tillage, strip cropping, and land retirement.

15) Use agricultural practices that promote organic matter in the soil to maintain soil quality and productivity, promote water infiltration, and reduce runoff. Organic matter enables the soil to hold nutrients and water, support microbes, and maintain the proper structure and texture for plant growth. Agricultural cropping, rotation, and tillage systems can be used to maintain or increase organic matter content.

16) For landowners who both farm and ranch, use intensive rotational grazing, which converts row crop and alfalfa acreage to pasture and has the potential to provide significant high quality habitat for grassland birds.

17) While it is better for birds (and cats) if cats are kept indoors, have domestic "barn" cats spayed or neutered, keep pet food and food bowls indoors so predators like raccoons and feral cats do not have an additional food source, and never intentionally feed feral cats. Cats (even well fed domestic cats) can be devastating to local songbird populations. Natural predators, like owls and hawks, are very efficient at controlling rodent pests, even around human dwellings.

Habitat Fragmentation

Habitat fragmentation—the breaking-up of contiguous areas of similar vegetation—occurs when a large, continuous tract of a particular vegetation type is converted to other vegetation types so that only pieces, or fragments, of the original vegetation type remain. Habitat fragmentation can be very detrimental to those species of birds and other wildlife that require these large patches to breed and forage successfully. In fact, habitat fragmentation, along with direct loss of habitat, is one of the main causes of population declines of many species of birds. Groups of species especially impacted by habitat fragmentation include those with large home ranges, very specific habitat requirements at the "micro-habitat" level, and poor dispersal skills. Fragmenting habitats also leads to an increase in the amount of edge (the junction between two different habitat types or successional stages) in relation to interior habitat. Creating more edge also leads to an increase in "edge effects"—increased rates of nest predation and nest parasitism, higher rates of competition between species for limited nesting and foraging sites, and reduced pairing and nesting success. Use the suggested Best Management Practices to eliminate or reduce habitat fragmentation wherever possible.

1) Avoid fragmenting existing grassland tracts. The larger the grassland, the greater the number of area-sensitive species, such as the Upland Sandpiper, that can nest successfully in the area.

2) For birds, a single large reserve is better than several small reserves because several species are area-sensitive and only breed in non-edge areas.

3) Reserves should have a compact shape that maximizes core area. Edge effect increases predation and cowbird nest parasitism.

4) Where fragmentation has already occurred, retain habitat quality in existing fragments. These sites may still be important for post-breeding dispersal and stopover spots for birds.

Rehabilitation

Grasslands can be successfully restored or created if you plan ahead, take your time, and monitor your results. A number of federal, state, local, and private programs exist to help with technical and financial support. Contact the Natural Resources Conservation Service, your local Conservation District, your local Agricultural Extension agent, or the Wyoming Game and Fish Department for more information.

1) When restoring grasslands, minimize the amount of edge habitat by designing roughly circular or square plots. Such programs should use native grasses and local seed sources.

2) When creating or rehabilitating grasslands, start with a drawing of the area. Include existing vegetation (both desirable and noxious), buildings, roads, water sources, land uses, neighboring property, etc. Choose plants (preferably native plants) that are adapted to the soil type, climate, available moisture, drainage, and other desirable plants. Choose at least three grass species for your seed mixture to make the best use of "microsites" in your grassland.

3) Proper seedbed preparation is very important to successfully establish or rehabilitate a grassland. It removes existing undesirable vegetation and weed seeds from the seedbed, which reduces competition for space and nutrients. The method you use to prepare the seedbed will depend on characteristics of the site and available funds. Some methods to consider include plowing or disking, herbicides, or solarization.

4) Determine the best method to apply seeds to the grassland you wish to establish or rehabilitate. Three commonly used methods are drill, no-till drill, and broadcast seeding. Drill seeding is used in areas that can be farmed intensively, but it creates uniform stands of plants that lack a natural appearance. No-till drill seeding is good for sites that are accessible to farm machinery, is less expensive than tilling, and reduces erosion, but is limited to sites that have been disked or sprayed to remove competitive plants. Broadcast seeding is best for sites inaccessible to farm machinery, or for small-scale projects.

5) Apply seeds in the fall to coincide with the availability of natural precipitation. Sites planted in the spring or summer may need to be irrigated throughout the summer to ensure seed germination and plant growth.

6) To maintain your site as grassland habitat and discourage invasion by woody plants, mow, burn, or lightly graze sections of your site in rotation. Mow or hay at the end of the second growing season after seeds have set (July) and before fall precipitation. (To provide nesting and winter habitat for birds, mow or hay every other year or every three years, in rotation.) Conduct low-intensity prescribed burns every year for the first few years, then every three to five years, in rotation. Initiate grazing three to five years after your site has become established. Use a deferred rest-rotation grazing system that leaves one pasture per year ungrazed, concentrates the impacts of grazing, and limits livestock access during the breeding season for birds.

7) Control nonnative weeds in your grassland through intensive mowing, hand-pulling, grazing, or herbicides. In some sites, prescribed burning may enhance native plant growth and reduce nonnative, invasive weeds.

Fire

Prior to human settlement and agricultural development, grasslands evolved with periodic burning. Although fires can be detrimental to prairie birds during the summer when eggs and nestlings might be destroyed, the absence of fire for a long period of time can also create problems when unburned prairie is slowly replaced by shrubs or trees, effectively eliminating the grassland habitat they need. Even when woody plants do not invade the prairie, grasslands will gradually change if they are not burned for several years. On an unburned prairie, the soil is shaded by a layer of fallen dead grass and an overstory of standing dead grass. Dead vegetation intercepts both sunlight and rainfall; ties up nutrients; and creates cool, dry, dark conditions that are unfavorable for the growth of young grass shoots. When fire burns across a grassland, this blanket of dead vegetation is removed and nutrients within the ash fall to the soil surface. The soil has more nutrients and can now receive sunlight and warmth, plants have more growing space, and grass shoots grow quickly from the surviving root system. The young growth in a recently burned grassland is more succulent, more easily digested, and more nutritious than older vegetation in unburned prairie. The density of forbs usually increases immediately after a fire, so plant diversity also increases for the next few years. Consequently, grassland fires typically result in an increase in the density of herbivores, which leads to a better food supply for predators, such as insect-eating birds. From the viewpoint of many species, a prairie fire is a necessity, not a disaster.

For more information about prescribed burning, contact your local Agricultural Extension agent, the Natural Resources Conservation Service, the Wyoming Game and Fish Department's fire management supervisor or habitat personnel, or the U.S. Forest Service fire management officer in your area.

1) Learn about prescribed burning and evaluate the possibility of using this as a management tool. Prescribed burns are used to reduce litter build-up, to reduce cool season invaders and woody species, and to rejuvenate desirable grass species, including warm season natives. Depending on management objectives, burns are conducted either from April through June or August through September. Prescribed burning to control woody species is best done in August or September.

2) In areas known to support nesting birds, prescribed burns should not be conducted until fall to avoid loss of nesting cover. To retain adequate residual cover for ground nesting birds the following spring, burns should be relatively small so a portion of the area contains nesting cover at all times.

3) Develop a fire use plan before burning. It should include the following:

a) Burn Area – Clearly define the boundaries of the burn area. Burn smaller sections within the larger area on a yearly rotational system to maintain habitat diversity.
b) Burn Objectives – Define the purpose of the prescribed burn, when it should be conducted, and the desired results.
c) Burn Prescription – Define the components of the burn that will accomplish your objectives. Time of year is a major burn prescription component for obtaining desired results. Burns should be conducted when preferred plants are dormant. Warm season grasses, like buffalo grass and blue grama, benefit from a spring burn. Cool season grasses, like bluebunch wheatgrass, Idaho fescue, western wheatgrass, and prairie junegrass, benefit from a fall burn following their growing season. Forbs typically benefit from fall burns (especially forbs that grow from rootstocks) and are negatively impacted by spring burns. From a wildlife standpoint, seasonal timing of a burn can be critical. For example, ground-nesting birds like the Greater Sage-Grouse and Chestnut-collared Longspur can be severely impacted if burns are conducted between April and August. To prevent negative impacts to wildlife and still provide habitat benefits, conduct prescribed burns in fall or early spring.
d) Burning Plan – Clearly define how the prescribed burn will be carried out on the ground. Include components such as fuel treatments and fire lines to ensure the fire will carry into all areas to be burned, will not burn too hot or flare up, and will be contained within natural or constructed boundaries (at least 10 feet (3 m) wide, or 50 feet (15 m) wide or more for downwind fire lines).

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 grassland 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 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.

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 grassland 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. Provide topography similar to the surrounding area to provide microsites that promote a mosaic pattern.

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) To minimize the effects of continuous noise on bird populations, reduce noise levels to 49 dBA or less, particularly during the bird nesting season. Constant noise generators should be located far enough away from sensitive habitats such as grouse leks and raptor nests that the noise that reaches those habitats is less than 49 dBA. For example, the noise impact from drill rigs is greater than 49 dBA when the rig is closer than about 800 feet (250 m) to a receptor; impact from a 26,000 horsepower compressor station is greater than 49 dBA when located closer than about 2,500 feet (750 m) to a receptor. 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).

11) 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.

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 shortgrass prairies 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.

Additional Sources of Information

Additional sources of information on Best Management Practices and bird habitat can be found at local offices of the Wyoming Game and Fish Department, Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service, Natural Resources Conservation Service, County Extension offices, Conservation Districts, and at National Wildlife Refuges. Some of these agencies may have special programs, as well as funding assistance, to help implement the recommended practices.

References and Additional Reading

Agricultural Ecosystems Research Committee of Wisconsin. 1997. Improving Habitat Quality of Rotationally Grazed Pastures for Grassland Birds, Final Report. Monona, WI.

Askins, R. A. 2000. Restoring North America's Birds. Yale University Press.

Bock, C. E., V. A. Saab, T. D. Rich, and D. S. Dobkin. 1992. Effects of livestock grazing on Neotropical migratory landbirds in western North America. Pages 296-309 *in* D. M. Finch and P. W. Stangel, editors. Status and Management of Neotropical Migratory Birds; 21-25 September 1992; Estes Park, CO. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-229. 422pp.

Candelaria, L. M., and M. K. Wood. 1981. Wildlife use of stock watering facilities. Rangelands 3:194-196.

Chaney, E., W. Elmore, and W. S. Platts. 1990. Livestock Grazing on Western Riparian Areas. U.S. Environmental Protection Agency. 45pp.

Clausen, M. 1994. Nebraska's threatened and endangered species—Mountain Plover—a threatened species. NEBRASKAland Magazine and the Nebraska Game and Parks Commission, Lincoln. 5pp.

Crawford, R., S. Galipeau, D. Lambeth, G. Berkey, D. H. Johnson, and R. Kreil. 1993. A Review of Wildlife Management Practices in North Dakota: Effects on Nongame Bird Populations and Habitats. U.S. Fish and Wildlife Service, Region 6. 51pp.

DeGraaf, R. M., N. G. Tilghman, and S. H. Anderson. 1985. Foraging guilds of North American birds. Environmental Management 9(6):493-536.

Esmoil, B. J., and S. H. Anderson. 1995. Wildlife mortality associated with oil pits in Wyoming. Prairie Naturalist 27(2):81-88.

Faaborg, J., M. Brittingham, T. Donovan, and J. Blake. 1992. Habitat fragmentation in the temperate zone: a perspective for managers. Pages 331-338 *in* D. M. Finch and P. W. Stangel, editors. Status and Management of Neotropical Migratory Birds; 21-25 September 1992; Estes Park, CO. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-229. 422pp.

Herkert, J. R., D. W. Sample, and R. E. Warner. 1996. Management of Midwestern grassland landscapes for the conservation of migratory birds. Pages 89-116 *in* F. R. Thompson, editor. Managing Midwestern Landscapes for the Conservation of

Neotropical Migratory Birds. USDA Forest Service. General Technical Report GTR-NC-187.

Knopf, F. L. 1988. Conservation of steppe birds in North America. International Council for Bird Preservation Technical Publication 7:27-41.

Knopf, F. L. 1994. Avian assemblages on altered grasslands. Pages 247-257 *in* J. R. Jehl, Jr. and N. K. Johnson, editors. A Century of Avifaunal Change in Western North America. Studies in Avian Biology (15), Cooper Ornithological Society.

Miller, B., G. Ceballos, and R. Reading. 1994. The prairie dog and biotic diversity. Conservation Biology 8:677-681.

Oneale, E. 1999. Fire Management and Wildlife. Habitat Extension Bulletin No. 49. Wyoming Game and Fish Department.

Oregon Department of Fish and Wildlife. Landowner's Guide to Creating Grassland Habitat. Portland, OR.

Paige, C., and S. A. Ritter. 1999. Birds in a Sagebrush Sea: Managing Sagebrush Habitats for Bird Communities. Partners In Flight Western Working Group, Boise ID. 47pp.

Paine, L. K., D. J. Undersander, S. A. Temple, and D. W. Sample. 1997. Managing rotationally grazed pastures for forage production and grassland birds. Proceedings of 1997 American Forage and Grassland Council 6:54-58.

Partners In Flight. 1995. Citizen's Guide to Migratory Bird Conservation. R. Bonney, S. Carlson, and M. Fischer, editors. Cornell Laboratory of Ornithology, Ithaca, NY. 36pp.

Pashley, D., and B. Pardo. 1994. The Prairie Pothole Region: Comprehensive Ecosystem Conservation. Partners In Flight, Winter 1994, Volume 4, No. 2. National Fish and Wildlife Foundation.

Plumb, G. E., and J. L. Dodd. 1993. Foraging ecology of bison and cattle on a mixed prairie: implications for natural area management. Ecological Application 3:631-643.

Rodenhouse, N. L., L. B. Best, R. J. O'Conner, and E. K. Bollinger. 1992. Effects of temperate agriculture on Neotropical migrant landbirds. Pages 280-295 *in* D. M. Finch and P. W. Stangel, editors. Status and Management of Neotropical Migratory Birds; 21-25 September 1992; Estes Park, CO. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-229. 422pp.

Rodenhouse, N. L., L. B. Best, R. J. O'Connor, and E. K. Bollinger. 1995. Effects of agricultural practices and farmland structures. Pages 269–293 *in* T. E. Martin and D. M. Finch, editors. Ecology and Management of Neotropical Migratory Birds. Oxford University Press, New York. 489pp.

Rumble, M. A. 1987. Avian use of scoria rock outcrops. Great Basin Naturalist 47(4):625-630.

Rumble, M. M., C. H. Sieg, D. W. Uresk, and J. Javersak. 1998. Native Woodlands and Birds of South Dakota: Past and Present. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. Research Paper RMRS-RP-8. 11pp.

Sampson, F. B., and F. L. Knopf, editors. 1996. Prairie Conservation: Preserving North America's Most Endangered Ecosystems. Island Press, Washington, D.C.

Smith, J. K., editor. 2000. Wildland fire in ecosystems: effects of fire on fauna. USDA Forest Service, Rocky Mountain Research Station, Odgen, UT. General Technical Report RMRS-GTR-42-Volume 1. 83pp.

Undersander, D. J., B. Albert, P. Porter, and A. Crossley. 1991. Pastures for profit: a hands on guide to rotational grazing. Cooperative Extension Publication A3529. University of Wisconsin, Madison.

United States Department of Agriculture. 1997. America's Private Land: A Geography of Hope. Washington, D.C. 80pp.

Vickery, P. D., J. R. Herkert, F. L. Knopf, J. Ruth, and C. E. Keller. Grassland Birds: An Overview of Threats and Recommended Management Strategies. Online http://birds.cornell.edu/pifcapemay/vickery.htm.

Wilcove, D. S. 1988. Changes in the avifauna of the Great Smoky Mountains: 1947-1983. Wilson Bulletin 100:256-271.

Wilcove, D. S., C. H. McClellan, and A. P. Dobson. 1986. Habitat fragmentation in the temperate zone. Pages 237-256 *in* M. E. Soule, editor. Conservation Biology: the Science of Scarcity and Diversity. Sinauer Associates, Sunderland, MA.