Wyoming Partners In Flight

Wyoming Bird Conservation Plan

Version 1.0

Edited by:

Andrea Cerovski, Wyoming Partners In Flight Chair
Mark Gorges, Riparian Habitat Group Chair
Tim Byer, Grassland Habitat Group Chair
Katy Duffy, Forest Habitat Group Chair
Dave Felley, Shrubland Habitat Group Chair

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EXECUTIVE SUMMARY

Justification

Continental and local declines in numerous bird populations have lead to concern for the future of migratory and resident bird species. The reasons for declines are complex. Habitat loss, habitat modification and fragmentation, loss of wintering and migratory habitat, and nest parasitism have been implicated. In 1990, the National Fish and Wildlife Foundation brought together federal, state, and local government agencies, foundations, conservation groups, industry, and the academic community to form a program to address the problem. Thus, Partners In Flight was conceived as a voluntary, international coalition dedicated to "keeping common birds common" and reversing the downward trends of declining species. Participants in Wyoming Partners In Flight, the state working group of Partners In Flight, developed the Wyoming Bird Conservation Plan as part of the international Partners In Flight effort.

Purpose

Effective and efficient ecological management involves determining which species and habitats are most in need of conservation. This Plan identifies priority species and habitats, and establishes objectives for bird populations and habitats in Wyoming. The Plan not only focuses on microhabitat requirements of priority species, but also identifies landscape scale requirements. Conservation actions are recommended and partnerships are identified to accomplish the objectives.

Scope

Of the 246 breeding bird species in Wyoming, 44 priority species in five major habitat types are addressed in this version of the Plan. If known, associate species that will benefit from management actions are listed with each priority species. Coordinating conservation by habitat enables land managers and landowners to efficiently focus on a set of priority birds and specific habitat characteristics they need.

Objectives and Strategies

Biological objectives are identified for each priority species in each habitat type to provide a target for ecological planning and implementation, and a bench mark for measuring success. Population objectives identify endeavors needed to ensure adequate, science-based population trend data is available for each priority species. Habitat objectives are identified to support the population objectives and describe the condition, amount, and/or location of the habitat where management is needed. Recommendations for achieving these objectives follow.

Evaluation of Progress

Inventory, monitoring, and research needs are listed that relate directly to management questions. We intend this to be a dynamic document that will be updated and revised as new information surfaces. Thus, we envision inventory, monitoring, and research fulfilling a critical link in the adaptive nature of this Plan.

Coordination

Many partners were instrumental in writing this document. However, coordination among existing and new partners is needed for the Plan to succeed. As we progress in Plan implementation, we will integrate with other initiatives. Information in the Plan can easily be linked with other landscape-level management programs. Discussions regarding integration have already begun nationally with the North American Waterfowl Management Plan and Colonial Waterbird and Shorebird groups. International coordination is well under way with Canada and Mexico, and coordination of projects across international boundaries is planned for the implementation phase. Although this Plan is specific to birds, coordination with other species groups will be a natural progression of implementation.

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INTRODUCTION

Overview of Partners In Flight

Continental and local declines in numerous bird populations have lead to concern for the future of migratory and resident bird species. The reasons for declines are complex and varied. Degradation, modification, fragmentation, and loss of breeding habitat; loss of wintering and migratory habitat; and nest parasitism have been implicated as the most devastating causes of population declines. Scientists and the concerned public agreed that a coordinated, cooperative conservation initiative focusing on nongame landbirds was needed. In late 1990, the National Fish and Wildlife Foundation brought together federal, state, and local government agencies; foundations; conservation groups; industry; the academic community; and international interests to form a program to address the problem. Thus, Partners In Flight (PIF) was conceived as a voluntary, international coalition of government agencies, conservation groups, academic institutions, private businesses, and concerned citizens dedicated to "keeping common birds common" and reversing the downward population trends of declining species. Wyoming Partners In Flight (WY-PIF) is the state working group of PIF, and was officially organized in 1991. Active participants include personnel from the Wyoming Game and Fish Department, Bureau of Land Management, U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, Bureau of Reclamation, the University of Wyoming, The Nature Conservancy, Teton Science School, Audubon Wyoming and state Audubon chapters, private landowners, and numerous volunteers.

The goal of Partners In Flight is to conserve, restore, or enhance populations of nongame landbirds and the habitats upon which they depend. This will be achieved by directing resources to landbird and habitat conservation through cooperative efforts in the areas of inventory and monitoring, research, management, education, and international cooperation, and will include all uses and users of the land.

Partners In Flight efforts are directed by several basic principles:

- Conservation of birds and their habitats while they are still common, thereby avoiding the risks and costs associated with endangered species.
- Conservation of habitats, which harbor multiple species of birds and other biological diversity, rather than on single species.
- Conservation based on sound science.
- Comprehensive conservation actions that address critical needs on breeding grounds, nonbreeding areas, and the migratory routes that connect them.
- Conservation that stresses maintenance of natural conditions and compatible economic management of natural resources.

- To build groundbreaking partnerships within which federal and state agencies, private conservation groups, academia, and industry can work together for bird and habitat conservation.
- To promote an informed, proactive constituency of people who are concerned about bird conservation and will voluntarily take action to protect birds and their habitats.

Bird Conservation Planning

Geographically based conservation plans were identified as necessary for nongame landbirds, much as the North American Waterfowl Management Plan directs efforts and prioritizes funding for waterfowl. "The Flight Plan" forms the strategy for coordinating, developing, and writing Bird Conservation Plans at state, regional, and national levels. An international planning effort is also underway but, understandably, is more difficult to coordinate.

Bird Conservation Plans are being completed for about 60 geographic units nationwide; mostly physiographic areas and Bird Conservation Regions, plus the 12 western states. The goal is then to compile the 60 plans into an umbrella National Bird Conservation Plan, which will serve as a means to generate action and resources. This compilation will include an assessment of the adequacy of each of the component plans.

A brief summary of how to accomplish conservation planning for birds follows. For a more detailed explanation, refer to Appendix I.

1) Rank species in order of priority from the updated Partners In Flight Priority Database (Carter et al. 1997). Identify the priority habitats for these species and, where feasible, place the priority species into groups based on habitat needs for each bird community or "suite". Then determine the highest priority habitats in the state.

2) Determine specific habitat needs and develop habitat and population objectives for each species or suite of species. Spread out population centers into suitable habitat types, or "source" habitats. Source habitats and source populations should be identified for each PIF physiographic area, and also "sink" habitats and populations, if known.

3) Develop Best Management Practices for each priority habitat or habitat group in the state; nominate global, continental, national, and/or state Important Bird Areas; and identify state Bird Conservation Areas.

4) Implement the Plan on-the-ground, monitor and evaluate its success, and modify the Plan as needed.

The Wyoming Partners In Flight Bird Conservation Plan identifies priority species, priority habitats, and relative problems and issues; establishes biological objectives (population objectives and habitat objectives); provides recommendations, including Best Management Practices, monitoring, research, education, and outreach; and includes Plan implementation and evaluation.

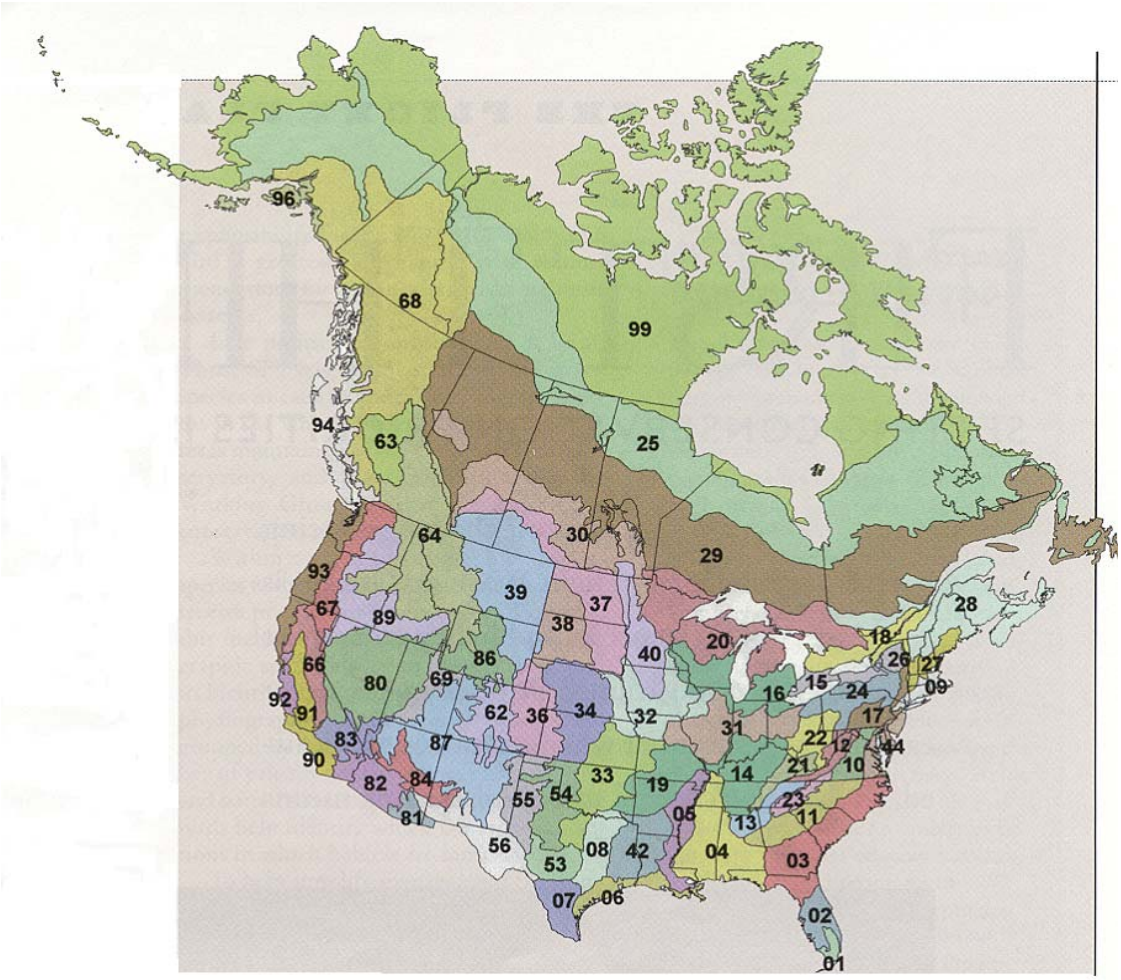
All PIF Bird Conservation Plans are intended to compliment the successful North American Waterfowl Management Plan and the recently initiated National Shorebird Conservation Plan and North American Colonial Waterbird Conservation Plan. Resident game birds are often not covered by these Plans because state agencies and conservation groups are addressing the needs of those species. However, it is ecologically and economically sensible to coordinate with representatives of other bird groups when implementing actions. Discussions of waterfowl species, shorebirds, colonial waterbirds, and/or resident game birds may be included in Plans as they contribute to the ecological picture of the nongame landbird species or habitats being addressed.

Wyoming Partners In Flight recognizes that there are gaps in our knowledge of Wyoming's birds. However, our intention is to assemble the best and most current scientific information into a format that land managers and landowners can use to put ideas into action. When new information becomes available, either through monitoring or research recommended in this Plan or from information previously overlooked, it will be incorporated into our recommendations and reprinted as a new version. Thus, we consider this a dynamic document in which adaptive management will play a large role.

This Bird Conservation Plan was developed by many people offering input in planning meetings and as reviewers. Planning meetings were open to anyone who had an interest in bird conservation and were designed to solicit information from participants that would form the core of this Plan. An important result of planning meetings was to capture scientific data and personal observations that were not available in the scientific literature. This information is especially important because local variations can dictate different needs and approaches for conservation. Again, because this is a dynamic document, any additional information that will add value to this Plan is welcome. Comments can be directed to: Andrea Cerovski, WY-PIF Chair, Wyoming Game and Fish Department, 260 Buena Vista, Lander, WY 82520; 307-332-7723 ext. 232; 307-332-6669 (fax); acerov@state.wy.us.

OVERVIEW OF WYOMING

Partners In Flight planning units, called Physiographic Areas (PAs), are defined on the basis of biotic communities and bird distribution. The continental United States is comprised of 62 PAs, and Wyoming contains portions of seven PAs (Figure 1). Our planning efforts extend beyond our state borders by necessity. To better address species and habitat conservation as a whole, we are working closely with the bordering states of Colorado, Utah, Idaho, and Montana.



Physiographic Areas in Wyoming:

36 = Central Shortgrass Prairie
39 = Northern Shortgrass Prairie
62 = Southern Rocky Mountains
64 = Central Rocky Mountains
69 = Utah Mountains
86 = Wyoming Basin
87 = Colorado Plateau

Figure 1. Physiographic areas used in bird conservation planning in the United States and Canada.

Elevations in Wyoming range from a low of 3,232 feet (969 m) in the northeast corner of the state to the summit of Gannett Peak in the Wind River Mountains at 13,804 feet (4,207 m) (Knight 1994). The mean elevation is 6,700 feet (2,030 m); 37% of the state consists of elevations greater than 7,000 feet (2,134 m) (Knight 1994).

A multitude of different soils exist, reflecting the influences of geologic substrate, topography, climate, animals, vegetation, and time (Knight 1994). Soils in mountainous areas are often shallow and not well developed; granites, basalts, and quartzites in mountain ranges weather very slowly, resulting in shallow, coarse soils. Deep soils occur where topography is lower. Sedimentary rocks are more frequently exposed in foothills and lowlands of the state, although sedimentary strata also occur in mountain ranges. Weathering of sandstone contributes to the formation of coarse-textured, sandy soil with a high infiltration rate, while fine-textured and deeper soils often develop from easily eroded shales, mudstones, and siltstones. Organic matter content increases from lowland up to montane grassland, then decreases to the alpine zone. Vegetation patterns in Wyoming are determined by these soil features: infiltration rate, depth, water-holding capacity, salinity, and aeration.

Because of the varied topography of the state, temperatures vary greatly and decrease with increasing elevation (Knight 1994). The mean daily high temperature in July ranges from 90° F (32° C) on the Great Plains and in the Bighorn Basin to less than 75° F (<24° C) in the mountains. The mean frost-free period varies from 125 days on the Great Plains, in the Bighorn Basin, and in the Wind River Basin to fewer than 25 days in the mountains. Freezing temperatures are possible at any time of the year at higher elevations. Especially in the southern part of the state, strong westerly winds frequently blow.

Wyoming is semi-arid; summer drought often occurs, especially in the lowlands (Knight 1994). Mean precipitation varies from 6 to 59 inches (15 to 150 cm) per year, with mountains receiving more precipitation than lowlands. Intermountain basins in the western two-thirds of the state are drier [6 to 12 inches (15 to 30 cm) precipitation per year) than the Great Plains region in the eastern one-third of the state, which averages 12 to 16 inches (30 to 40 cm) per year. Mountains and foothills throughout the state receive 16 to 59 inches (40 to 150 cm) per year. Precipitation is often in the form of snow at higher elevations, especially during winter months.

The variety of avian species in Wyoming is just as diverse as the soils and climate. A total of 403 species of birds have been documented in Wyoming; 84 are year-round residents, 162 are summer residents (typically breeders), 13 are winter residents, 66 are migrants, 77 are of accidental occurrence, and one is extinct (Luce et al. 1999). Biologists typically strive to manage habitat for the year-round, summer, winter, and migrant species. This task is not as easy as it first sounds. Much of the most important habitat for these species occurs on private land, or on public land on which other uses may take

precedence. The challenge to biologists, landowners, and land managers alike is to determine and work toward a balance between habitat use and habitat conservation, protection, and restoration on public and private lands for the benefit of both wildlife and humans.

Land Type Delineation maps are being compiled at the University of Wyoming in cooperation with the Bureau of Land Management. The mapping was to be completed by the end of 1999, and a statewide map and report should now be available.

In Wyoming, 49% of the total 62,343,040 acres (25,248,931 ha) of land surface is federally managed (Table 1), 5% is managed by state agencies, and 46% of the land surface is in private ownership.

Table 1. Federal land surface in Wyoming.

Agency	Acres
Bureau of Land Management [a]	18,417,149
U.S. Forest Service	9,254,297
National Park Service	2,408,895
Bureau of Reclamation	572,853
U.S. Fish and Wildlife Service	49,466
Naval Petroleum Reserve	9,481
U.S. Army	9,464
U.S. Air Force	6,091
Bureau of Indian Affairs	1,296
Agricultural Research Service	734
Federal Aviation Administration	591
Veterans' Administration	346
Western Area Power Administration	231
U.S. Postal Service	17
General Services Administration	6
Bonneville Power Administration	4
Energy Research and Development Administration	2
Total	30,729,923

[a] Includes some acreage [approximately 500,000 acres (202,500 ha)] assigned to other agencies but administered by the BLM.

The Bureau of Land Management has produced a Surface Management Map that depicts all surface ownership in Wyoming. These can be purchased at any BLM office in Wyoming. They can be ordered from Bureau of Land Management, Wyoming State Office, P.O. Box 1828, Cheyenne, WY 82003-01828, or by calling 307-775-6256.

Wyoming GAP Analysis was completed by the Wyoming Cooperative Fish and Wildlife Research Unit and the University of Wyoming in 1996. The GAP Analysis land cover for Wyoming map recognizes 41 different vegetation covers in the state: 12 in the forest type, 7 in the grass type, 12 in the shrub type, 5 in the unvegetated type, and 5 classified as other (USGS 1996) (Figure 2). Using GAP Analysis and Wyoming Game and Fish Department habitat descriptions for avian species in Wyoming (Luce et al. 1999), 18 habitat types were classified in Wyoming for the purpose of assigning a high priority habitat type or types to each priority avian species (Table 2). This allowed for grouping of avian species based on overall habitat type (e.g. montane riparian) and similar habitat requirements within that habitat type (e.g. dense shrub component for nesting), rather than dealing with single species management. By using this "species suite" approach where feasible, the maximum number of species will benefit from management actions specific to that suite. (A "species suite" is a group of species with similar or overlapping habitat requirements that respond similarly to habitat conditions and management actions.)

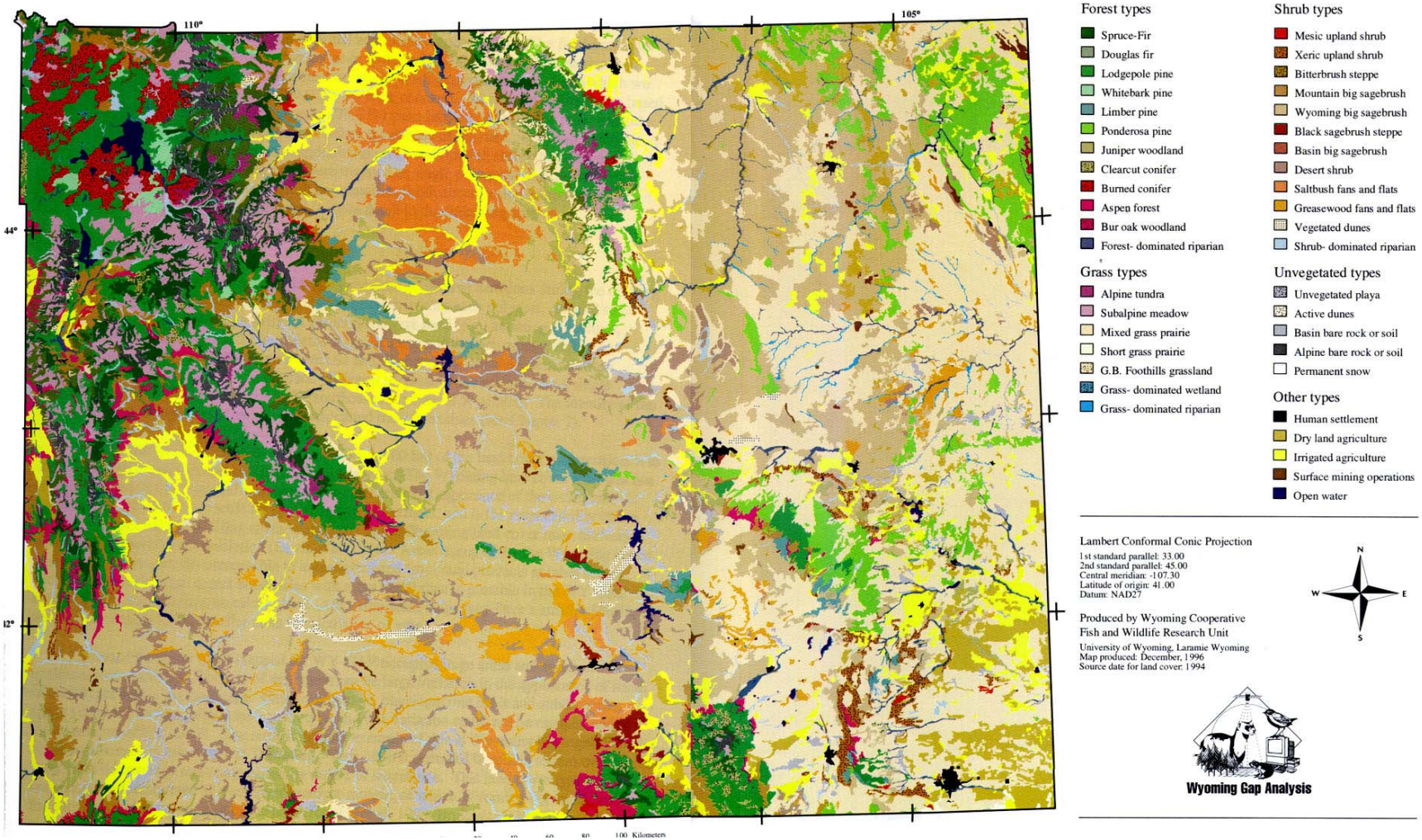


Figure 2. GAP Analysis Map for Wyoming.

Table 2. Wyoming Partners In Flight (underlined) and GAP Analysis habitat groupings in Wyoming, and the percent total land surface each habitat encompasses. [a]

Montane Riparian
(1.45%)
~ Mesic upland shrub (0.24%)
~ Forest-dominated riparian (1.21%)

Plains/Basin Riparian
(1.48%)
~ Grass-dominated riparian (0.26%)
~ Shrub-dominated riparian (1.22%)

Meadows
(2.88%)
~ Subalpine meadows (2.88%)

Wetlands
(0.05%)
~ Grass-dominated wetland (0.05%)

Aquatic
(0.57%)
~ Open water (0.57%)

Shortgrass Prairie
(20.28%)
~ Mixed grass prairie (20.17%)
~ Short grass prairie (0.04%)
~ Great Basin Foothills grassland (0.07%)

Alpine Tundra/Grassland
(0.38%)
~ Alpine tundra (0.38%)

High Elevation Conifer
(4.79%)
~ Spruce-fir (2.49%)
~ Whitebark pine (0.28%)
~ Lodgepole pine – in higher elevations (2.02%)

Mid Elevation Conifer
(6.38%)
~ Limber pine (0.80%)
~ Douglas fir (1.48%)
~ Lodgepole pine – *in lower elevations* (4.10%)

Low Elevation Conifer
(2.70%)
~ Ponderosa Pine (2.70%)

Aspen
(1.33%)
~ Aspen forest (1.33%)

Juniper Woodland
(2.01%)
~ Juniper woodland (2.01%)

Shrub-steppe
(42.74%)
~ Mountain big sagebrush (3.45%)
~ Wyoming big sagebrush (30.83%)
~ Black sagebrush steppe (0.17%)
~ Basin big sagebrush (0.01%)
~ Desert shrub (4.07%)
~ Saltbush fans and flats (2.71%)

Shrub-steppe
(continued)
~ Greasewood fans and flats (1.50%)

Mountain-foothills Shrub
(0.87%)
~ Xeric upland shrub (0.75%)
~ Bur oak woodland (0.11%)
~ Bitterbrush steppe (0.01%)

Agricultural Croplands
(7.25%)
~ Dryland agriculture (3.05%)
~ Irrigated agriculture (4.20%)

Urban
(0.29%)
~ Human settlement (0.29%)

Specialized
(4.73%)
~ Unvegetated playa (0.05%)
~ Active dunes (0.06%)
~ Basin bare rock or soil (1.69%)
~ Alpine bare rock or soil (1.09%)
~ Permanent snow (0.20%)
~ Clearcut conifer (0.33%)
~ Burned conifer (0.93%)
~ Vegetated dunes (0.17%)
~ Surface mining (0.21%)

[a] Total land surface is slightly greater than 100% due to rounding of percentages.

STATE OF KNOWLEDGE OF WYOMING BIRDS: PRIMARY RESOURCES

Different avian inventory and monitoring programs have been on-going in Wyoming since the early 1900s. A summary of the primary resources is presented below.

- 108 available Breeding Bird Survey (BBS) routes (Figure 3, Tables 3-5) (state coordinator: Andrea Cerovski, Wyoming Game and Fish Department, 260 Buena Vista, Lander, WY 82520)
- 17 Christmas Bird Counts
  ~ Albany County (compiler: Jane Dorn, 307-634-6328)
  ~ Bates Hole (compiler: Charles Scott, 307-473-2512)
  ~ Buffalo (compiler: Dean Bjerke, 307-684-2796)
  ~ Casper (compiler: Chris Michelson, 307-234-7455)
  ~ Cheyenne (compiler: Jane Dorn, 307-634-6328)
  ~ Cody (compiler: Ursula Kepler, 307-587-4609)
  ~ Crowheart (compiler: Anna Moscicki, 307-455-2904)
  ~ Dubois (compiler: Anna Moscicki, 307-455-2904)
  ~ Evanston (compiler: Tim Gorman, 307-789-9504)
  ~ Gillette (compiler: Verna Hayes, 307-682-3376)
  ~ Green River (compiler: Rick Steenberg, 307-875-6224)
  ~ Jackson (compiler: Jan Hayse, 307-733-6700)
  ~ Kane (compiler: James Peters, 307-548-6814)
  ~ Lander (compiler: Del Nelson, 307-332-5102)
  ~ Sheridan (compiler: Judy Ward, 307-672-3907)
  ~ Star Valley (compiler: Dru Hanich, 307-883-2277)
  ~ Story - Big Horn (compiler: Jean Daly, 307-674-9728)
- 6 Riparian transects
  ~ Ash Creek (Sheridan area)
  ~ Belle Fourche River (Devils Tower area)
  ~ Garden Creek (Casper area)
  ~ North Platte River Parkway (Casper area)
  ~ Sand Creek (Sundance area)
  ~ Tongue River (Sheridan area)
- 4 Monitoring Avian Productivity and Survivorship (MAPS) stations or Constant Effort Mist Netting projects
  ~ Deep Creek MAPS station (Lander area)
  ~ Oxbow Bend MAPS station (Grand Teton National Park area)
  ~ Teton Science School MAPS station (Kelly area)
  ~ Seedskadee National Wildlife Refuge (Green River area; 3 years of data)

- Migratory Birds of High Federal Interest monitoring data (mainly from coal mines) (contact: Pat Deibert, U. S. Fish and Wildlife Service, Wyoming Field Office, 4000 Morrie Avenue, Cheyenne, WY 82001)
- Wyoming Game and Fish Department (WGFD) Wildlife Observation System (WOS) database (contact: WGFD, 5400 Bishop Boulevard, Cheyenne, WY 82006)
- WGFD's Atlas of Birds, Mammals, Reptiles, and Amphibians in Wyoming (Luce et al. 1999) (contact: Bob Oakleaf, WGFD, 260 Buena Vista, Lander, WY 82520)
- U.S. Forest Service (USFS) Thunder Basin National Grassland raptor database (contact: Tim Byer, USFS, 2250 East Richards Street, Douglas, WY 82633)
- Grand Teton National Park Wildlife Observation Database (contact: GTNP, P.O. Box 170, Moose, WY 83012)
- Wyoming Natural Diversity Database (WYNDD) (contact: Gary Beauvais, WYNDD, 1604 Grand Avenue, Suite #2, Laramie, WY 82070)
- Wyoming-specific Bird Books and Publications
  - ~ Dorn, J. L., and R. D. Dorn. 1990. Wyoming Birds.
  - ~ Downing, H., editor. 1990. Birds of North-central Wyoming.
  - ~ Grave, B. H., and E. P. Walker. 1913. The Birds of Wyoming, with an explanation of recent changes in their distribution, economic aspects also considered.
  - ~ Knight, W. C. 1902. The Birds of Wyoming.
  - ~ McCafferty, C. E. 1930. An Annotated and Distributional List of the Birds of Wyoming.
  - ~ McCreary, O. 1939. Wyoming Bird Life.
  - ~ Nye, D. L., M. Back, and H. Hinchman. 1979. Birds of the Upper Wind River Valley.
  - ~ Pettingill, O. S., Jr., and N. R. Whitney, Jr. 1965. Birds of the Black Hills.
  - ~ Raynes, B. 1984. Birds of Grand Teton National Park and the Surrounding Area.
  - ~ Scott, O. K. 1993. A Birder's Guide to Wyoming.
- Partners In Flight Priority Database *(*Carter et al. 1997*)*
- Colonial waterbird database (contact: Andrea Cerovski, WGFD, 260 Buena Vista, Lander, WY 82520)
- Wyoming Bird Records Committee database (contact: Andrea Cerovski, WGFD, 260 Buena Vista, Lander, WY 82520)
- Raptor nest database (contact: Andrea Cerovski, WGFD, 260 Buena Vista, Lander, WY 82520)
- Wyoming Cooperative Fish and Wildlife Research Unit (contact: Stan Anderson, Wyoming Coop Unit, Box 3166 University Station, Laramie, WY 82071)
- Grand Teton National Park avian studies: Christmas Bird Count, Landbird monitoring (Martin Cody's bird monitoring at about 25 sites), North American Migration Count (since 1992) (contact: GTNP, P.O. Box 170, Moose, WY 83012)

- Yellowstone National Park Mid-winter Trumpeter Swan Survey database (contact: Terry McEneaney, P.O. Box 168, Yellowstone National Park, WY 82190)
- Tri-state Trumpeter Swan Survey database (contact: Terry McEneaney, P.O. Box 168, Yellowstone National Park, WY 82190)
- Yellowstone National Park databases: California Gull, Peregrine Falcon, Osprey, American White Pelican, Caspian Tern, Harlequin Duck, Whooping Crane, and Trumpeter Swan (contact: Terry McEneaney, P.O. Box 168, Yellowstone National Park, WY 82190)
- Yellowstone National Park avian studies: Landbird point count transects, Christmas Bird Count, North American Migration Count, Mid-winter Bald Eagle surveys, Mount Washburn migratory raptor counts (3 years of data), Neotropical migratory bird transects in lodgepole pine (4 - 5 years of data) (contact: Terry McEneaney, P.O. Box 168, Yellowstone National Park, WY 82190)
- Seedskadee National Wildlife Refuge information and databases: waterfowl, shorebird, and Trumpeter Swan monitoring data; nesting surveys for Bald Eagles and other raptors; Breeding Bird Survey route data; wildlife sightings database; season/habitat/behavior database (contact: Carol Damberg, Seedskadee NWR, P.O. Box 700, Green River, WY 82935)

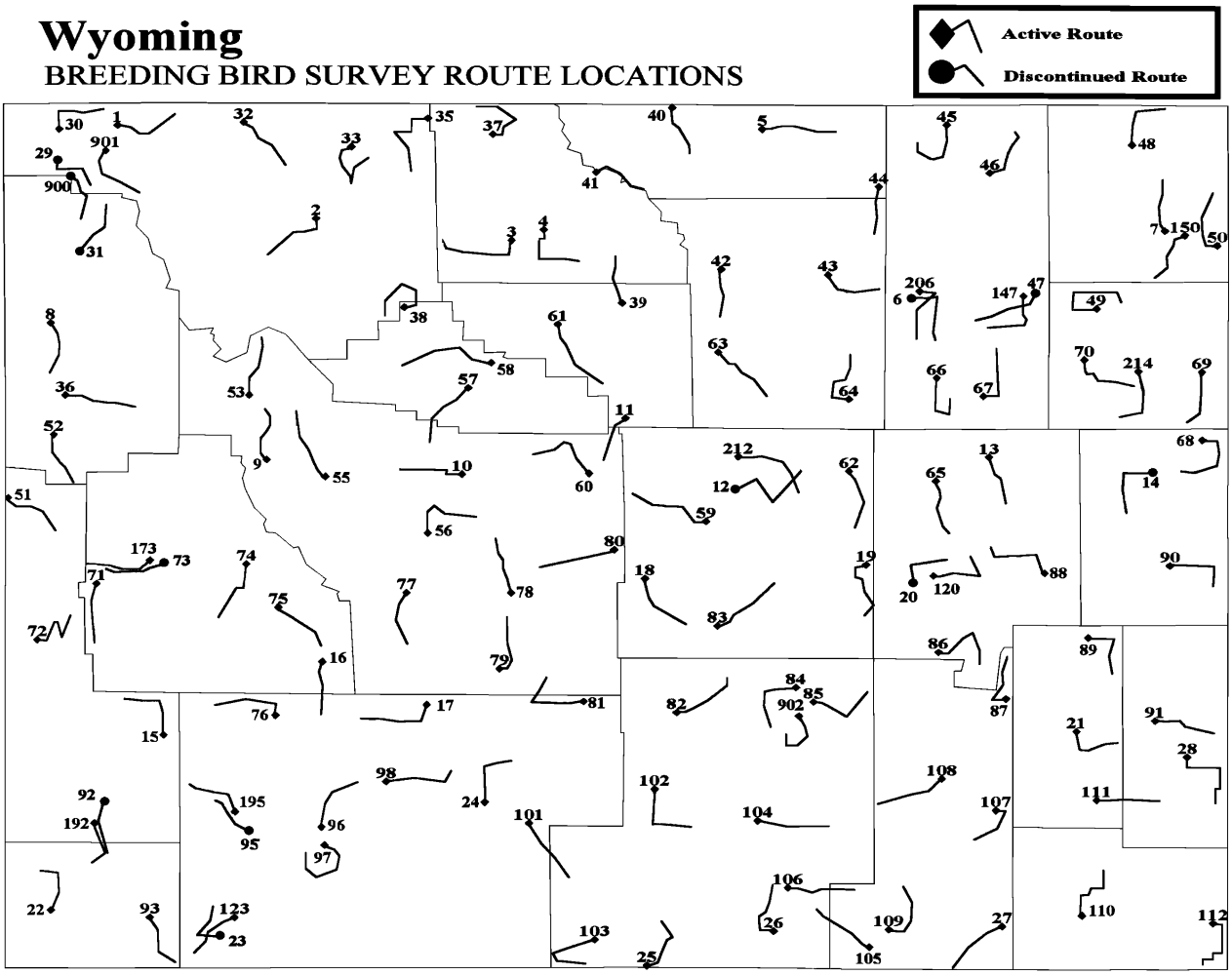


Figure 3. Breeding Bird Survey route map for Wyoming.

Table 3. Breeding Bird Survey time line, 1968-1980. Names under the years are the observers who conducted the routes. Continuous years with the same observer are distinguished with a line. Years that routes were not conducted are left blank.

Route Number and Name	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1 NE Entrance (YNP)													
2 Cody													
3 Otto			Kessinger----------				Domi[a]----------						McGough-------
4 Basin			Kessinger----------				Domi[a]---						Raper---------
5 Wyarno							Hall----------		Downing----------				
6 Clarkelen	Hall----		Kessinger------		Spring		Downing----------					CHANGED TO #206 IN 1979	
7 Sundance								Downing----------					
8 Colter Bay	Scott----------												
9 Dubois	Back----------			Back----------									
10 Midvale							Back----------						
11 Nowood													
12 Natrona	Scott----------												
13 Bill							Tate---						
14 Redbird	Scott----------												
15 Fontenelle													
16 Elk Horn													
17 Bear Creek	Layton----------				Layton----------							Layton----------	
18 Ervay						Layton----------							
19 Brookhurst	Scott----------												
20 Glenrock	Layton----------				Layton----------						CHANGED TO #120 IN 1978		
21 Dwyer													
22 Cumberland										June----------			
23 McKinnon		Layton----------			Layton----------				June----------				
24 Patrick Draw						Layton----------			June----------				
25 Savery													
26 Riverside	Gree[a]----------												
27 Buford							Spring-		Spring----------		Dorn----------		
28 Yoder	Gree[a]----------											Luce----------	
29 Canyon (YNP)													
30 Mammoth (YNP)													
31 West Thumb (YNP)	ROUTE NO LONGER RUN												
32 Hunter Peak													
33 Clark													
35 Frannie													
36 Moose									Scott----------				
37 Lovell													
38 Meeteetse													
39 Ten Sleep													
40 Dayton													Hanebury------

Table 3. Continued.

Route Number and Name	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
41 Bald Mountain													
42 Crazy Woman												Daly----------	
43 Schoonover													
44 Arvada													
45 Recluse													Pallister-----
46 Soda Well												Daly----------	
47 Piney													Pallister-----
48 Seely													
49 Upton													
50 Moskee													Faanes--------
51 Alpine												Oakleaf----------	
52 Wilson												Raynes----------	
53 Horse Creek													Mikol---------
55 Crowheart													
56 Ethete													
57 Anchor													
58 Gebo													Baggs---------
59 Arminto													
60 Lysite													
61 Worland													
62 Teapot Dome													
63 Mayoworth													
64 Sussex													
65 Harland Flats													
66 Pine Tree													Gasson--------
67 Highlight													Gasson--------
68 Riverview													
69 Newcastle													
70 Raven													
71 Soda Lake													Johnson-------
72 Buckskin Mtn.													Johnson-------
73 Daniel													Johnson-------
74 Boulder													
75 Big Sandy													
76 Farson													
77 Fiddler Lake												Oakleaf----------	
78 Sand Draw													
79 Sweetwater													Emmerich------
80 Gas Hills													

Table 3. Continued.

Route Number and Name	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
81 Bairoil													
82 Lamont													
83 Pathfinder													
84 Leo													
85 Shirley												Bohne----------	
86 Warbonnet													
87 Fletcher Peak												Rothwell-	
88 Shawnee													
89 Meadowdale													
90 Lusk													
91 Lingle													Rothwell------
92 Diamondville	ROUTE NO LONGER RUN									June----------			
93 Mountain View													June----------
95 Green River										June----------			
96 Reliance										June----------			
97 Rock Springs										June----------			
98 Black Rock													
101 Wamsutter													
102 Rawlins													
103 Baggs													
104 Walcott													
105 Fox Park													
106 Ryan Park													
107 Sybille Canyon													McAd[a]---------
108 Rock River													
109 Harmony													Bohne---------
110 Cheyenne													Floyd---------
111 Chugwater												Rothwell----------	
112 Pine Bluff													Strickland----
120 Welch											Layton----------		
123 Flaming Gorge													
147 Rozet													
173 Ryegrass													
195 Seedskadee													
206 Caballa Creek													
900 Hayden Val. (YNP)	ROUTE NO LONGER RUN												
901 Yellowstone (YNP)													
902 Pryor Flats													

[a] These names were reported as a 4 letter code; full names are unknown.

Table 4. Breeding Bird Survey time line, 1981-1990. Names under the years are the observers who conducted the routes. Continuous years with the same observer are distinguished with a line. 1981 routes conducted by the same observer as in 1980 have 2 dashes before the observer's name. Years that routes were not conducted are left blank.

```
Route Number and Name   1981       1982       1983       1984       1985       1986       1987       1988       1989       1990

 1  NE Entrance (YNP)             Bystrak----                                                       Nutting--------------------------
 2  Cody                                     Belitsky--                                            Greenquist-----------------------
 3  Otto             --McGough----           Stelter--------------------------           Stelter-------------------------------------
 4  Basin            --Raper-----------------Stelter--------------------------           Stelter-------------------------------------
 5  Wyarno           --Downing----Eads-------Jackson--------------------------Downing---------------Berry----------------------------
 6  Clarkelen   CHANGED TO #206 IN 1979
 7  Sundance                      Adams-------------------------------------------------------------------------------------------
 8  Colter Bay                                                                                                 Wallen----------------
 9  Dubois             Merrifield----------------------Abbott----------------           Abbott----------------Wimpfheimer Abbott----
10  Midvale                                                                                 Ritter-----------------Ryder-----------------
11  Nowood                                                                                            Means------            Means-----
12  Natrona            Herold------------------------------------------------------------------------------------------------------
13  Bill
14  Redbird          --Scott-------------------------------------------------------------------------------------------------------
15  Fontenelle                    Row------------------------------                       Luce------------------Baker------
16  Elk Horn                                                                                          Kinter-----            Kinter----
17  Bear Creek       --Layton---------------------------------------           Layton-----------------------------------------------
18  Ervay            --Layton-----           Layton-------------------------------------------------           Layton----------------
19  Brookhurst       --Scott-------------------------------------------------------------------------------South-------
20  Glenrock     CHANGED TO #120 IN 1978
21  Dwyer
22  Cumberland       --June------------------                                                          Luce-------
23  McKinnon         --June-----------------------------                      Kesselheim-  CHANGED TO #123 IN 1988
24  Patrick Draw     --June-------Hays-------June-------                                                Jahnke-----------------Raper-----
25  Savery                                                                                             Jahnke-----Fitton------
26  Riverside                                                                                                     Straw-----------------
27  Buford
28  Yoder            --Luce------------------                                Lawrence-----------------------------------------------
29  Canyon (YNP)                  Bystrak--ROUTE NO LONGER RUN
30  Mammoth (YNP)                 Gniadek----------------          Zarki-------------------------------------------------------------
31  West Thumb (YNP)              Bystrak--ROUTE NO LONGER RUN
32  Hunter Peak                   Bystrak----Holmes-----                      Hicks------            Hicks----------------------------
33  Clark                                                                                                                   Hicks-----
35  Frannie                                                                                                       Bryant------
36  Moose            --Scott---------------------------------------Herold-----South-----------------------------------------------
37  Lovell                                                                                                        Peters----------------
38  Meeteetse
39  Ten Sleep
```

Table 4. Continued.

```
Route Number and Name   1981       1982       1983       1984       1985       1986       1987       1988       1989       1990

 40  Dayton           --Hanebury-------------------------Downing-------------------------------------Johnson----------------Daly------
 41  Bald Mountain                                                                                                            Roney-----
 42  Crazy Woman      --Daly-------------------------------------------------------------------------------------------------Posner----
 43  Schoonover                  Pallister--                                Pallister-----------------------------------------------
 44  Arvada                      Segerstrom------------                     Segerstrom-Daly------------------           Daly------
 45  Recluse                     Segerstrom------------                     Segerstrom-Burton----------------           Oedekoven-
 46  Soda Well        --Daly-----------------------------                                Ernst-----------------------------------------
 47  Piney            --Pallister--Gasson-----Segerstrom-                                Winland---            Winland---------------
 48  Seely                                                                                                                    Droege----
 49  Upton                                                                               Ryder-----------------Lanka-------
 50  Moskee                      Bystrak----                                            Adams-----------------------------------------
 51  Alpine                                                                                                   Luce------------------
 52  Wilson           --Raynes-----Glen-------Raynes---------------------------Duffy-----------------------------------------------
 53  Horse Creek                 Mikol----------------------------Ritter-(formerly Mikol)-----------------------------------------
 55  Crowheart                                                                           Reid------
 56  Ethete
 57  Anchor
 58  Gebo             --Baggs------           Lawson-----                                           Fuchs------
 59  Arminto                     Pate------------------           Pate-------           Guenzel-------------------------------------
 60  Lysite                                                                                                   Ryder-----------------
 61  Worland
 62  Teapot Dome        Pate-----------------------------                                Guenzel-------------------------------------
 63  Mayoworth                   Talbott----Luce----------------------------           Bjerke----------------Johnson-----Bjerke----
 64  Sussex
 65  Harland Flats                                                                                                            Cerovski--
 66  Pine Tree        --Gasson-----           Segerstrom-                                Hurley-----Johnson----            Leggett---
 67  Highlight        --Gasson----------------Segerstrom-                                Hurley-----           Oelklaus--------------
 68  Riverview                   Fuchs----------------------------                      Helms-----------------------------------------
 69  Newcastle                                                                                       Ryder------Lanka-------Adams-----
 70  Raven
 71  Soda Lake        --Johnson-------------------------------------------------                   Wollrab----            Smith-----
 72  Buckskin Mtn.    --Johnson---------------
 73  Daniel           --Johnson-------------------------------------------------                   Wollrab----CHANGED TO #173 IN 1988
 74  Boulder                     Row-----------------------------
 75  Big Sandy                             Straley----                                Straley---------------Fralick---------------
 76  Farson                                June-------
 77  Fiddler Lake                Oakleaf----                                          Belitsky--------------            Nelson----
 78  Sand Draw
 79  Sweetwater       --Emmerich-------------------------------------------------------------------------------------------------
 80  Gas Hills
```

Table 4. Continued.

```
Route Number and Name   1981       1982       1983       1984       1985       1986       1987       1988       1989       1990

 81  Bairoil                                                                                          Bredehoft--            Hiatt-----
 82  Lamont                                                                                 Hiatt----------------------------------------
 83  Pathfinder                     Pate-----------------------------                       Guenzel---------------------------------------
 84  Leo                            Gilbert---
 85  Shirley            Hays-------                                                                                   Luce--------Rudd------
 86  Warbonnet                                                                                                                Droege----
 87  Fletcher Peak      Rothwell-------------------------------------------------------------                         Lawrence--------------
 88  Shawnee                                                                                          Helms----------------------------
 89  Meadowdale                                Hymas----------------------------                                   Fitton------Ritter----
 90  Lusk                           Fuchs----------------------------                       Helms----------------------------------------
 91  Lingle           --Rothwell-----------------------------------------------Stroud-----Straw------Lockwood---------------Howe------
 92  Diamondville     --June-------Hays--ROUTE NO LONGER RUN
 93  Mountain View    --June-----------------------------                                     Luce-------           Deen------------------
 95  Green River      --June------------------Luke------------------   CHANGED TO #195 IN 1986
 96  Reliance         --June-------Hays-------Luke------------------
 97  Rock Springs     --June-----------------------------                                     Raper------------------------------Luke------
 98  Black Rock                                                                                                                Christiansen
101  Wamsutter                                                                                                                   Jahnke----
102  Rawlins                                                                                          Rinkes---------------------------
103  Baggs                                                                  Moody------           Jahnke-----Longobardi------------
104  Walcott                        Long-------                       Long-------                                Parks-------Long------
105  Fox Park
106  Ryan Park
107  Sybille Canyon                                                                                                Ritter------Mobley----
108  Rock River                                                                                                                Oneale----
109  Harmony            Hays-------Bystrak----                                                  Bohne----------------------------------------
110  Cheyenne         --Floyd------           Hill-------------------------------------------------------------------------------------
111  Chugwater        --Rothwell-----------------------------------------------Bohne------                                Rothwell----
112  Pine Bluff         Strickland-----------------------Wollrab----                                                      Samuelson-------------
120  Welch            --Layton-----           Layton-----------------------------------------------------------------------------------
123  Flaming Gorge                                                                                    Christiansen         Christiansen
147  Rozet
173  Ryegrass                                                                                                                    Wollrab---
195  Seedskadee                                                             Adams-----
206  Caballa Creek
900  Hayden Valley (YNP)                                       Zarki----------------------------  ROUTE NO LONGER RUN
901  Yellowstone (YNP)                                                                            Zarki----------------------------
902  Pryor Flats
```

Table 5. Breeding Bird Survey time line, 1991-1998. Names under the years are the observers who conducted the routes. Continuous years with the same observer are distinguished with a line. 1991 routes conducted by the same observer as in 1990 have 2 dashes before the observer's name. Years that the route was not conducted are left blank.

```
Route Number and Name   1991       1992       1993       1994       1995       1996       1997       1998

 1  NE Entrance (YNP)--Nutting--------------------------           Nutting----           McEneaney-------------
 2  Cody             --Greenquist-           Nutting-------------------------------------------------------
 3  Otto             --Stelter----Stephens-------------------------------------------------------------
 4  Basin            --Stelter----           Easterly------------------------------------------------------
 5  Wyarno           --Berry-------------------------------------------------------------------------------
 6  Clarkelen     CHANGED TO #206 IN 1979
 7  Sundance           Yemington--Adams------------------------------------------------------------------
 8  Colter Bay       --Wallen-----------------------------------------------Duffy----------------------------
 9  Dubois           --Abbott-------------------------------------           Vernon----------------
10  Midvale          --Ryder------           Ryder-----------------------------Hnilicka-------------------------
11  Nowood                                   Walgren-------------------------------------------------------
12  Natrona          --Herold----------------  CHANGED TO #212 IN 1993
13  Bill                        Picken----------------                      Bartosiak------------------------
14  Redbird                                    CHANGED TO #214 IN 1994
15  Fontenelle         Leebt------Deno-------------------------------------------------------------------
16  Elk Horn                                                               Gunyan-----                     Meyer------
17  Bear Creek       --Layton----------------                              Cerovski-------------------------
18  Ervay
19  Brookhurst         Scott------                      Patterson--Walgren------------------------------------
20  Glenrock      CHANGED TO #120 IN 1978
21  Dwyer                       Lutz-------           Roberts---------------Felley-----
22  Cumberland                  Deno------------------------------------------------------------------------
23  McKinnon      CHANGED TO #123 IN 1988
24  Patrick Draw     --Raper-----------------           Cerovski----------------------------------------------
25  Savery                      Michelson-------------           Michelson--
26  Riverside        --Straw------           Straw----------------------------           Loose-----------------
27  Buford                                   Johnson-------------------------------------           Johnson----
28  Yoder            --Lawrence----------------------------------------------------------------------------
29  Canyon (YNP)  ROUTE NO LONGER RUN
30  Mammoth (YNP)      McEneaney-------------------------------------------------------------------------
31  West Thumb (YNP)  ROUTE NO LONGER RUN
32  Hunter Peak                 Hicks-----------------------------------------------------------------------
33  Clark              Roop------------------           Roop-------
35  Frannie            Bryant-----                                      Wehrfritz--
36  Moose            --South-------------------------------------------------------------------------------
```

Table 5. Continued.

```
Route Number and Name   1991       1992       1993       1994       1995       1996       1997       1998

 37  Lovell           --Peters-------------------------------------------------------------------------------
 38  Meeteetse          Miller---------------------------          Miller---------------------------------------
 39  Ten Sleep                                                     Ward-----------------------------------------
 40  Dayton           --Daly-------          Corbett---------------------------          Corbett---------------
 41  Bald Mountain    --Roney-------------------------------------------------
 42  Crazy Woman      --Posner------------------------------------------------                                Nutting----
 43  Schoonover       --Pallister---------------------------------------------                                Ward-------
 44  Arvada           --Daly-------          Daly------------------Ward-------------------------------------
 45  Recluse          --Oedekoven----------------------------------------------------------------------------
 46  Soda Well        --Ernst--------------------------------------------------------------------------------
 47  Piney         CHANGED TO #147 IN 1991
 48  Seely              Cerovski---Yemington-------------------------------------------------------------------
 49  Upton              Lanka------Talbot-----Brimeyer---Dykstra----Brimeyer--------------Anderson--------------
 50  Moskee             Yemington--Adams-----------------------------------------------------------------------
 51  Alpine                        Luce-------Wile-----------------------------------------          Wile-------
 52  Wilson           --Duffy--------------------------------------------------------------------
 53  Horse Creek      --Ritter----------------Crane-----------------------------------------------------------
 55  Crowheart
 56  Ethete             Firchow---------------------------          Firchow----          Firchow---------------
 57  Anchor                                   Firchow----
 58  Gebo                                     Stephens------------------------------------Atkins----------------
 59  Arminto                       Thiele-----          Patterson-------------
 60  Lysite           --Ryder-------------------------------------------------Hnilicka---          Hnilicka---
 61  Worland                       Serrano--------------------------------------------------------------------
 62  Teapot Dome
 63  Mayoworth        --Bjerke-------------------------------------------------------------------------------
 64  Sussex             Fralick---------------          Thiele----------------------------------------------
 65  Harland Flats    --Cerovksi--------------Hunter-----          Hunter-----
 66  Pine Tree                                James----------------------------
 67  Highlight        --Oelklaus--------------          Oelklaus---
 68  Riverview        --Helms-----------------Robertson------------------------Anderson-------------------------
 69  Newcastle                     Talbott----Brimeyer-------------------------Anderson-------------------------
 70  Raven                         Bartosiak--Picken-----Bartosiak--Domsalla---Bartosiak-----------------------
 71  Soda Lake          Bohne-----------------Fralick---------------------------          Fralick----
 72  Buckskin Mtn.                 Stone------          Fralick----
 73  Daniel        CHANGED TO #173 IN 1988
 74  Boulder            Rawlins----                      Rawlins---------------          Rawlins---------------
 75  Big Sandy                     Ritter-----          Smith------          Smith----------------------------
 76  Farson                                                    Hunter-----
```

Table 5. Continued.

```
Route Number and Name   1991       1992       1993       1994       1995       1996       1997       1998

 77  Fiddler Lake     --Nelson-------------------------------------Crane-------------------------------------
 78  Sand Draw                                Jones-----------------           Jones------
 79  Sweetwater       --Emmerich--------------Ryder-------------------------------------------------------------
 80  Gas Hills          Laurion--------------------------
 81  Bairoil          --Hiatt-----------------------------------------------------------------------------------
 82  Lamont           --Hiatt-----------------------------------------------------------------------------------
 83  Pathfinder         Hines------Schwieger-------------------------------------------------------------------
 84  Leo                                      Walgren-------------------------------------------------------
 85  Shirley                      Easterly---Hines-----------------           Hines----------------------------
 86  Warbonnet                    Schwieger--           Schwieger-----------------------------------Lawrence---
 87  Fletcher Peak    --Lawrence--------------------------------------------------------------------------------
 88  Shawnee          --Helms-----------------Robertson--Helms-----------------                     Kroger-----
 89  Meadowdale       --Ritter-----Lutz-------           Hnilicka---Zornes-----
 90  Lusk             --Helms-----------------Robertson--Helms-----------------                     Lawrence---
 91  Lingle             Ritter-----Lutz------------------          Lutz-------Felley--------------------------
 92  Diamondville                     CHANGED TO #192 IN 1983
 93  Mountain View    --Deen-------                      Adams------
 95  Green River    CHANGED TO #195 IN 1986
 96  Reliance
 97  Rock Springs     --Luke------------------           Gunyan----------------
 98  Black Rock                               Gunyan---------------------------
101  Wamsutter        --Jahnke----            Jahnke-----           Cerovski---           Woolley---------------
102  Rawlins          --Rinkes----------------------------                      Apple----------------------------
103  Baggs              Iversen----                                 Hnilicka---           Woolley---------------
104  Walcott            Blomquist-----------------------------------------------------------------------------
105  Fox Park                     Bohle-------------------------------------------------------------------------
106  Ryan Park
107  Sybille Canyon   --Mobley-----           Pauley-----                                 Felley----------------
108  Rock River       --Oneale-----------------Young-----------------           Young------           Young------
109  Harmony                                  Guenzel----
110  Cheyenne                     Brockmann-------------------------Zornes-----Deibert--------------------------
111  Chugwater          Rothwell---                       Rothwell--------------
112  Pine Bluff                   Samuelson--Young--------------------------------------           Young------
120  Welch              Michelson-----------------------------------------------------------------------------
123  Flaming Gorge                Reinmuth--------------Norvell----Lewis------           Paulin----------------
147  Rozet              Winland----           Hayes------
150  Gov't. Valley (NEW IN 1992)   Adams--------------------------------------------------------------------
173  Ryegrass                                 Smith------           Smith----------------------------
192  Carter
```

Table 5. Continued.

Route Number and Name	1991	1992	1993	1994	1995	1996	1997	1998
195 Seedskadee		Luke-------	Bryant----------		Pedersen---	Halvorson----------		
206 Caballa Creek		Plato----------						
212 Bucknum			Herold----------					
214 Hampshire				Bartosiak----------		Beauchaine-	Bartosiak----------	
901 Yellowstone (YNP)	McEneaney----------							
902 Prior Flats	Scott-----							

BIRD PRIORITIZATION

Purpose

Effective and efficient ecological management involves determining which species and habitats are most in need of conservation. The Wyoming Partners In Flight species prioritization process was designed as a tool for this important task. Priority species selected for discussion in Version 1.0 of the Wyoming Bird Conservation Plan were chosen using the prioritization process as the initial scoring tool, and the knowledge of WY-PIF participants and other local experts to refine the priority list. We recognize that there are gaps in our knowledge of Wyoming birds. However, the Wyoming Bird Conservation Plan is a dynamic and working document, so new information will be incorporated into our prioritization process and subsequent recommendations.

Partners In Flight initially focused only on Neotropical migratory birds (those species that breed in the United States and Canada and winter in Latin America). As the national program progressed, emphasis has expanded to include all breeding, wintering, and resident birds. Following the national PIF expanded emphasis, the Wyoming Bird Conservation Plan will concentrate on the birds that will be most positively influenced by management, as well as those species with the greatest immediate threats of extirpation. In many cases, management of habitat groups will provide protection for suites of priority species and allow land managers to participate in critical conservation efforts. This approach often results in less of a financial burden than single-species management practices sometimes incur. Migratory waterfowl, shorebirds, and colonial waterbirds are not included in the Wyoming Bird Conservation Plan, as the needs of these species are being addressed by other conservation initiatives (the North American Waterfowl Management Plan, the National Shorebird Conservation Plan, and the National Colonial Waterbird Conservation Plan).

Process for Prioritizing Species

Wyoming Partners In Flight participants developed the current list of priority species based on a combination of the seven criteria in the national Partners In Flight Priority Database (Carter et al. 1997). This database serves as a defensible method of prioritizing both species and habitats in need of conservation. The criteria include Wyoming-dependent and Wyoming-independent factors. The Wyoming-independent criteria are constant over a species' range and do not vary for each species. The Wyoming-dependent criteria were the key components used to prioritize species and their conservation action needs. In the absence of any more rigorous statewide surveys, Breeding Bird Survey data dating back to 1968 were used to determine population trends in Wyoming.

Criteria

Within each criterion below, a species was given a rank score ranging from 1 to 5, with 1 being the least critical rank and 5 the most critical. Each ranked species could potentially receive a low score of 7 and a high score of 35. However, setting conservation goals based only on total score could be misleading; therefore, each total score was reviewed in conjunction with its component parts. In Wyoming, species were initially ranked using total score, area importance, and population trend.

1. **Relative Abundance (RA)** - The abundance of a bird, in appropriate habitat within its entire range, relative to other bird species. This criterion gives an indication of a species' vulnerability to withstand cataclysmic environmental changes. A low score would indicate a higher relative abundance, therefore reducing the risk of complete extirpation from losses in one or more regions. Higher scores indicate a lower relative abundance, thus more vulnerability to drastic losses or population changes.

2. **Breeding Distribution (BD)** - A relative measure of breeding range size as a proportion of North America [defined as the main body of the continent, excluding Greenland, through Panama and the islands of the Caribbean, comprising an area of 8,517,290 mi^2 (22,059,680 km^2) (National Geographic Society 1993)], and as such it provides an index of a species' vulnerability to random environmental events. High scores indicate localized breeding, thus a higher likelihood of serious decline from drastic environmental changes. Low scores indicate wide breeding distribution, therefore less likelihood of extirpation. Used for breeding birds only.

3. **Non-breeding Distribution (ND)** - A relative measure of non-breeding, or winter, range size as a proportion of North America, and as such it provides an index of a species' vulnerability to random environmental events. High scores indicate localized distribution on the non-breeding grounds. Low scores indicate wide distribution on the non-breeding grounds, therefore less likelihood of extirpation. Used for wintering birds only.

4. **Threats on Breeding Grounds (TB)** - The ability of a habitat in an area to support populations of a species in that area. Two factors are considered here: 1) each species' demographic and ecological vulnerability (the potential inability of a species to recover from population loss by normal reproductive effort due to low reproductive rate, high juvenile mortality, or both; and the level of ecological specialization of a species and, hence, its potential inability to withstand environmental change), and 2) habitat loss or disruption (a combination of the amount of habitat or conditions necessary for survival and reproductive success that has been lost since 1945, and the amount that is anticipated to be lost in the future). High scores indicate either a large loss of habitat or a species that is an extreme

ecological specialist. Low scores indicate a stable or increasing habitat or a species that is an ecological generalist. Used for both breeding and wintering birds.

5. **Threats on Non-breeding Grounds (TN) –** Range-wide threats on non-breeding, or winter, grounds. This is scored using the same criteria as threats on breeding grounds but reflects non-breeding issues, including migratory habitat. Used for wintering birds only.

6. **Population Trend (PT)** - The overall population trend of each species assigned independently for each state, province, or physiographic area. This criterion must meet two thresholds, reliability and magnitude, to warrant either a very high or very low score. When possible, a score was assigned using BBS data, which incorporated a population trend uncertainty score based on the statistical validity of the BBS data (i.e. a species must be detected on a minimum of 14 BBS routes per state for population trends to have statistical significance). This criterion was chosen to alert managers to species with modest, but certain, population declines.

7. **Area Importance (AI)** - The abundance of a species within a state, province, or physiographic area relative to its abundance throughout its range. This criterion helps direct conservation efforts toward areas that are most important to a species' survival. Area Importance is scored locally; therefore, high scores indicate that a large proportion of the species' breeding or winter range occurs in Wyoming, or a species is using a habitat that is only available in Wyoming. Low scores indicate that a small proportion of the species' range occurs in Wyoming, or the preferred habitat is widespread across its range. Used for both breeding and wintering birds.

Priority Species

Priority bird species in Wyoming were identified from the PIF Priority Database (Carter et al. 1997) and by qualitative, informed decisions. Those species with a total score of 18 or above, Area Importance (AI) of 3 or above, and/or Population Trend (PT) of 3 or above from the database, or with a total score less than 18 but of significant local interest were identified as the highest priority species. However, as more information becomes available, the highest priority species for Wyoming may change, as this is a dynamic database that allows for updated information to be periodically inserted and reviewed. The primary habitat type or types required for breeding were identified for each species to determine the highest priority habitat types for the state. Finally, the type of conservation strategy needed to ensure survival for each priority species was determined (Tables 6-9).

The initial focus for Version 1.0 of the Wyoming Bird Conservation Plan is on the highest priority avian species (Levels I and II below) and highest priority habitat types (italicized in Table 10), with others being addressed as time and funding allow.

Table 6. Level I (Conservation Action). Species clearly needs conservation action (CA). Includes species of which Wyoming has a high percentage of and responsibility for the breeding population (R), monitoring (M), and the need for additional knowledge (K) through research into basic natural history, distribution, etc.

Species	PIF Score [a]	AI [b]	PT [c]	Primary Habitat Type(s)
Mountain Plover	28	4	3	Shortgrass Prairie, Shrub-steppe
Trumpeter Swan	26	3	3	Wetlands
Sage Grouse	26	5	3	Shrub-steppe
Baird's Sparrow	26	2	3	Shortgrass Prairie
McCown's Longspur	26	3	2	Shortgrass Prairie, Shrub-steppe
Ferruginous Hawk	23	4	3	Shrub-steppe, Shortgrass Prairie
Brewer's Sparrow	23	5	5	Shrub-steppe, Mountain-foothills Shrub
Wilson's Phalarope	22	3	5	Wetlands
Franklin's Gull	22	3	3	Wetlands
Sage Sparrow	22	5	2	Shrub-steppe, Mountain-foothills Shrub
Swainson's Hawk	21	3	3	Plains/Basin Riparian
Long-billed Curlew	21	2	3	Shortgrass Prairie
Short-eared Owl	20	3	3	Shortgrass Prairie
Northern Goshawk	19	4	3	High Elevation Conifer, Mid Elevation Conifer, Aspen
Peregrine Falcon	19	3	3	Specialized (cliffs)
Burrowing Owl	19	3	4	Shortgrass Prairie
Forster's Tern	19	2	3	Wetlands
Bald Eagle	18	3	3	Montane Riparian, Plains/Basin Riparian
Upland Sandpiper	18	2	2	Shortgrass Prairie
Black Tern	18	3	3	Wetlands

[a] From the PIF Priority Database (Carter et al. 1997).
[b] AI = Area Importance (from the PIF Priority Database, Carter et al. 1997).
[c] PT = Population Trend (from the PIF Priority Database, Carter et al. 1997).

Table 7. Level II (Monitoring). The action and focus for the species is monitoring (M). Includes species of which Wyoming has a high percentage of and responsibility for the breeding population (R), species whose stability (S) may be unknown (S?), species that are peripheral (P) for breeding in the habitat or state, or additional knowledge (K) may be needed.

Species	PIF Score [a]	AI [b]	PT [c]	Primary Habitat Type(s)
Calliope Hummingbird	23	5	3	Mid Elevation Conifer, Montane Riparian
Lewis' Woodpecker	23	3	3	Low Elevation Conifer, Plains/Basin Riparian
Cassin's Kingbird	22	3	3	Juniper Woodland, Plains/Basin Riparian
Lark Bunting	22	4	4	Shortgrass Prairie, Shrub-steppe
American White Pelican	21	3	3	Aquatic
Williamson's Sapsucker	21	3	3	Mid Elevation Conifer
Black-backed Woodpecker	21	3	3	Mid Elevation Conifer, High Elevation Conifer
Gray Flycatcher	21	3	3	Juniper Woodland, Mountain-foothills Shrub
Juniper Titmouse [d]	21	3	3	Juniper Woodland
Dickcissel	21	3	3	Shortgrass Prairie
Chestnut-collared Longspur	21	2	3	Shortgrass Prairie
Scott's Oriole [d]	21	3	3	Juniper Woodland
Harlequin Duck	20	3	3	Montane Riparian
Snowy Plover	20	3	3	Wetlands
Black-chinned Hummingbird	20	2	3	Plains/Basin Riparian, Shrub-steppe
Rufous Hummingbird	20	2	3	Mid Elevation Conifer
Red-naped Sapsucker	20	3	2	Aspen
Three-toed Woodpecker	20	4	3	Mid Elevation Conifer, High Elevation Conifer
Willow Flycatcher	20	3	4	Montane Riparian, Plains/Basin Riparian
Hammond's Flycatcher	20	2	3	High Elevation Conifer with Aspen, Montane Riparian
Cordilleran Flycatcher	20	3	3	Montane Riparian, Mid Elevation Conifer
Pygmy Nuthatch	20	3	3	Low Elevation Conifer
Marsh Wren	20	3	4	Wetlands
American Dipper	20	3	3	Montane Riparian

Table 7. Level II (Monitoring), continued.

Species	PIF Score [a]	AI [b]	PT [c]	Primary Habitat Type(s)
Plumbeous Vireo	20	3	3	Mid Elevation Conifer, Low Elevation Conifer
Townsend's Warbler	20	3	3	High Elevation Conifer, Mid Elevation Conifer
Dusky Flycatcher	19	3	2	Low Elevation Conifer, Aspen, Mountain-foothills Shrub
Western Bluebird	19	3	3	Juniper Woodland, Low Elevation Conifer
Sage Thrasher	19	5	2	Shrub-steppe
Grasshopper Sparrow	19	3	5	Shortgrass Prairie, Shrub-steppe
Bobolink	19	2	3	Shortgrass Prairie, Shrub-steppe
Common Loon	18	3	3	Wetlands
Black-billed Cuckoo	18	2	3	Plains/Basin Riparian
Yellow-billed Cuckoo	18	3	3	Plains/Basin Riparian
Eastern Screech-Owl	18	3	3	Plains/Basin Riparian
Western Screech-Owl	18	3	3	Plains/Basin Riparian
Great Gray Owl	18	3	3	Mid Elevation Conifer, High Elevation Conifer
Boreal Owl	18	3	3	High Elevation Conifer
Broad-tailed Hummingbird	18	2	2	Montane Riparian, Plains/Basin Riparian, Mid Elevation Conifer
Western Scrub-Jay [d]	18	3	3	Juniper Woodland
Loggerhead Shrike	18	3	3	Shrub-steppe
Vesper Sparrow	18	5	4	Shrub-steppe
Lark Sparrow	18	3	4	Shrub-steppe
Golden-crowned Kinglet	17	3	3	High Elevation Conifer
MacGillivray's Warbler	17	3	1	Montane Riparian, Plains/Basin Riparian
Ash-throated Flycatcher [d]	16	2	3	Juniper Woodland
Bushtit [d]	16	3	3	Juniper Woodland
Brown Creeper	16	3	3	Mid Elevation Conifer, High Elevation Conifer
Merlin	15	3	3	Low Elevation Conifer

[a] From the PIF Priority Database (Carter et al. 1997).
[b] AI = Area Importance (from the PIF Priority Database).
[c] PT = Population Trend (from the PIF Priority Database).
[d] These species are already addressed in the Wyoming Game and Fish Department's Nongame Species Accounts for Utah Juniper Obligates (Fitton 1989).

Table 8. Level III (Local Interest). Species that Wyoming Partners In Flight may recommend for conservation action (CA) that are not otherwise high priority but are of local interest (LI). Can include monitoring (M).

Species	PIF Score [a]	A [b]	PT [c]	Primary Habitat Type(s)
Virginia's Warbler	24	3	3	Juniper Woodland, Mountain-foothills Shrub
Prairie Falcon	23	5	3	Specialized (cliffs)
Brown-capped Rosy-Finch	23	3	3	Alpine Tundra/Grassland
Black-throated Gray Warbler	22	3	3	Juniper Woodland, Mountain-foothills Shrub
Black Rosy-Finch	22	3	3	Alpine Tundra/Grassland
Blue Grouse	21	3	3	Mid Elevation Conifer, High Elevation Conifer
American Avocet	21	2	4	Wetlands
Western Grebe	20	3	3	Wetlands, Aquatic
Clark's Grebe	20	3	3	Wetlands, Aquatic
White-tailed Ptarmigan	20	3	3	Alpine Tundra/Grassland
Common Poorwill	19	3	3	Mountain-foothills Shrub, Shrub-steppe
Sharp-tailed Grouse	19	3	3	Mountain-foothills shrub OR Shortgrass Prairie (habitat type depends on subspecies)
Golden Eagle	19	5	3	Specialized (cliffs)
Northern Harrier	19	4	3	Wetlands, Meadows
Lazuli Bunting	19	3	3	Montane Riparian, Plains/Basin Riparian
Willet	18	3	2	Wetlands
Red-headed Woodpecker	18	2	3	Plains/Basin Riparian, Low Elevation Conifer
Say's Phoebe	18	4	3	Shrub-steppe
Northern Rough-winged Swallow	18	4	4	Plains/Basin Riparian
Clark's Nutcracker	18	4	3	High Elevation Conifer, Mid Elevation Conifer
Rock Wren	18	3	5	Specialized (rock outcrops)
Canyon Wren	18	3	4	Specialized (canyons)
Bewick's Wren	18	3	3	Juniper Woodland
Veery	18	2	4	Montane Riparian
Ovenbird	17	2	3	Plains/Basin Riparian
Bullock's Oriole	17	3	2	Montane Riparian, Plains/Basin Riparian

[a] From the PIF Priority Database (Carter et al. 1997).
[b] AI = Area Importance (from the PIF Priority Database).
[c] PT = Population Trend (from the PIF Priority Database).

Table 9. Level IV (Not Considered Priority). Not considered a priority species; species is known to be stable (S) or increasing, or is addressed elsewhere in other management plans; no action is needed; monitoring (M) is not precluded but is not the focus; or species is extirpated (E) and no action is needed.

Species	PIF Score [a]	AI [b]	PT [c]	Primary Habitat Type(s)
Barrow's Goldeneye [d]	22	3	3	Wetlands
Hooded Merganser [d]	20	2	3	Aquatic
Ring-necked Duck [d]	20	4	3	Wetlands
Sandhill Crane [d]	20	4	1	Wetlands
Cinnamon Teal	19	3	4	Wetlands
Canvasback [d]	19	3	3	Wetlands
Redhead [d]	19	2	3	Wetlands
Black-billed Magpie	19	4	5	Generalist
Green-tailed Towhee	19	4	2	Mountain-foothills Shrub, Shrub-steppe
Wood Duck [d]	18	3	3	Plains/Basin Riparian
Bufflehead	18	3	3	Wetlands
Northern Bobwhite [e]	18	3	3	Plains/Basin Riparian
California Gull	18	3	3	Aquatic
Chimney Swift	18	3	3	Urban
Mountain Chickadee	18	3	5	High Elevation Conifer, Mid Elevation Conifer
Black-headed Grosbeak	18	3	1	Mid Elevation Conifer, Aspen
Clay-colored Sparrow	18	2	3	Mountain-foothills Shrub, Shrub-steppe
Mountain Bluebird	17	4	2	Mountain-foothills Shrub, Shrub-steppe
Warbling Vireo	17	4	2	Plains/Basin Riparian, Mid Elevation Conifer, Aspen
Western Tanager	17	3	2	Mid Elevation Conifer, High Elevation Conifer
Rose-breasted Grosbeak	17	2	3	Plains/Basin Riparian, Montane Riparian
Cassin's Finch	17	3	2	Mid Elevation Conifer, High Elevation Conifer

[a] From the PIF Priority Database (Carter et al. 1997).
[b] AI = Area Importance (from the PIF Priority Database).
[c] PT = Population Trend (from the PIF Priority Database).
[d] Specific management plans already exist for waterfowl and the Rocky Mountain Greater Sandhill Crane.
[e] Classified as a game species in Wyoming.

HABITAT GROUP PRIORITIZATION

In the West, vegetation associations are mostly uniform within specific habitats and, as most things in nature, do not end at state boundaries. Many of the states within the Western Working Group (WWG) region of Partners In Flight have habitats in common, with the exception of Alaska and California. To coordinate bird conservation planning across boundaries and strive for similar biological objectives for shared species, WY-PIF participants developed a common, general nomenclature for habitat types. Each state in the WWG defined habitat types with the specific differences in their state, but based their hierarchies on the WWG habitat group headings (riparian, grassland, forest, and shrubland) (Table 10).

During the draft planning phase, we determined the highest priority habitats on which to focus initial efforts based on the needs of the highest priority avian species and the number of species that occur in each habitat type (Table 11). (This initial prioritization of habitat types was based on primary habitats used for breeding, but when determining biological objectives - both population and habitat objectives - habitats used during migration and winter were also considered.) When converted to graph form, it becomes clear that the highest priority habitat types for breeding birds in Wyoming are Montane Riparian, Plains/Basin Riparian, Wetlands, Shortgrass Prairie, High Elevation Conifer, Mid Elevation Conifer, Juniper Woodland, Shrub-steppe, and Mountain-foothills Shrub based on both the number and percent of priority breeding bird species that require that habitat type (Figure 4). However, in light of personnel, funding, and time constraints and after much discussion, we determined it was best to focus initially on those highest priority habitat types that were critical for the highest priority breeding birds but limited in quantity or distribution, that faced immediate threats of loss or degradation, or that were not already addressed under an existing management plan. The top five habitat types that Version 1.0 of this Plan begins to address include: Plains/Basin Riparian, Montane Riparian, Shortgrass Prairie, Mid Elevation Conifer, and Shrub-steppe (Table 10). Other habitat types identified as priority will be addressed and included in updated versions of this Plan as they are completed.

Table 10. Wyoming Partners In Flight habitat groups, habitat types, and descriptions. (Highest priority habitat types for Version 1.0 of the Wyoming Bird Conservation Plan are in italics.)

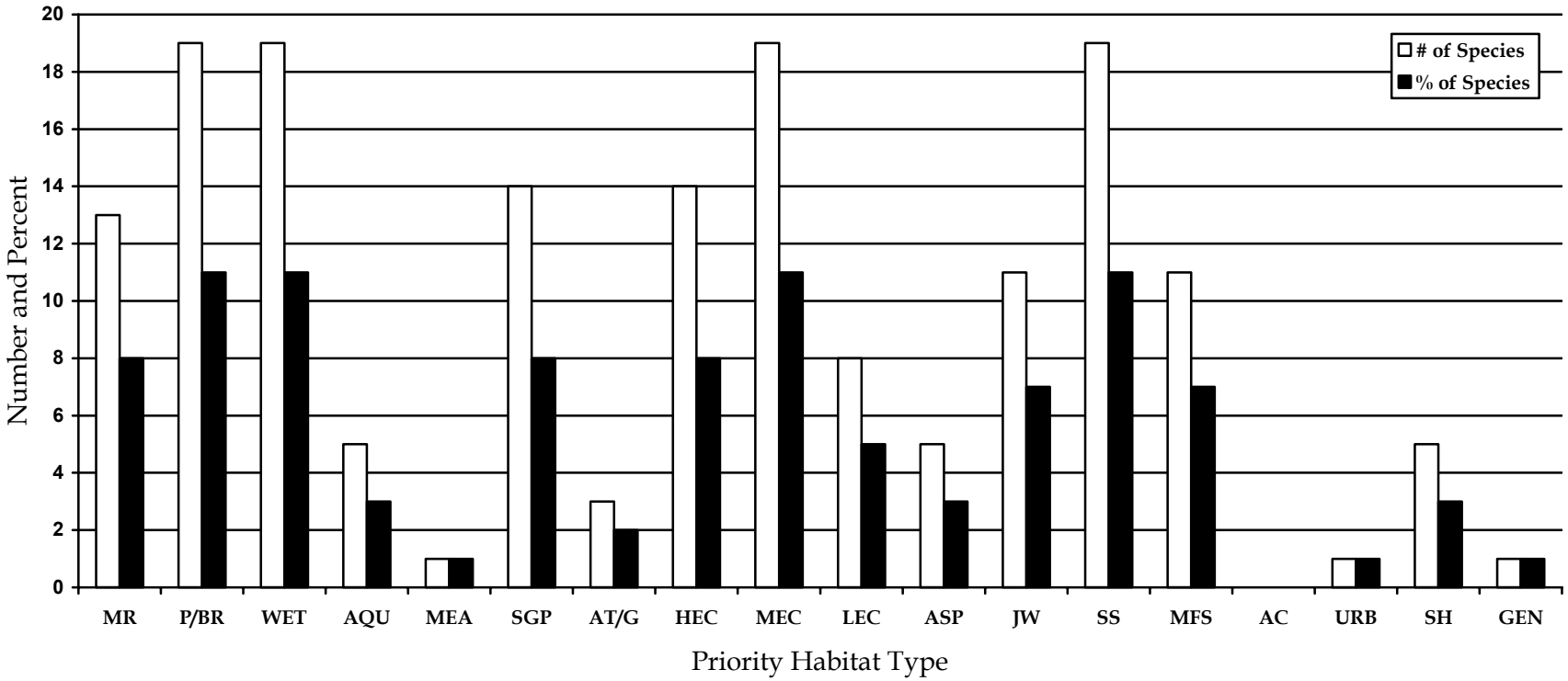
Habitat Group **Habitat Type**	**General Habitat Type Description**
Riparian	
Montane Riparian	Dominated by willows, alder, dogwood, mountain maple, and water birch; can include narrowleaf cottonwood, spruce, and sedges/rushes; occurs in a mountain setting.
Plains/Basin Riparian	Dominated by cottonwoods, elderberry, buffaloberry, introduced Russian olive, boxelder, willows, green ash, American elm, snowberry, chokecherry, Virginia creeper, and/or grasses/ rushes/sedges; occurs in a lower elevation setting.
Wetlands	Areas where water is present most of the time; includes marshes, shallow water, and areas with water-saturated soil; vegetation includes cattails, rushes, sedges, and willows.
Aquatic	Dominated by open, deep water; includes lakes, ponds, and reservoirs.
Meadows	Includes wet-moist meadows and wet-moist meadow grasslands.
Grassland	
Shortgrass Prairie	Includes but may not be limited to blue grama, buffalo grass, wheatgrass, bluestem, and needle-and-thread grass; includes mixed grass species in localized areas.
Alpine Tundra/Grassland	Tundra, alpine meadows, boulder fields, above 11,000 feet.
Forest	
High Elevation Conifer	Dominated by Englemann spruce/subalpine fir; can include lodgepole pine, whitebark pine, and aspen.
Mid Elevation Conifer	Mixed conifer; pure or mixed stands that can include limber pine, Douglas fir, lodgepole pine, blue spruce, and/or ponderosa pine; can include aspen.
Low Elevation Conifer	Dominated by ponderosa pine.
Aspen	Dominated by aspen; can include meadows or conifers.
Shrubland	
Juniper Woodland	Dominated by juniper, but may include other species.
Shrub-steppe	Dominated by sagebrush, greasewood, saltbush, and rabbitbrush; can include a grass component.
Mountain-foothills Shrub	Pure or mixed shrub stands that can include but are not limited to mountain mahogany, serviceberry, Gambel's oak, bitterbrush, skunkbush sumac, snowberry, hawthorn, wild plum, chokecherry, and boxelder.
Other Habitat Groups	
Agricultural Croplands	Includes pasture, croplands, irrigated native meadows, shelterbelts, and Conservation Reserve Program lands.
Urban	Self-explanatory.
Specialized Habitats	Areas having unique characteristics such as rock outcrops, cliffs, caves, shorelines, banks, burns, buildings, mines, roadsides, logging, etc.
Generalist	Species that breed in any habitat type.

Table 11. Priority breeding birds and habitats in Wyoming.

Habitat Group Habitat Type	PIF Prioritization Database Scores								Number of Species	Percent of Species [a]
	< or = 18		19 - 21		22 - 24		> or = 25			
	N	%	N	%	N	%	N	%		
Riparian Habitat Group	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~
Montane Riparian	6	4	6	4	1	1	0	0	13	8
Plains/Basin Riparian	13	8	4	2	2	1	0	0	19	11
Wetlands	4	2	11	7	3	2	1	1	19	11
Aquatic	1	1	4	2	0	0	0	0	5	3
Meadows	0	0	1	1	0	0	0	0	1	1
Grassland Habitat Group	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~
Shortgrass Prairie	1	1	8	6	2	1	3	2	14	8
Alpine Tundra/Grassland	0	0	1	1	2	1	0	0	3	2
Forest Habitat Group	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~
High Elevation Conifer	8	5	6	4	0	0	0	0	14	8
Mid Elevation Conifer	9	5	9	5	1	1	0	0	19	11
Low Elevation Conifer	2	1	5	3	1	1	0	0	8	5
Aspen	2	1	3	2	0	0	0	0	5	3
Shrubland Habitat Group	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~
Juniper Woodland	4	2	4	2	3	2	0	0	11	7
Shrub-steppe	6	4	6	4	4	2	3	2	19	11
Mountain-foothills Shrub	1	1	6	4	4	2	0	0	11	7
Other Habitat Groups	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~	~ ~
Agricultural Croplands	0	0	0	0	0	0	0	0	0	0
Urban	1	1	0	0	0	0	0	0	1	1
Specialized Habitats	2	1	2	1	1	1	0	0	5	3
Generalist	0	0	1	1	0	0	0	0	1	1
Total	**60**	**36**	**77**	**46**	**24**	**14**	**7**	**4**	**168**	**100**

[a] Due to rounding of percentages, row sums may be off by 1, but column sums are accurate and based on the number of species divided by total species.

Figure 4. Number and percent of priority breeding birds in Wyoming in each priority habitat type.



Priority Habitat Types:				
	MR	Montane Riparian	LEC	Low Elevation Conifer
	P/BR	Plains/Basin Riparian	ASP	Aspen
	WET	Wetlands	JW	Juniper Woodland
	AQU	Aquatic	SS	Shrub-steppe
	MEA	Meadows	MFS	Mountain-foothills Shrub
	SGP	Shortgrass Prairie	AC	Agricultural Croplands
	AT/G	Alpine Tundra/Grassland	URB	Urban
	HEC	High Elevation Conifer	SH	Specialized Habitats
	MEC	Mid Elevation Conifer	GEN	Generalist

PRIORITY BIRD SPECIES AND HABITATS: INFORMATION, ISSUES, AND RECOMMENDATIONS

Note: This section currently focuses only on the five highest priority habitat types. However, this is a dynamic document so this section will be expanded to include the remaining habitat types, in order of priority, as personnel, time, and funding allow.

Riparian Habitat Group

Plains/Basin Riparian

1) Describe the habitat:

a) Historic conditions: Prior to the influence of European American settlers, riparian areas were probably limited to river and creek sides (fewer trees occurred away from the direct influence of the river or stream). Areas that had beaver pond influence were more extensive in width and changes were more dynamic. Also, prior to the construction of dams for flood control, irrigation, and hydroelectric power, seasonal flood regimes were very important to cottonwood and willow regeneration. Wildlife ungulate pressure on riparian habitat was most likely cyclic and not constant. More diverse age classes of cottonwoods and willows occurred. More braided river channels with oxbows and gravel bars were present.

b) Present conditions: Dominated by cottonwoods, elderberry, buffaloberry (several species), introduced Russian olive, boxelder, willow (several species), green ash, American elm, snowberry, chokecherry, Virginia creeper, and grasses/rushes/sedges; occurs in a lower elevation setting. Unregulated rivers still have flood zones, although water for irrigation is still removed. Decadent cottonwoods with little or no regeneration occur in some or many areas. Irrigated areas may cause more wet meadows and wetlands, and may encourage cottonwood and willow development through higher water tables. Encroachment of non-native species including Russian olive, tamarisk, and weed invasions (leafy spurge, thistle) is a problem. Drying of sites caused by changes in channel morphology, regulated water flows, irrigation withdrawals, and urbanization is a concern.

2) Identify the issues:

a) Use: We have working rivers in this state! Recreation, irrigation, livestock grazing, wildlife use, urbanization, and hydroelectricity are major uses.

b) Access: Most plains/basin riparian habitat is in private ownership, which keeps large numbers of people from impacting the habitat. Riparian areas are where people focus their activities; when we have access to them and we use them heavily. High intensity impacts in accessible sites are a concern.

c) Problems: Incompatible livestock grazing, high intensity recreation, flood control and irrigation which cause a drop in the water table and creates stands of decadent cottonwoods with little or no regeneration, stream bank stabilization which reduces braiding and the flood zone and narrows the stream channel, encroachment of non-native species (including Russian olive, tamarisk, and weed invasions like leafy spurge and thistle), drying of sites (caused by changes in channel morphology, regulated water flows, irrigation withdrawals, and urbanization), unnaturally high wildlife ungulate populations, and urbanization (planting exotics; loss of habitat diversity; domestic dogs and cats; exotic wildlife like European Starlings and House Sparrows; increased predators like skunks, raccoons, and red foxes).

d) What has been the cause of change to the habitat: Declines in densities and abundance of cottonwood forests can be attributed mainly to reduced stream flow and changes in the rates of channel migration and sedimentation following damming, and incompatible livestock grazing. Increased water salinity, groundwater pumping, water developments, channelization, stream control, stream bank stabilization, increased human pressure, land clearing, urbanization, and increased occurrence of fire have also contributed to the stress.

3) Best Management Practices:

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

Introduction

Riparian areas – lands adjacent to creeks, streams, rivers, ponds, and lakes where the vegetation is strongly influenced by the presence of water - are both ecologically and economically important. Water quality, biological diversity, wildlife habitat, agricultural and ranching productivity, timber production, water and power sources, recreation, and basic aesthetics are all vital functions of riparian areas. In the western United States, riparian habitat covers only about two percent of the land surface, but it is the single most productive type of wildlife habitat and benefits the greatest number of species. For example, more than 75% of all wildlife species in southeastern Wyoming depend on riparian habitats, and in the western United States, more bird species rely on riparian habitats than all other western rangeland vegetation types combined. Besides providing crucial wildlife habitat, healthy riparian areas provide many important ecological functions - they store water and recharge aquifers, filter chemical and organic wastes, trap sediment, build and maintain streambanks, reduce soil erosion, and produce plants. Water, soil, vegetation, and land form are components of the riparian area that must be considered for successful management. In a healthy riparian ecosystem, the four are in balance and mutually support one another.

From an avian perspective, healthy riparian areas are critical as nesting, wintering, and migratory habitat, and the number and diversity of birds in riparian areas is a direct indication of ecosystem health. Approximately 73 of Wyoming's avian species have been identified as using riparian habitats. Some of these, such as the Yellow-billed Cuckoo and Willow Flycatcher, are among the most imperiled of the migratory species in Wyoming and the West. The best way to help the largest number of birds in Wyoming is to maintain or improve the condition of vegetation in riparian areas to represent diverse, healthy plant communities. The greatest species richness (the number of different species and individuals) is positively associated with tall deciduous trees, high densities of medium to large diameter trees, low densities of small trees, and a high relative forb cover. The highest density of nesting pairs of birds is associated with good canopy cover, a high diversity of tree species, lack of conifer tree dominance, and low relative grass cover. This type of plant diversity in riparian areas will be ideal for bird populations, will help maintain water quality and reduce soil erosion, and will provide forage for livestock and wildlife.

Many of the Best Management Practices (BMPs) for riparian areas 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) Manage riparian areas for stable, non-eroding banks; good water quality; stable, year-round flows; and sustainable use without abuse over the long term.

2) Manage riparian areas from a watershed perspective. Ensure that riparian areas are continuous along the entire drainage and are as wide as the soil and water table will allow riparian vegetation to exist. This will reduce habitat fragmentation, which will help ease predation and cowbird nest parasitism.

3) Implement riparian monitoring programs to establish baseline data and identify changes in habitat quality (both positive and negative) through time.

4) Consider both long- and short-term impacts and/or benefits of any activities within or adjacent to riparian areas. Recreation, development, and improper grazing in riparian areas can reduce the multi-aged, multi-layered structure, including snags (standing dead trees) and diseased trees, most beneficial to birds.

5) Provide multiple layers of plants, or "vertical vegetation structure", in woody riparian habitats. Many bird species nest and forage within 10 feet (3 m) of the ground, so it is critical to have sufficient amounts of vegetation at that level. Healthy woody riparian areas have young trees and shrubs that provide this layer.

6) Manage for a stable or increasing population of native woody species. Ensure that all age classes are present (seedling, young, mature, and decadent), with more seedlings present than decadent plants, and more young plants than mature ones.

7) Manage for a variety of locally native plants. Different plant species host different insect populations, which provide food for a variety of bird species.

8) When planting trees, select native species and avoid Russian olive and tamarisk (salt cedar). These exotic woody plants are vigorous species that can be established easily in many areas, but they out-compete native plants and host relatively few insect species. Most birds avoid foraging in Russian olive and tamarisk trees, so they have little value as wildlife habitat and can quickly degrade existing native wildlife habitat.

9) 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. Important habitat on private land can be protected with conservation easements. In some cases, landowners can derive income from hunters, birders, and naturalists who visit the region.

Grazing

Livestock grazing is one of the most extensive human-caused influences on riparian areas in the western United States. Proper stocking levels and grazing regimes can be effective habitat management tools and compatible with riparian area maintenance and improvement. However, improper grazing practices in riparian areas can eliminate vegetation and associated wildlife, widen stream channels, cause soil erosion, increase sediment load in the stream channel, increase stream water temperature, encourage invasion of noxious plants, change streambank configuration, and lower surrounding water tables. The degraded condition of many riparian areas and watersheds in the West is from uncontrolled grazing that occurred in the late 19th and early 20th centuries; today's successful manager can learn from past mistakes. Grazing systems, like deferred-rotation, rest-rotation, high intensity-low frequency, and short-duration, combine periods of use with nonuse, and can be effective management tools to increase animal productivity and achieve habitat objectives. 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. Birds typically do not respond to the presence of livestock, but rather to the impacts that livestock grazing has on vegetation. These Best Management Practices for grazing focus on protecting riparian areas during crucial growing periods.

1) Grazing management plans should be developed and evaluated on a case-by-case basis by the managing agency or landowner because no single grazing strategy will fit all situations. Include riparian area management as an integral part of each grazing management plan. Determine site-specific riparian area objectives and tailor the grazing management plan to help meet the objectives. Consider the site's specific factors of concern, such as bank instability or loss of woody plants; the site's potential and capability; its suitability for grazing livestock and the type of stock best suited to the area; and the ideal grazing strategy, including the time, place, amount, duration, and intensity of grazing. Monitor the effects of each grazing strategy on the riparian area to check progress toward the objectives. Record how key riparian plant species, the overall riparian ecosystem, and key upland plant species respond to grazing management (annual photographs taken from the same point are helpful).

2) Maintain proper stocking rates and livestock distribution to protect riparian ecosystems. Incompatible grazing can have harmful long-term effects on survival and regeneration of tree and shrub seedlings; can negatively influence the species, structure, and health of riparian vegetation; and can cause soil compaction, bank trampling, and degraded water quality from waste materials and excessive soil in the water. Manage grazing intensity at a level that will maintain the composition, density, and vigor of desired plants and will not damage riparian soils, streambanks, or water quality.

3) Limit the amount of time livestock spend in pastures with riparian areas. This can be a significant factor in the condition of the riparian area. Base the length of the grazing period within a riparian zone on the areas livestock are actually using, not the entire pasture. If needed, add more rest to grazing cycles to increase plant vigor, allow streambanks to regenerate, or encourage more desirable plant species composition.

4) Sagebrush that grows up to the edge of an existing or historical stream channel is evidence of chronic problems. If grazing is the cause, livestock should be managed more intensively to remove the negative impacts, or other interventions should be considered until the water table has been restored and mesic (moisture-loving) plant species reestablish themselves on the site. At that point, grazing may be used as a management tool. Both birds and livestock will ultimately benefit.

5) Exclude livestock from riparian areas with high risk and poor recovery potential when there is no practical way to protect those riparian areas while grazing adjacent uplands.

6) Fencing can isolate riparian areas into one or a few pastures; other pastures should be exclusively uplands. This can simplify management intended to protect riparian areas. If animal movement can be controlled by herding, turning water on or off, or some other method, fencing may not be necessary. However, fencing may be the best alternative for rapid restoration of riparian ecosystems. When fencing riparian areas to exclude livestock, make sure all riparian plant community types are included in the exclosure. Fences that parallel a stream should be located well outside the riparian zone so that animals trailing along the fence will not be impacting the streambanks and riparian vegetation.

7) If riparian areas are fenced to exclude livestock, provide access to a short, straight, stable section of stream with a gentle bank as a livestock watering site (water gap). Avoid installing water gaps where streambanks bend and curve; this is where the water flow puts additional pressure on the banks, and livestock trampling can cause significant streambank damage and excessive sediment in the waterway.

8) Manage pastures with riparian habitat as separate units in a rotation grazing system. Where feasible, use a deferred-rotation or rest-rotation system, whereby no pasture is grazed the same season (spring, summer, or fall) two years in a row. A year of rest for each riparian pasture every three to four years is beneficial for long-term riparian habitat maintenance. In some areas, use of these pastures late in the grazing season by cows with calves will produce the best use of upland forage resources and reduce impacts on riparian areas.

9) Control the timing of grazing to keep livestock off streambanks when they are most vulnerable to damage (when the ground is saturated) and to coincide with the physiological needs of target plant species. Also, sheep may be favored in areas prone to bank damage, since sheep are lighter-weight and cause less damage to streambanks.

10) Ensure adequate residual vegetation cover is left after grazing; this is essential for maintaining riparian ecosystem health. Instead of focusing on how much vegetation can be removed, focus on how much and what type of vegetation should be left to ensure that the riparian area is able to perform its functions (reducing water flow speed, trapping sediment, bank building, and erosion protection). The vegetation present at the end of the growing season or at the end of a grazing period, whichever comes last, is what will be available during the next runoff period. (Projections of residual vegetation should also consider seasonal wildlife use prior to runoff.)

11) Spring grazing may increase the herbaceous component of the understory, which is very important for ground foraging and seed eating birds, and reduce browsing pressure on woody species, which are essential for maintaining riparian functions. However, grazing must be completed in time for the plants to regrow, at least 60 to 75% of current growth should be retained (no more than 25 to 40% removed), and at least 6 inches (15 cm) of stubble height should remain (special situations, such as critical fisheries habitats or easily eroded streambanks, may require leaving stubble heights greater than 6 inches). Spring grazing may be beneficial where livestock can be attracted to the uplands by succulent herbaceous plants, when cool temperatures may not drive livestock into riparian areas and may discourage loitering in the cooler riparian zone, where saturated soil in the riparian area may discourage livestock from entering, or where well-drained soils reduce the risk of compaction. Spring grazing may be detrimental where wet soils increase the potential negative impacts of soil compaction, bank trampling, and erosion; when repeated grazing of the area occurs, which may reduce plant vigor and change plant composition; and where grazing can adversely affect birds and other wildlife in the area.

12) Hot season grazing (mid- to late summer) in riparian areas should be avoided. During this period, livestock are especially likely to concentrate in riparian areas and can seriously degrade the vegetation and stream channel. Once the upland forage cures, livestock should be moved to a pasture without riparian areas or regularly herded out of riparian areas.

13) Light fall grazing can help maintain functioning riparian areas if at least 60 to 70% of plant growth remains (use is no more than 30 to 40%), no significant consumption of willows and other shrubs occurs, and stubble heights of 4 to 6 inches (10 to 15 cm) are retained (special situations, such as critical fisheries habitats or easily eroded streambanks, may require leaving stubble heights greater than 6 inches). Fall grazing may be beneficial when riparian vegetation consists of herbaceous (grass/forb) species rather than woody (tree/shrub) species; where cool season grasses provide palatable forage in upland areas; when off-stream water is available near forage; or when cooler temperatures draw livestock out of riparian areas. Fall grazing may be detrimental when it negatively impacts woody species; when regrowth does not occur until the following spring, which may affect the ability of the vegetation to fulfill their riparian functions during spring runoff; and when incentives to draw livestock away from riparian areas are not available. Advantages of fall grazing include less impact on wildlife habitat, reduced conflicts with ground nesting birds, and less soil compaction and streambank trampling due to drier soils. Also, since most plants have completed their growth cycle by this time, grazing will not adversely affect plant development.

14) Winter grazing may be the least detrimental to riparian health and may improve livestock distribution and plant response. This strategy focuses on plants when they are dormant so it allows total rest during the growing season, which promotes plant vigor and production of seed and roots. Winter grazing may be beneficial where soil type makes compaction and streambank trampling during other seasons likely; when the pasture is large enough to supplemental feed and water livestock well away from the stream; where drainages are colder than surrounding uplands or open, south-facing slopes are available, which decrease riparian area use by livestock; and when recovery of deteriorated uplands and riparian areas is needed. Winter grazing may be detrimental where damage to woody species can occur from browsing, rubbing, or trampling; and where grazing of dead standing vegetation can reduce riparian functions the following spring.

15) Allow time for plants to rest and regrow between grazing periods to ensure they remain vigorous and productive. Plants that are continuously grazed during the growth period will lose their vigor and stop producing seeds, and their roots will die back, eventually causing a change in the plant community from more productive, palatable species to less productive and less palatable plants.

16) Discourage trailing along streambanks by placing logs across trails, perpendicular to the stream channel.

17) Herding on horseback can be an effective tool for managing livestock in riparian areas. Make sure riders know the reasons behind herding and what is expected of them; poorly conducted riding can cause more damage to the riparian zone and to livestock performance than having the livestock remain in the riparian area.

18) Improve livestock distribution and forage use by using salt and mineral blocks, but avoid placing them within riparian areas [keep them at least 0.5 mile (0.8 km) from the stream] or in immediately adjacent uplands.

19) Improve adjacent upland forage to lure livestock out of riparian areas.

20) If needed, add more pastures to increase management flexibility and rest for riparian vegetation.

21) The presence of off-stream water is an important management tool to encourage livestock to move away from riparian areas. Develop shade and water (wells, windmills, guzzlers, or water piped from the stream) 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 5).

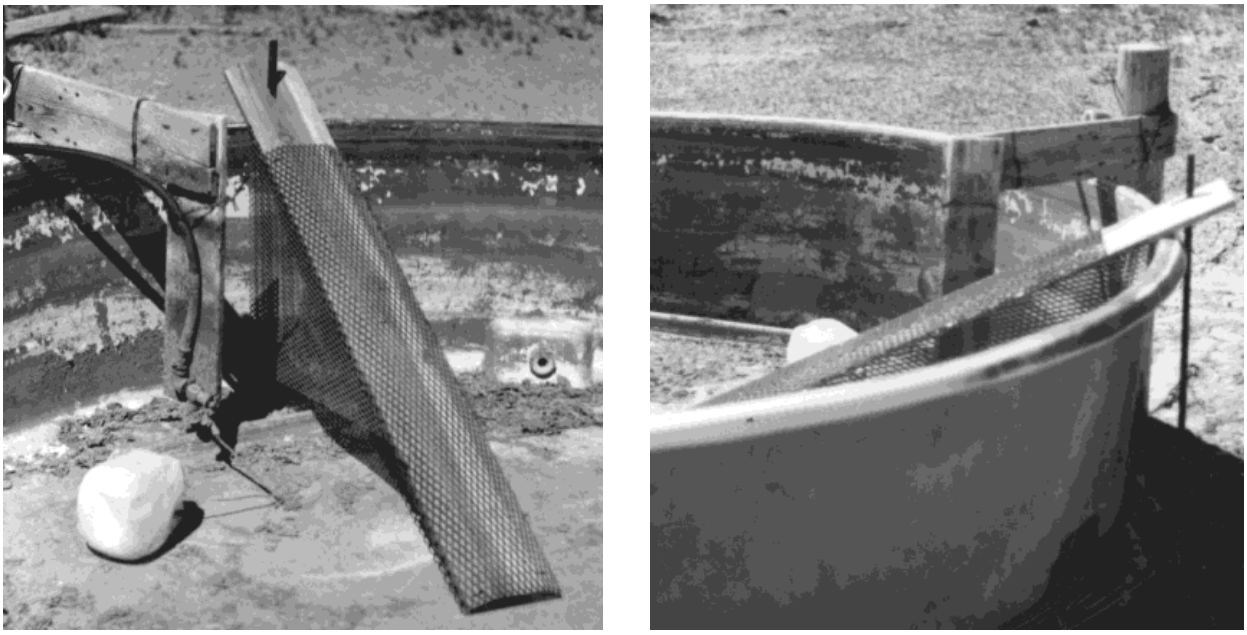


Figure 5. Escape ramps placed in stock tanks and troughs to prevent drowning of small birds and mammals (photographs courtesy of Mark Gorges, Bureau of Land Management).

22) Locate livestock-handling facilities and collection points outside of riparian areas. Branding, loading, and other handling efforts should be limited to areas and times that do not harm soils and plants in riparian zones.

23) Changing from cattle to sheep, or vice versa, may help with implementing some of the suggested grazing BMPs.

24) Conversion to agriculture is the greatest threat to birds in this habitat type. Efforts to maintain ranching and compatible grazing regimes as the dominant economic force and land use in riparian habitat will benefit birds. The Conservation Reserve Program has helped bird habitat, but permanent easements on important riparian areas could be significantly more beneficial.

25) Play an active role in managing riparian areas. Success in maintaining or improving riparian health depends on the degree of operator involvement.

Agriculture

These recommendations for agricultural practices will benefit birds and other wildlife, and also help to protect water quality and reduce soil erosion.

1) Leave a buffer of uncultivated grasses, shrubs, and trees along all waterways, including rivers, streams, ditches, drains, etc. Cultivating up to the edge of a waterway removes important vegetative filters, increases sedimentation, accelerates siltation, and shortens irrigation pump life. Re-establish woody and herbaceous vegetation through plantings and, if necessary, fencing.

2) Avoid driving tractors and other equipment in riparian areas.

3) Protect ditch banks and streambanks from burning. The vegetation along banks reduces erosion, filters runoff, maintains water quality, and provides wildlife habitat.

4) Maintain large patches of riparian habitats; fragmented habitats result in increased predation and increased nest parasitism by cowbirds.

5) Prevent chemical runoff into streams and rivers. Agricultural chemicals can harm downstream riparian vegetation and wildlife.

6) Prevent soil from eroding into adjacent waterways. Increased sedimentation reduces the quality of aquatic habitat.

7) When irrigating, avoid depleting ground water and diverting streams outside their natural stream channels. These actions can kill moisture dependant riparian plants by leaving them high and dry. Avoid converting native habitat to agriculture, especially in areas too dry to farm without irrigation. 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).

8) 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.

9) Avoid converting existing riparian areas to agriculture; this is the greatest threat to birds in this habitat type. Permanent easements on important riparian areas could benefit both landowners and wildlife. 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.

Forestry

Timber harvesting, including firewood cutting, can negatively affect riparian areas by removing nesting trees and foraging sites from the riparian zone. Standing dead and live trees also trap sediments and nutrients, moderate water temperatures, and provide large organic debris. These recommendations can help reduce the impacts of forestry practices on riparian areas.

1) To protect the stream channel and provide habitat for birds that depend on mature trees, retain a buffer zone in timber harvest and firewood cutting areas where no cutting is allowed. Other activities within these zones should be modified to protect natural resources. Biologists within the Wyoming Game and Fish Department, U.S. Forest Service, or Bureau of Land Management can give advice on the appropriate buffer width for the area.

2) Maintain mature stands of trees adjacent to meadows to help species like the Olive-sided Flycatcher. Maintain snags (standing dead trees) and dead-topped trees along perimeters of wet meadows and in stream corridors. These provide nesting cavities for birds and enhance the number of insects available for food. Snags eventually topple

and become organic debris, so retain an abundance of mature trees to replace them over time.

3) Avoid locating landings, log decks, or skid trails in or through riparian areas.

4) Route helicopter flight paths away from riparian areas and locate helicopter landing sites more than ¼ mile (0.4 km) from riparian areas, especially from May through July. Helicopters and other loud noises interfere with songbird breeding activity, which relies on singing and being heard.

5) Maintain a shrubby understory in stands of trees adjacent to meadows and along stream courses to help species like the MacGillivray's Warbler and Yellow Warbler.

6) Avoid operating heavy equipment through, along, or across riparian areas. If equipment operation is necessary, use tracked equipment rather than wheeled vehicles, and only during winter when the ground is frozen and less vulnerable to damage.

7) During fire activities, locate incident bases, camps, helibases, staging areas, helispots, and other centers for incident activities outside of riparian areas. Design fuel treatment and fire suppression strategies, practices, and actions to reduce disturbance of riparian vegetation. Keep chemical retardant, foam, or additives out of surface waters.

Engineering

Damming or diverting streams and rivers can dramatically alter the hydrology of the watershed by trapping spring floodwater and releasing artificially steady and high summer flows. These changes directly affect the downstream vegetation. All potential upstream and downstream effects of dams and diversions should be addressed. Well-planned roads, stream crossings, and other engineering projects can help reduce disturbance to riparian areas. Use the recommendations below to minimize impacts of engineering projects.

1) Avoid building roads parallel to streams in riparian zones or through wet meadows. Stream crossings should be at right angles to minimize impacts on riparian vegetation, streambanks, soils, and water quality.

2) Roads and rights-of-way often cross riparian corridors, which can fragment bird habitat and reduce its value. Combine all of these disturbances at one crossing site to decrease the area impacted.

3) Design roads with adequate structures to prohibit vehicles from leaving the roads and off-roading in riparian zones or adjacent uplands.

4) Construct new and improve existing culverts, bridges, fords, and other stream crossings to accommodate a 100-year flood, including associated bedload and debris, where those crossings could pose a substantial risk to riparian ecosystems.

5) Maintain buffer zones between riparian areas and mining, oil, gas, sand/gravel, and geothermal activities, including structures, roads, and support facilities.

6) Avoid straightening or diverting sections of stream channel. These activities increase stream velocity and erosion, reduce streambank stability, and negatively impact upstream and downstream habitat.

7) Before altering water flows where cottonwood stands occur, develop a standardized environmental assessment program that describes historical patterns of cottonwood abundance; establishes an inventory of present cottonwood distribution, abundance, and age-class composition; and establishes long-term study sites to follow changes in the cottonwood forest. Regular monitoring of the water table and cottonwood abundance, mortality, and replenishment should provide indices of stress and decline. Establish control sites upstream from a dam or diversion structure to help detect downstream changes.

8) Reduce cottonwood decline downstream from dams or diversions through mitigation. Water management plans and dam operations can reduce cottonwood mortality, improve seedling replenishment, and enhance seed germination by meeting moisture requirements at critical periods. Mitigation measures include enhancing river flows, altering summer flows, maintaining spring flooding, preparing or modifying a site to enhance seedling growth, replanting from shoot or root cuttings, and using physical measures to enhance replenishment or prevent grazing damage.

9) Restore disturbed areas with native vegetation, prevent grazing by livestock while plants recover, and eliminate the invasion of non-native plants during the reclamation period.

Recreation

Unfortunately for birds, people also like to use healthy riparian areas and some recreational uses are not compatible with bird conservation goals. Recreational use can affect birds by creating disturbance and habitat degradation, especially during the breeding season. Birds are also affected by vegetation trampling and firewood gathering. One study found that of 106 nonconsumptive uses, 73% of them negatively affected wildlife. The recommendations below can help minimize negative affects associated with recreation.

1) Consider potential disturbances to birds and habitat (and other wildlife) when planning or locating camping sites, picnic areas, and other sites of human activity within riparian areas.

2) Locate new recreation sites outside of riparian areas wherever possible. If sites must be within riparian zones, concentrate them in one area, rather than spreading them throughout the riparian area, to limit negative impacts on breeding birds and habitat. Keep disturbance to soils and vegetation to less than 15% of the area within the developed site.

3) Avoid constructing new trails along or parallel to riparian areas.

4) Keep pets under control in recreation areas. Free-roaming dogs and cats can be devastating to birds that nest on or just above the ground.

5) Provide firewood at developed campgrounds to decrease the use of riparian areas as a wood source.

6) Promote "Tread Lightly" recreation ethics. Educate recreationists about problems humans can cause in riparian habitat and how they can avoid damaging these areas.

7) Manage or restrict all-terrain vehicles, bicycles, and horses in riparian areas and wet meadows because soil compaction and ruts caused by these uses can lead to the drying of these wet areas.

8) Reduce recreational disturbances in riparian areas, including bird watching, during the bird nesting season, especially where rare, sensitive, or endangered species nest.

9) Plant dense native vegetation, such as willows, to screen and reduce human use of fragile or vulnerable riparian areas.

10) Avoid using foggers for mosquito control in riparian habitats, especially during the nesting season, so a food source remains available for birds.

Beavers

Beavers alter the landscape. Although they cut down trees, they also create suitable sites for establishing new growth of trees and shrubs. Where beaver populations are stable, their activities help store water, buffer floods, raise water tables, and provide a diversity of habitats. Restoring or maintaining beaver populations can be an effective habitat management tool, depending on habitat goals.

1) Establish desired beaver population levels on a drainage-by-drainage basis, and manage for that level. Address damage and loss of mature trees where they occur, and control beaver populations by relocation or harvest.

2) Maintain beaver populations in locations where they currently occur. Encourage and promote reintroduction into areas that were historically occupied by beavers, and provide suitable habitat for reintroduced animals.

3) Avoid removing beavers and destroying beaver dams where their activities do not affect irrigation, property developments, or habitat quality. Removing beavers and their dams can reduce water storage, lower water tables, reduce riparian vegetation, increase soil erosion, degrade aquatic habitat, and increase flood damage potential.

4) Willow planting may create suitable beaver habitat where absent, and aspen regeneration may improve habitat suitability for beavers in some areas.

5) Reintroduce beavers into drainages where gullying occurs and where willow re-establishment is a goal. Stream gradients should be less than 4%, and there should be an adequate supply of woody vegetation for food and dam-building materials (these may have to be supplemented).

Pesticides and Herbicides

Pesticides and herbicides can harm bird populations if used incorrectly. Pesticides can negatively affect bird populations for the very reason they were created – to kill insects. Birds, even seed-eaters, depend on insects to feed their young. Loss of insect prey during the nesting season can be devastating, and can turn a habitat that regularly produces birds into one that does not. Also, many migrants rely on insects in riparian areas to store up or replenish fat reserves for their journey. Improperly used pesticides can directly kill birds, or weaken them and make them more susceptible to disease or unable to produce young. Herbicides change the composition of the vegetation in the riparian area, which causes loss of nesting sites and declines in prey abundance. If pesticides or herbicides must be used, label directions should always be carefully followed.

1) Strictly limit pesticide and herbicide application in riparian areas and adjacent sites to activities that improve or maintain the riparian vegetation and aquatic community (e.g. elimination of competitive noxious weeds). Where pesticides or herbicides are needed, use them as part of an Integrated Pest Management (IPM) program. IPM involves closely monitoring pest populations of both plants and animals, and using chemicals only when and where pests are likely to cause economically or ecologically important damage. This reduces exposure of wildlife to harmful chemicals and reduces the destruction of non-target insects and plants.

2) If available, use biological control for specific noxious species, rather than chemical control.

3) When possible, apply pesticides and herbicides by hand to target weeds and other pests as specifically as possible.

4) Carefully plan aerial application of herbicides to prevent drift of chemicals into riparian areas. Depending on the wind speed, provide a buffer zone of 1 to 4 miles (1.6 to 6.4 km) downwind of the aircraft, and 250 feet to 1 mile (0.08 to 1.6 km) upwind. Avoid spraying herbicides in winds exceeding 10 mph (16 kph), or during calm weather when temperature inversions may prevent sprays from reaching the ground. Pellet herbicides are less prone to wind drift and are preferred when applying near riparian areas. Check with the Wyoming Department of Agriculture for more specific information.

5) Work with state and federal agencies, such as APHIS, to coordinate the use of pesticides where necessary.

Rehabilitation

Riparian vegetation can be divided into two zones, each defined by its distance from the stream. The first zone and line of defense for the riparian area is the vegetation at the edge of the water. These plants, called the vegetative liner, keep moving water and debris away from the streambank. An effective vegetative liner should be at least 10 feet (3 m) wide; the wider the vegetative liner, the more protection is provided during flooding. Ideal plants for the vegetative liner have pliable stems, establish quickly, tolerate water logging, regenerate after injury, and form a uniform stand. In many areas, native willows are excellent liner plants. Beyond the vegetative liner, as a second line of defense, is a combination of native trees and shrubs. This zone should be 30 to 150 feet (9 to 46 m) wide from the high water mark (terrain, soil type and condition, and adjacent land uses and ownership will influence the appropriate width at each location). The vegetation in this second zone increases the filtering capability of the area, provides wildlife habitat, and helps shade the stream. Where rehabilitation of riparian zones is needed, use a combination of suggested methods below.

1) Always identify and address the causes of riparian degradation before starting rehabilitation. Many rehabilitation projects fail without a change in other management activities, such as grazing or intensive recreation.

2) Tailor specific rehabilitation efforts to each riparian area. Physical factors such as stream type, geology, climate, and elevation will influence the project's success.

3) Determine specific objectives for each riparian area, and develop a monitoring program to track whether the objectives are being met.

4) To rehabilitate streambank damage, erosion, and adjacent over-utilized upland sites that all erode and add soil to streams, use willow plantings, dry root stock transplants, seeding, and/or livestock exclusion. Plant only native species to increase nesting cover and foraging opportunities for birds. Protect new plantings and seedings from livestock and wildlife use.

5) Cottonwood forest regeneration requires periodic flooding that scours out seedbeds for cottonwood seedlings. Where flood control and other water storage or diversions have removed this scouring action, consider sod removal, irrigation, or seeding to encourage cottonwood regeneration.

6) Replenish cottonwood riparian forests to compensate for mortality of mature trees. Seed germination requires spring flooding to prepare seedbeds and recharge underground water levels so seedlings have continuous moisture until their root systems develop. After the first two years, cottonwood saplings grow increasingly tolerant of flooding and drought stress as they develop larger root systems.

7) Remove exotic plants, like Russian olive and tamarisk (salt cedar), that compete with native plant species and do not provide foraging or nesting opportunities for wildlife.

8) Where streambank erosion is severe, banks may have to be reshaped to at least a 1:1 slope, and then stabilized with 4 to 6 inch (10 to 15 cm) diameter willow or cottonwood posts planted with a power auger or backhoe two feet below the low flow water surface. Streambank revegetation works best on slower moving streams [less than 9 feet (3 m) per second] with relatively flat gradients. On faster streams, a combination of vegetation and structural measures, like riprap or jetties, may be needed to stabilize streambanks.

9) Stabilize and protect eroding banks with professionally designed rock riprap, tree revetments, or gabions. Structural options include placing instream structures, such as low-head dikes, to improve riparian systems by slowing flow, increasing sediment deposition, and allowing re-establishment of riparian vegetation. These structures should not be used as substitutes for proper riparian management but as temporary solutions while addressing the causes of deterioration.

10) Avoid channelizing streams, re-routing streams, straightening meanders, or diking banks. Where channelization has occurred in the past, restore meanders to raise water tables, narrow and deepen channels, stabilize banks, and allow re-growth of woody riparian vegetation.

11) Reintroduce beavers into drainages where gullying occurs and where willow re-establishment is a goal. Stream gradients should be less than 4%, and there should be an adequate supply of woody vegetation for food and dam-building materials (these may have to be supplemented).

12) Eliminate the invasion of non-native plants during the rehabilitation period. Fabric or plastic mats are very useful in riparian areas to help tree seedlings stay ahead of grass competition.

13) Landowners interested in improving riparian habitat on their lands can seek financial assistance and expert advice from the U. S. Fish and Wildlife Service's Partners for Wildlife Program (307-332-8719), the U. S. Natural Resources Conservation Service (307-261-6453), or the Wyoming Game and Fish Department (1-800-842-1934).

Wildlife Management

Wildlife, especially big game animals, can impact riparian areas. Managing for one species can sometimes have negative impacts on other species, such as birds. Wildlife management goals for each riparian area should be well planned, and should compliment the overall goals of the riparian community.

1) Consider riparian area conditions and big game impacts (e.g. on willows or aspen) when setting herd objective levels. Do not exceed the carrying capacity of riparian habitats.

2) Cooperate with the Wyoming Game and Fish Department to identify and eliminate wild ungulate impacts to riparian areas. Locate ungulate feeding sites outside of riparian areas.

3) Be aware of the impacts that cowbird nest parasitism and predators have on nesting birds. Increased nest parasitism results when forests are fragmented or livestock grazing occurs near woody habitats during the nesting season, and predators like raccoons, skunks, and crows often increase in number around human developments. Manage nest parasite and predator issues where negative impacts to birds occur.

Residential and Urban Development

Urban and residential environments can be particularly hazardous for breeding birds. Nest predators such as crows, squirrels, raccoons, skunks, and domestic cats are common, as are nest parasites, Brown-headed Cowbirds. Human impacts on the environment and on birds can also be intense. Within riparian corridors, individual houses result in habitat fragmentation, human disturbance, and introduction of exotic plants species and predators like cats. The recommendations below will help reduce the impact of human developments on both birds and habitat.

1) Retain and plant vegetation that is native to your area when landscaping, including a natural distribution of vegetation in the ground, shrub, and tree layers. This will result in a more natural-looking landscape, and will provide food, shelter, and nest sites for birds. Avoid planting exotic species, especially aggressive non-natives like Russian olive and tamarisk (salt cedar), because these have relatively little value to wildlife.

2) Where possible, keep snags and dying trees in place. If safety is a concern, cut them to a height of about 10 feet (3 m), rather than removing them altogether.

3) Clump housing into a small area and leave the rest of the riparian corridor as "open space" to reduce habitat fragmentation. Conservation easements can be used to protect the open space for perpetuity.

4) Control Brown-headed Cowbirds in residential areas if nest parasitism becomes a problem.

5) Keep domestic cats indoors or leashed when outside, and never feed feral cats. Keep pet food bowls indoors and tightly cover all outdoor garbage cans so predators like raccoons do not have an additional food source.

6) For more information on landscaping for wildlife, contact the Wyoming Game and Fish Department (1-800-842-1934).

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 riparian areas to resident and Neotropical migratory birds and other species. This could range anywhere from interpretive signs on public lands, to distribution of Best Management Practices to landowners, to presentations at local grade schools, etc.

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4) Highest priority bird species and their habitat requirements (note: see Tables 6-9 for a description of status information for each species)**:**

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Swainson's Hawk (SWHA) *Buteo swainsoni* Level I CA, M Score = 21 AI = 3 PT = 3	~Cottonwood spp. ~Rocky Mountain juniper ~Trees of any species where trees are present, or shrubs if trees are absent, or cliffs if both are absent ~Open understory	~Trees and shrubs for nests and roosts	~Elevation <9,000 feet ~Flat to gently rolling terrain	~Open areas for foraging ~≤30% cultivated croplands	~Nest fidelity ~Winters in South America

Bald Eagle (*Haliaeetus leucocephalus*), Level I, CA, M, Score = 21, AI = 3, PT = 3, would appear here based on priority, but this species will not be addressed in the Wyoming Bird Conservation Plan because issues, management strategies, and population goals are already addressed in the Bald Eagle Recovery Plan.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Lewis' Wood-pecker (LEWO) *Melanerpes lewis* Level II M Score = 23 AI = 3 PT = 3	~Cottonwood spp. ~Ponderosa pine	~Snags of 15" dbh or greater ~Snag density ≥1 per 10 acres in either cottonwood or pine ~Dense understory – 30 to 50% in mid to upper-mid seral conditions ~High structure	~Elevation <8,500 feet	~Open stands of trees with snags ~Fire can be beneficial ~Both early and late succession ~Usually places nest on north to east facing slope	~Requires cavities for nesting ~Nests occur in clumps ~Responds negatively to incompatible livestock grazing ~Nesting competition with European Starling and American Kestrel may occur ~Winters south to Mexico

Cassin's Kingbird (*Tyrannus vociferans*), Level II, M, K, P, Score = 22, AI = 3, PT = 3, would appear here based on priority, but this species is currently documented as a peripheral breeder in Wyoming, and will not be addressed in the Wyoming Bird Conservation Plan at this time.

Black-chinned Hummingbird (*Archilochus alexandri*), Level II, M, P, Score = 20, AI = 2, PT = 3, would appear here based on priority, but this species is currently documented as a peripheral breeder in Wyoming, and will not be addressed in the Wyoming Bird Conservation Plan at this time.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Willow Flycatcher (WIFL) *Empidonax traillii* Level II M Score = 20 AI = 3 PT = 4	~Willow ~Alder ~Cottonwood spp. ~Hawthorne ~Water birch	~Low structure	~Elevation <10,000 feet	~Thickets associated with open stands ~Early to mid succession ~Vegetation must be near water ~About 5 acres needed per breeding pair	~Riparian obligate ~Common cowbird host ~Populations increase with decreased livestock grazing and no poisoning or removal of willows ~Winters in Mexico and Central America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Black-billed Cuckoo (BBCU) *Coccyzus erythrop-thalmus* Level II M Score = 18 AI = 2 PT = 3	~Cottonwood spp. ~Open woodlands	~High structure ~Dense vegetation		~Mid to late succession ~Urban areas can be important	~Insecticide use greatly reduces caterpillar prey base ~Winters in South America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Yellow-billed Cuckoo (YBCU) *Coccyzus americanus* Level II M Score = 18 AI = 3 PT = 3	~Cottonwood spp.	~Mid to high canopy closure ~Nests ≤25 feet above ground in dense deciduous vegetation near water	~Elevation <7,000 feet	~Late succession ~Requires extensive, mature riparian woodlands, especially cottonwood or willow ~Requires ≥25 acres (prefers 100 acres or more) of broad-leafed forest at least 330 feet wide and ≥2.5 acres of dense nesting habitat per pair ~Marginal habitat is ≥10 acres of broad-leafed forest ≥165 feet wide	~Riparian obligate ~Loss of mature cottonwood stands is detrimental ~Cottonwood stand fragmentation is detrimental ~Insecticide use greatly reduces caterpillar prey base ~Winters in South America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Eastern Screech-Owl (EASO) *Otus asio* Level II M Score = 18 AI = 3 PT = 3	~Needs cavities in trees	~Prefers open subcanopy and sparse shrub cover ~Requires snags and large trees	~Elevation <8,000 feet	~May be restricted to eastern WY	~Susceptible to disturbance at nest site ~Nest cavity competition with other species may occur ~Will nest in artificial nest boxes ~Winters in North America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Western Screech-Owl (WESO) *Otus kennicottii* Level II M Score = 18 AI = 3 PT = 3	~Cottonwood spp. ~Aspen ~Conifers associated with riparian habitat	~Mid to old growth ~Requires snags and large trees	~Elevation <7,000 feet		~Winters in North America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Broad-tailed Humming-bird (BTLH) *Selasphorus platycercus* Level II M Score = 18 AI = 2 PT = 2	~Willow ~Cottonwood spp. ~Aspen ~Ponderosa pine ~Englemann spruce ~Subalpine fir ~Douglas fir	~ Overhanging branches ~Edge habitat associated with open meadows containing flowering plants	~Nests to treeline	~Nests near or over a stream	~Females show nest site fidelity ~Bright colored electric fence insulators may be a problem ~Winters in Mexico and Central America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Mac-Gillivray's Warbler (MGWA) *Oporornis tolmiei* Level II M Score = 17 AI = 3 PT = 1	~Shrub component (such as willow, alder, chokecherry, dogwood) ~Sapling forest	~Dense understory ~Brushy vegetation ~Moderate cover	~Elevation <9,000 feet	~Moist areas ~Mid to late succession ~Patchy habitat	~Responds negatively to long-term livestock grazing (however, proper grazing can enhance shrub density and cover) ~Uncommon cowbird host ~Winters in Mexico and Central America

5) Biological objectives and recommendations:

Swainson's Hawk

Found throughout most of Wyoming. Inhabits prairies, plains, deserts, large mountain valleys, savannahs, open pine-oak woodlands, and cultivated lands with scattered trees. Builds a large, platform stick nest about 2 to 4 feet across and 1 foot high in an isolated tree; occasionally nests on the ground, a low cliff, rocky pinnacle, or cutbank. May build its nest 100 feet above ground in a large cottonwood, or lower in a willow or shrub. Often reuses the same nest each year, or uses an old nest of another bird, especially magpie, as the base for its nest. Eggs [2 to 3, 2.2 inches (57 mm)] are white and sparsely marked with dark brown blotches. Soars at high altitudes in search of prey. May also hunt from a perch, such as a fence post or low tree, or from a vantage point on the ground. Feeds mostly on small mammals, but will also take small birds, lizards, snakes, frogs, toads, and large insects. Winters in southern South America. Populations have declined due to loss of native grasslands and nest trees, conversion of suitable agricultural land to urbanization, pesticide use (especially on the wintering grounds), and shooting during migration. Other species that may benefit from habitat management for this species include the Red-tailed Hawk, Ferruginous Hawk, Rough-legged Hawk, Golden Eagle, American Kestrel, Mourning Dove, Great Horned Owl, Western Kingbird, Eastern Kingbird, and Loggerhead Shrike.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Swainson's Hawks have been detected on 75 BBS routes in Wyoming, including 37 routes on which they were observed a minimum of 3 years.

a) Maintain Swainson's Hawks on the 75 BBS routes on which they were observed (Figure 6).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 12).

3) Implement long-term (minimum 5 to 10 years) population trend monitoring in plains/basin riparian habitat using aerial surveys that determine nest occupancy and productivity in years with normal or high prey availability, and presence/absence (total number) monitoring in years with low prey availability. (This is especially important following the demise of over 5% of the world's population of Swainson's Hawks in 1995 on their wintering grounds due to accidental poisoning from the pesticide monocrotophos.)

4) Develop a cooperative, statewide, interagency/non-governmental organization database on Swainson's Hawk nest sites, with data sensitivity built in.

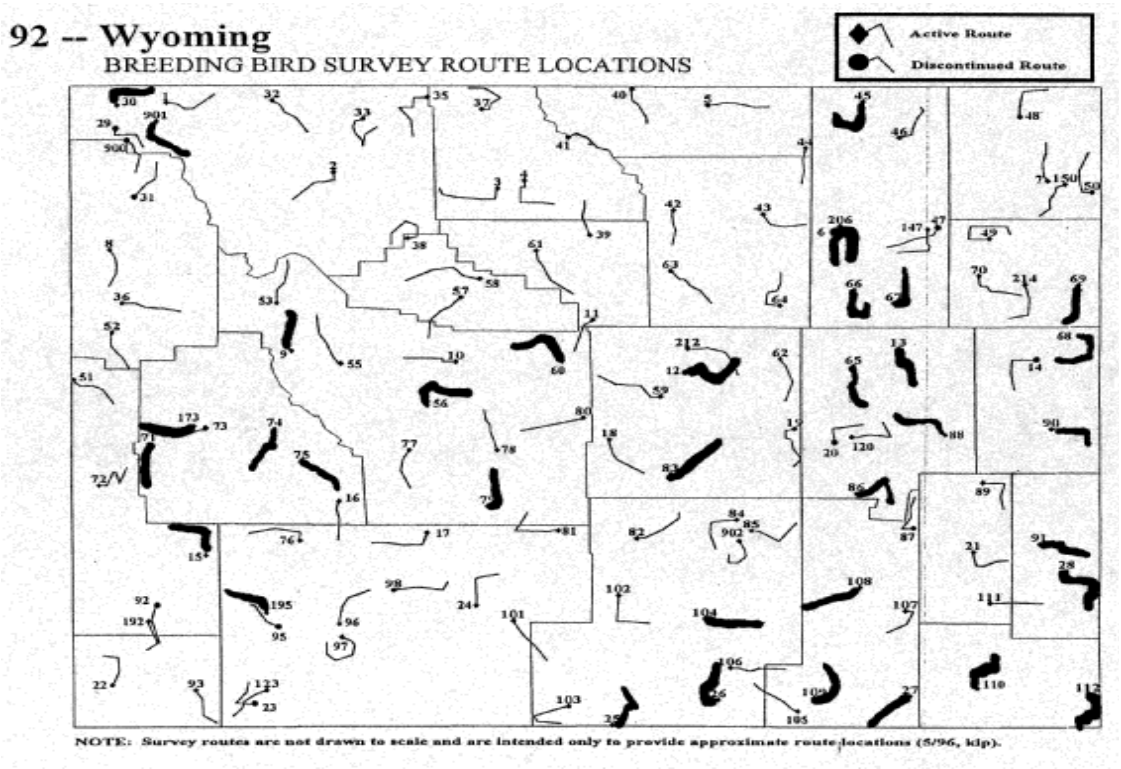

Figure 6. Bold lines indicate Breeding Bird Survey routes on which Swainson's Hawks have been observed from 1968 through 1998.

Table 12. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Swainson's Hawks were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
002 Cody	4	0.36
003 Otto	1	0.09
006 CHANGED TO 206	(6)	2.99
008 Colter Bay	1	0.08
009 Dubois	1	0.11
010 Midvale	2	0.14
011 Nowood	1	0.25
012 CHANGED TO 212	1	0.24
013 Bill	1	0.50
014 CHANGED TO 214	1	0.03
015 Fontenelle	2	0.43
016 Elk Horn	1	0.25
017 Bear Creek	1	0.12
019 Brookhurst	1	0.04
020 CHANGED TO 120	1	0.10
022 Cumberland	1	0.14
024 Patrick Draw	1	0.05
025 Savery	2	0.80
026 Riverside	2	0.92
027 Buford	3	1.36
028 Yoder	3	0.67
030 Mammoth, YNP	2	0.31
036 Moose	1	0.04
038 Meeteetse	1	0.14
041 Bald Mountain	1	0.17
043 Schoonover	2	0.25
044 Arvada	1	0.15
045 Recluse	2	0.40
047 CHANGED TO 147	1	0.14
049 Upton	1	0.27
052 Wilson	1	0.11
055 Crowheart	1	0.50
056 Ethete	2	0.83
057 Anchor	1	1.00
059 Arminto	1	0.10
060 Lysite	2	0.44
062 Teapot Dome	1	0.29
065 Harland Flats	1	0.80
066 Pine Tree	2	2.44
067 Highlight	3	1.30
068 Riverview	4	1.20
069 Newcastle	4	1.00

Table 12. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
070 Raven	2	0.57
071 Soda Lake	1	0.29
073 CHANGED TO 173	(3)	1.29
074 Boulder	2	0.88
075 Big Sandy	2	0.60
076 Farson	1	0.50
078 Sand Draw	1	0.33
079 Sweetwater	1	0.21
080 Gas Hills	1	0.33
083 Pathfinder	3	1.13
085 Shirley	1	0.18
086 Warbonnet	2	0.57
087 Fletcher Park	1	0.06
088 Shawnee	3	0.56
090 Lusk	4	1.31
091 Lingle	1	0.33
092 CHANGED TO 192	1	0.17
093 Mountain View	(1)	0.33
095 CHANGED TO 195	(2)	1.00
096 Reliance	1	0.25
097 Rock Springs	1	0.07
101 Wamsutter	1	0.33
103 Baggs	1	0.50
104 Walcott	2	0.92
107 Sybille Canyon	2	0.29
108 Rock River	4	2.43
109 Harmony	3	1.63
110 Cheyenne	8	3.35
111 Chugwater	1	0.08
112 Pine Bluff	9	2.46
120 Welch	1	0.10
147 Rozet	1	0.50
173 Ryegrass	4	2.20
195 Seedskadee	4	1.25
206 Caballa Creek	9	2.57
212 Bucknum	1	0.50
900 NO LONGER RUN	2	1.00
901 Yellowstone, YNP	2	0.82

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the maximum number of stops out of 50 on which species was observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Maintain and restore a dynamic plains/basin cottonwood gallery with a higher emphasis on mid and late seral stages of deciduous trees and shrubs.

2) Minimize loss of existing plains/basin cottonwood habitat, and strive to increase the amount of this habitat type in appropriate sites statewide.

3) Preserve trees that already contain Swainson's Hawk nests, since breeding pairs often use the same nest year after year.

4) Ensure cottonwood regeneration for multi-storied canopy in riparian habitat and suitable upland sites (e.g. old homesteads and shelterbelts).

5) Link existing and restored plains/basin riparian habitat where feasible (this will help reduce the potential of sink habitats).

6) Work cooperatively with other agencies, organizations, and individuals to determine Swainson's Hawk habitat status and management strategies on the non-breeding grounds.

Recommendations

1) Implement riparian Best Management Practices that emphasize protection and establishment of woody species, especially cottonwood riparian habitats.

2) Avoid disturbing nest sites from May 1st through August 31st.

3) Protect nest trees from livestock rubbing with fencing or other barriers.

4) Minimize control programs that reduce populations of Swainson's Hawk prey, especially rodents and grasshoppers.

Lewis' Woodpecker

Scattered throughout Wyoming; is very localized in suitable habitat. Inhabits open country with scattered trees; open or park-like ponderosa pine forests are probably the major breeding habitat. Attracted to burned out stands of Douglas-fir, mixed conifer, juniper, and riparian and oak woodlands, but is also found in deciduous forests, especially riparian cottonwoods. Prefers areas with a good understory of grasses and shrubs to support insect prey populations. Excavates a cavity nest from 20 to 25 feet above ground in a live or dead tree or tall stump with an average diameter-at-breast-height (dbh) of 15 inches. Favors ponderosa pine and cottonwood trees for nesting. Eggs [6 to 7, 1 inch (26 mm)] are white. Feeds on insects, nuts, conifer seeds, and berries either caught in the air or gleaned from the ground or tree bark. Winters from central Colorado south to northern and western Mexico. Populations using riparian woodlands in arid and semiarid areas have greatly declined due to loss and degradation of these habitats by incompatible livestock grazing. Competition with European Starlings and American Kestrels for nest cavities may be another factor in population declines. Other species that may benefit from habitat management for this species include the American Kestrel, Swainson's Hawk, Bald Eagle, Willow Flycatcher, Lazuli Bunting, Northern Rough-winged Swallow, and Warbling Vireo.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Lewis' Woodpecker in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain snags of $\geq$15 inches (38 cm) dbh at a density of $\geq$1 snag per 10 acres (4 ha) in plains/basin cottonwood gallery forests statewide.

2) Maintain a dense understory, with 30 to 50% in mid to upper-mid seral conditions.

Recommendations

1) Implement riparian Best Management Practices that emphasize maintaining snags in plains/basin riparian habitat.

2) Implement riparian Best Management Practices that emphasize maintaining a grass/forb/shrub understory so insect prey is available.

3) Refrain from using insecticides in areas where Lewis' Woodpeckers occur.

4) Do not encourage European Starlings to nest, and control, reduce, or remove European Starlings populations where nesting cavity competition is a concern.

Willow Flycatcher

Scattered throughout the mountains of Wyoming where it is closely tied to river bottoms. Is a riparian obligate that uses willow or alder thickets along streams, especially where streams are bordered by open stands of cottonwoods. Also found in brushy fields, and along edges of bogs, thickets, or groves of small trees in grasslands. Builds a loosely woven cup nest of plant down and fibers in a horizontal fork or upright crotch on the outside edge of a low shrub or tree. Eggs [3 to 4, 0.7 inch (18 mm)] are buff with brown spots near the large end. Is a common cowbird host; occasionally responds by burying the cowbird egg in the bottom of the nest. Feeds on flying insects caught in the air. Winters in Mexico and Central America. Population declines in the West are due to a combination of riparian habitat degradation by incompatible livestock grazing and heavy nest parasitism by cowbirds. Deforestation on the wintering grounds may also threatened population stability. Populations increase in response to a reduction in cattle grazing and cessation of willow control in riparian habitats. Other species that may benefit from habitat management for this species include the Harlequin Duck, MacGillivray's Warbler, Wilson's Warbler, Song Sparrow, Lincoln's Sparrow, Warbling Vireo, Dark-eyed Junco, Yellow-breasted Chat, Common Yellowthroat, Lazuli Bunting, and Blue Grosbeak.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Willow Flycatchers have been detected on 38 BBS routes in Wyoming, including 12 routes on which they were observed a minimum of 3 years.

a) Maintain Willow Flycatchers on the 38 BBS routes on which they were observed (Figure 7).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 13).

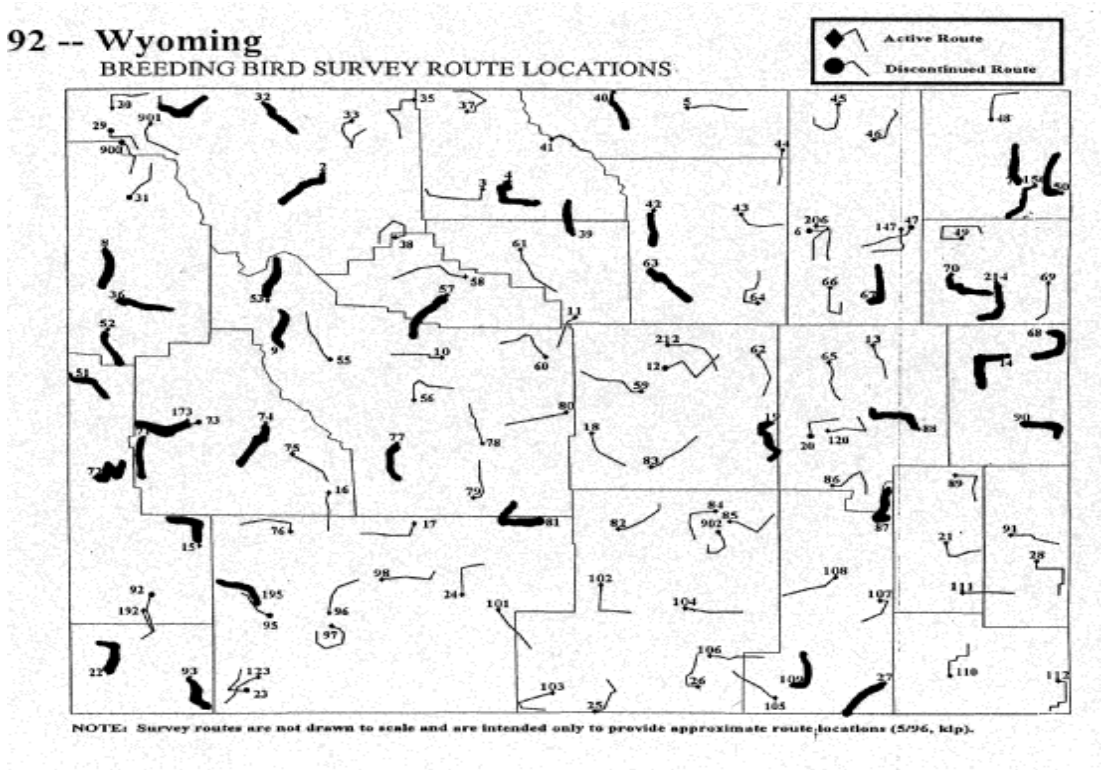

Figure 7. Bold lines indicate Breeding Bird Survey routes on which Willow Flycatchers have been observed from 1968 through 1998.

Table 13. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Willow Flycatchers were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
001 NE Entrance, YNP	5	1.70
002 Cody	2	0.18
004 Basin	1	0.05
007 Sundance	1	0.17
008 Colter Bay	6	2.31
009 Dubois	2	0.22
014 CHANGED TO 214	1	0.09
015 Fontenelle	3	2.00
019 Brookhurst	1	0.07
022 Cumberland	1	0.14
027 Buford	1	0.18
032 Hunter Peak	2	0.39
036 Moose	1	1.57
040 Dayton	4	2.24
042 Crazy Woman	3	1.00
050 Moskee	5	0.79
051 Alpine	5	3.70
052 Wilson	13	6.84
053 Horse Creek	1	0.11
057 Anchor	3	4.00
063 Mayoworth	1	0.06
067 Highlight	1	0.10
068 Riverview	(1)	0.27
070 Raven	1	0.14
071 Soda Lake	1	0.79
072 Buckskin Mountain	2	4.60
073 CHANGED TO 173	1	0.14
074 Boulder	1	0.63
077 Fiddler Lake	3	0.29
081 Bairoil	1	0.10
087 Fletcher Park	1	0.24
088 Shawnee	1	0.11
090 Lusk	1	0.08
093 Mountain View	(2)	1.67
095 CHANGED TO 195	(2)	13.00
104 Walcott	1	0.08
109 Harmony	1	0.38
150 Government Valley	1	0.14
214 Hampshire	1	0.20

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the maximum number of stops out of 50 on which species was observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Maintain habitat patches greater than 5 acres (2 ha) in size to facilitate Willow Flycatcher nesting success.

2) Provide 50 to 75% shrub cover in areas where Willow Flycatchers occur.

Recommendations

1) Manage for a diversity of woody vegetation near water and open stands of cottonwoods.

2) Refrain from using insecticides in areas where Willow Flycatchers occur.

3) Control cowbird nest parasitism by managing livestock and residential development.

Black-billed Cuckoo

Found mainly in the north-central part of Wyoming, with a few scattered reports from elsewhere in the state. Prefers upland woodlands that provide a variety of trees, shrubs, and vines; requires low, dense, shrubby vegetation that is commonly associated with riparian habitats in Wyoming. Builds a well-concealed platform nest of twigs lined with grass and plant down, typically 4 to 6 feet above ground. Eggs [2 to 3, 1.1 inches (27 mm)] are bluish-green. Feeds primarily on hairy caterpillars gleaned from vegetation, but also eats bird eggs, frogs, lizards, berries, and fruit. Winters in South America. Use of pesticides to control hairy caterpillars, tent caterpillars, and gypsy moths greatly reduce the Black-billed Cuckoo's prey base, and incompatible livestock grazing eliminates or degrades vertical diversity needed for successful nesting. Other species that may benefit from habitat management for this species include the Willow Flycatcher, Yellow Warbler, MacGillivray's Warbler, Song Sparrow, Warbling Vireo, Yellow-breasted Chat, Common Yellowthroat, Lazuli Bunting, and Blue Grosbeak.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Black-billed Cuckoo in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain dense shrubs and diverse vegetation heights in plains/basin riparian habitat.

Recommendations

1) Refrain from using insecticides in areas where Black-billed Cuckoos occur.

Yellow-billed Cuckoo

Found mainly along the eastern edge of Wyoming, with a few scattered reports from elsewhere in the state. Is a riparian obligate species that prefers extensive areas of dense thickets and mature deciduous forests near water, and requires low, dense, shrubby vegetation for nest sites. Builds a flimsy platform nest of twigs lined with leaves, grass, moss, and rootlets on the horizontal limb of a tree or shrub 4 to 8 feet above ground. Eggs [4, 1.2 inches (31 mm)] are light blue to light greenish-yellow. Feeds primarily on hairy caterpillars gleaned from vegetation, but also takes other insects, spiders, and some fruits, frogs, and lizards. Winters in South America. Is extremely sensitive to habitat fragmentation. Population declines in parts of its range are due to deterioration and fragmentation of riparian woodland habitat and to prey scarcity caused by pesticides. Other species that may benefit from habitat management for this species include the Yellow Warbler and Bullock's Oriole.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Yellow-billed Cuckoo in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain riparian cottonwood forests of ≥25 acres (10 ha) in size and ≥330 feet (100 m) wide.

2) Maintain ≥2.5 acres (1 ha) of dense shrubs and diverse vegetation heights per breeding pair.

Recommendations

1) Implement riparian Best Management Practices that maintain mature riparian cottonwood stands.

2) Eliminate fragmentation of riparian cottonwood stands in areas where Yellow-billed Cuckoos occur.

3) Refrain from using insecticides in areas where Yellow-billed Cuckoos occur.

Eastern Screech-Owl

Potential distribution is statewide, but typically occurs east of the Continental Divide. Favors riparian woodlands with widely spaced trees interspersed with grassy open areas for hunting. For nesting and roosting, requires cavities in trees with a minimum diameter-at-breast-height (dbh) of 12 inches. Nests in a natural cavity or old woodpecker cavity, especially those made by Northern Flickers. Eggs [4 to 5, 1.4 inches (34 mm)] are white. Swoops down on its prey from a perch and eats primarily rodents, but will also take insects, spiders, centipedes, scorpions, crayfish, amphibians, reptiles, fish, and small birds. Is a year-round resident in Wyoming. Loss of woodland and riparian habitats due to agricultural and urban development is a concern. Nest cavity competition with other species may occur. Other species that may benefit from habitat management for this species include the Northern Flicker.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Eastern Screech-Owl in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain an open subcanopy and sparse shrub cover interspersed with grassy open areas for hunting in plains/basin riparian habitat where Eastern Screech-Owls occur.

2) Manage for snags of $\geq$12 inches (30 cm) dbh for nesting in plains/basin riparian habitat.

Recommendations

1) Erect artificial nest boxes to enhance population distribution and nesting success where competition with other species occurs.

2) Implement riparian Best Management Practices that emphasize maintaining snags suitable for Eastern Screech-Owls in plains/basin riparian habitat.

Western Screech-Owl

Potential distribution is statewide, but typically occurs west of the Continental Divide. Favors riparian woodlands with widely spaced trees interspersed with grassy open areas for hunting. Requires cavities for nesting and roosting in trees with a minimum diameter-at-breast-height (dbh) of 12 inches. Nests in a natural cavity or old woodpecker cavity, especially those made by Northern Flickers. Eggs [2 to 5, 1.4 inches (36 mm)] are white. Swoops down on its prey from a perch and eats primarily rodents, but will also take insects, spiders, centipedes, scorpions, crayfish, amphibians, reptiles, fish, and small birds. Is a year-round resident in Wyoming. Low elevation deciduous forests and riparian areas are rapidly disappearing in some areas due to agricultural demands and urban development. Increased tree cutting could lead to a loss of essential habitat and nest cavities. Appears to be particularly susceptible to adverse weather conditions; severe winters cause a certain number of mortalities every year. Other species that may benefit from habitat management for this species include the Northern Flicker and Pileated Woodpecker.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Western Screech-Owl in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Manage cottonwoods for a mid to old growth canopy cover interspersed with grassy open areas for hunting in plains/basin riparian habitat where Western Screech-Owls occur.

2) Manage for snags of $\geq$12 inches (30 cm) dbh for nesting in plains/basin riparian habitat.

Recommendations

1) Implement riparian Best Management Practices that emphasize maintaining snags suitable for Western Screech-Owls in plains/basin riparian habitat.

Broad-tailed Hummingbird

Found in most of the mountainous areas of Wyoming, although the state is on the northern limit of its breeding range. Inhabits meadows and patches of flowers within riparian shrub habitat, mixed conifer forests, and aspen stands, from 4,000 to 11,000 feet. Sometimes ranges eastward onto the plains. A woven cup nest of downy materials, such as willow or cottonwood seeds, covered with bits of bark, fine rootlets, and lichen and held together with spider's silk is saddled on a large horizontal limb or small twig in a shrub near or over water in cottonwood, willow, aspen, Douglas fir, ponderosa pine, subalpine fir, or other mixed conifer forests. Nest is usually 4 to 15 feet above ground. Eggs [2, 0.5 inch (13 mm)] are white. Feeds on nectar from a variety of flowers, but also eats small insects and spiders. Winters in Mexico. Loss of flowering plants due to incompatible livestock grazing is a concern. Other species that may benefit from habitat management for this species include the Rufous Hummingbird, Calliope Hummingbird, Willow Flycatcher, and Lincoln's Sparrow.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Broad-tailed Hummingbirds have been detected on 22 BBS routes in Wyoming, including 7 routes on which they were detected for a minimum of 3 years.

a) Maintain Broad-tailed Hummingbirds on the 22 BBS routes on which they were observed (Figure 8).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 14).

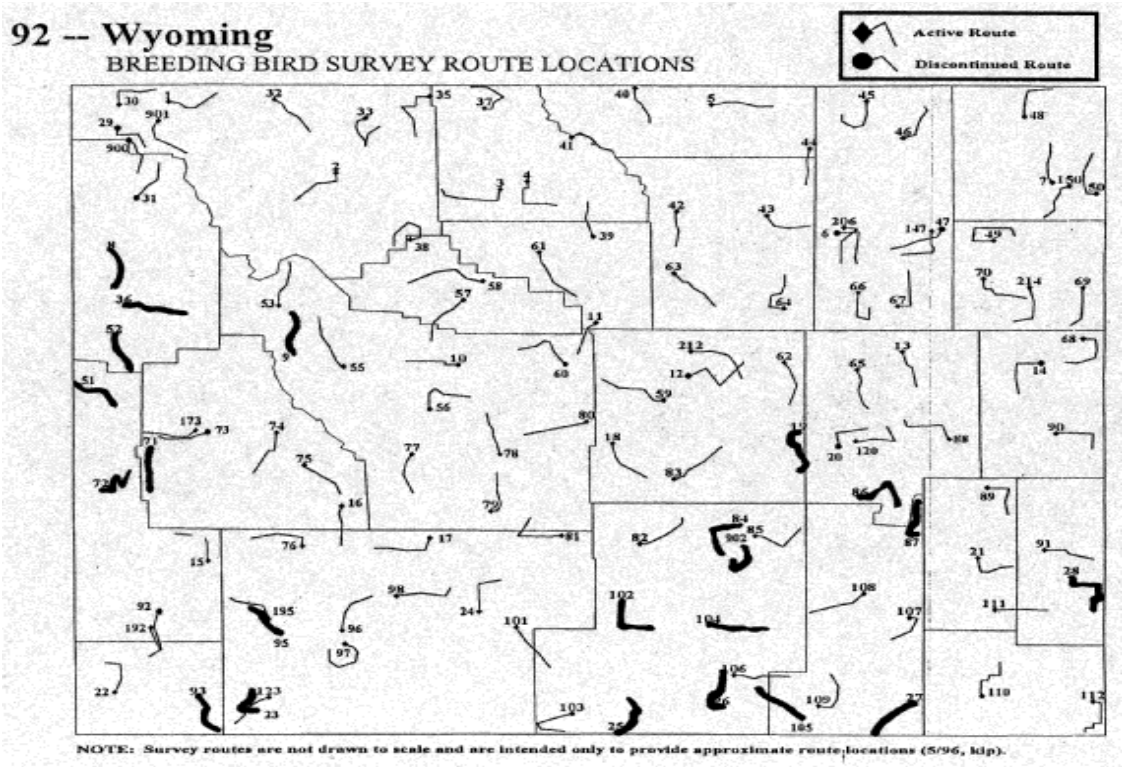

Figure 8. Bold lines indicate Breeding Bird Survey routes on which Broad-tailed Hummingbirds have been observed from 1968 through 1998.

Table 14. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Broad-tailed Hummingbirds were observed from 1968 through 1998.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
008 Colter Bay	1	0.15
009 Dubois	1	0.04
019 Brookhurst	1	0.11
023 CHANGED TO 123	1	0.07
025 Savery	7	5.40
026 Riverside	4	0.75
027 Buford	4	1.00
028 Yoder	1	0.06
036 Moose	5	2.17
051 Alpine	9	5.60
052 Wilson	8	3.53
071 Soda Lake	3	1.21
072 Buckskin Mountain	2	1.80
084 Leo	2	0.33
086 Warbonnet	8	4.43
087 Fletcher Park	6	3.41
093 Mountain View	1	2.22
095 CHANGED TO 195	1	0.25
102 Rawlins	1	0.22
104 Walcott	1	0.17
105 Fox Park	7	4.43
902 Pryor Flats	1	1.00

Habitat Objectives

1) Provide preferred Broad-tailed Hummingbird nesting habitat near or over streams.

2) Provide edge habitat associated with open meadows containing flowering plants.

3) Reduce impacts to flowering plants from recreation, grazing, and wildlife foraging.

Recommendations

1) Implement riparian Best Management Practices that emphasize patches of flowering plants within plains/basin riparian habitat.

2) Eliminate incompatible livestock grazing and recreation in riparian habitat that adversely impacts the flowering plant component.

3) Monitor the impacts of wildlife foraging on flowering plants in riparian areas.

MacGillivray's Warbler

Found throughout most of the mountainous areas of Wyoming. Uses low, dense shrubs; shady, damp thickets; forest edges; burned areas; and brushy hillsides. Prefers burned or cut areas in early successional stages. Builds a grassy cup nest about 1 to 5 feet above ground in a fir sapling, scrub oak, alder, chokecherry, or other shrub. Is an uncommon cowbird host. Eggs [4, 0.7 inch (18 mm)] are white to creamy colored and marked with brown. Feeds mostly on insects, such as beetles and caterpillars, gleaned from vegetation, tree bark, and the ground. Winters in southern Baja California, central Mexico, and south to western Panama. Population declines are due to riparian habitat degradation by incompatible livestock grazing. Other species that may benefit from habitat management for this species include the Wilson's Warbler, Song Sparrow, Lincoln's Sparrow, Warbling Vireo, Dark-eyed Junco, Yellow-breasted Chat, Common Yellowthroat, Lazuli Bunting, and Blue Grosbeak.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate MacGillivray's Warblers have been detected on 26 BBS routes in Wyoming, including 11 routes on which they were observed a minimum of 3 years.

a) Maintain MacGillivray's Warblers on the 26 BBS routes on which they were observed (Figure 9).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 15).

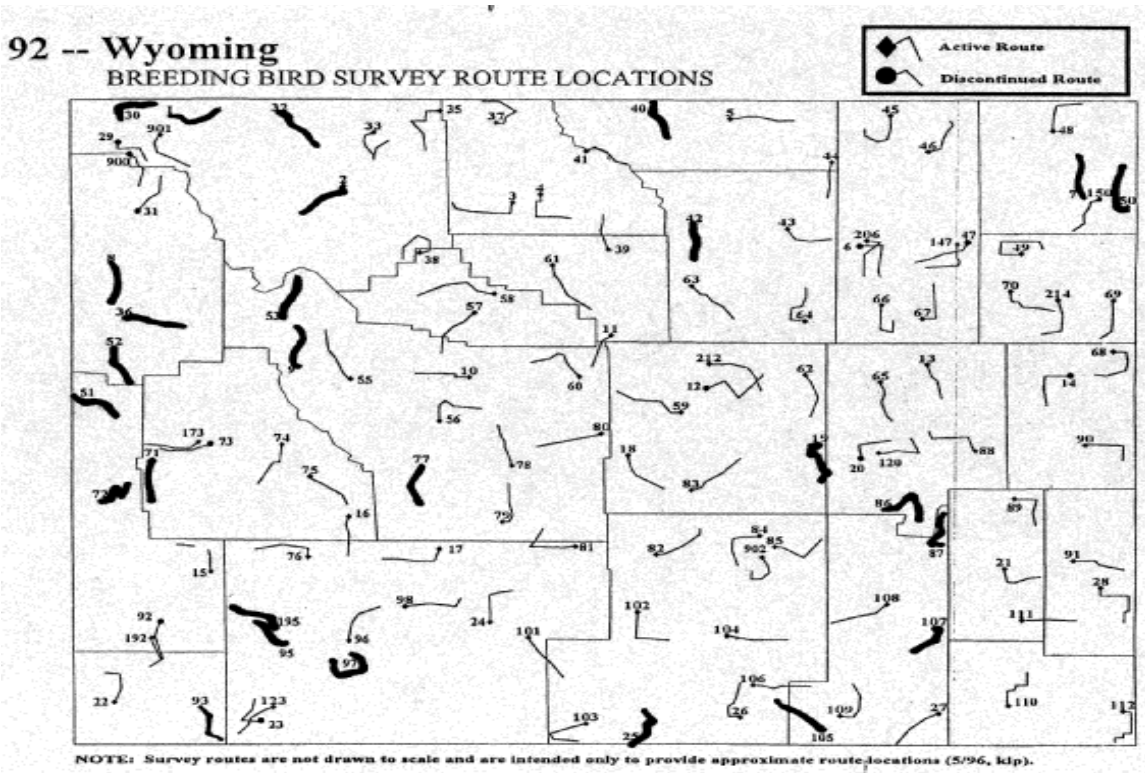

Figure 9. Bold lines indicate Breeding Bird Survey routes on which MacGillivray's Warblers have been observed from 1968 through 1998.

Table 15. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which MacGillivray's Warblers were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
001 NE Entrance, YNP	4	1.70
002 Cody	3	0.36
007 Sundance	6	2.78
008 Colter Bay	10	2.46
009 Dubois	1	0.11
019 Brookhurst	(2)	0.61
025 Savery	7	2.60
030 Mammoth, YNP	7	3.50
032 Hunter Peak	3	1.46
036 Moose	7	4.57
040 Dayton	1	0.06
042 Crazy Woman	2	0.94
050 Moskee	8	6.00
051 Alpine	14	8.00
052 Wilson	11	5.47
053 Horse Creek	4	0.56
071 Soda Lake	20	8.14
072 Buckskin Mountain	16	11.60
077 Fiddler Lake	2	0.43
086 Warbonnet	1	0.57
087 Fletcher Park	1	0.12
093 Mountain View	1	0.33
095 CHANGED TO 195	(2)	2.25
097 Rock Springs	1	0.07
105 Fox Park	22	6.00
107 Sundance	(2)	0.71
195 Seedskadee	3	0.38

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the maximum number of stops out of 50 on which species was observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Provide dense understory with brushy vegetation and moderate cover in areas where MacGillivray's Warblers occur.

Recommendations

1) Avoid long-term livestock grazing in riparian habitat that adversely impacts the shrub component.

2) Intensively graze livestock periodically in riparian habitat (once every few years, depending on the site) to enhance shrub density and cover.

3) Implement riparian Best Management Practices that emphasize protection and establishment of dense shrub understory.

6) Inventory, monitoring, and research needs:

Inventory and Monitoring Needs

"Monitoring Wyoming's Birds: The Plan for Count-based Monitoring"

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Introduction

Population monitoring is the foundation of avian conservation. Without reliable monitoring data, conservation efforts may be misguided and inefficient. Monitoring is required under federal and state legislative and agency mandates, as well as a host of long-range plans, forest plans, ecoregional plans, preserve management plans, etc. (Sauer 1993, Manley et al. 1993, Colorado Division of Wildlife 1994). From a global biodiversity perspective, Wyoming hosts many bird species at or near their greatest regional abundances (Table 16) and therefore has a high, long-term responsibility to conserve these species (*sensu* Rosenberg and Wells 2000).

The effective conservation and management of Wyoming's birds depend on adequate monitoring information, which, to a large extent, does not exist. To date, resource managers have relied on data derived from the Breeding Bird Survey (BBS), currently the best and most extensive bird-monitoring program, to monitor bird populations (Robbins et al. 1989, Sauer 1993). The BBS uses volunteers to conduct roadside surveys of birds across North America and produces indices of population abundance at the continental scale for many common bird species (see Robbins et al. 1986). However, many species and habitats are inadequately sampled by the BBS (Robbins et al. 1993, Sauer 1993) and BBS data do not reliably predict population trends at small geographic scales (Sauer 2000). Additionally, the design and implementation of the BBS is such that results generated from these efforts are often inconclusive due to the difficulty associated with interpreting index counts (Sauer 2000) and numerous confounding variables (Robbins et al. 1986, Bohning-Gaese et al. 1993, Sauer et al. 1994, James et al. 1996, Thomas 1996, Rosenstock et al. in prep.). For these reasons, BBS data are generally insufficient to guide local or regional management decisions.

Several authors have suggested implementing regional habitat-based bird monitoring programs to complement data generated by the BBS (Butcher 1992, Butcher et al. 1993, Sauer 2000, Sauer and Cooper 2000). In cooperation with the agencies charged with protecting and managing Colorado's birds, Rocky Mountain Bird Observatory (RMBO) proposed and successfully implemented a bird monitoring program for the state, entitled "Monitoring Colorado's Birds" (MCB), in which every agency/organization has the opportunity to contribute and benefit by assuming responsibility for the dominant habitats on the lands they manage (Table 17). This nationally-recognized program, often referred to as "The Colorado Model", is currently being considered for adoption by several states. In Colorado, it is supported by the Colorado Division of Wildlife, U.S. Forest Service, Bureau of Land Management, and National Park Service. Now, in cooperation with Wyoming Partners In Flight (WY-PIF), we propose a similar plan, based on the Colorado model, to monitor the birds of Wyoming. This plan is "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring" (MWB).

MWB is designed to provide population trend or status data on all regularly-occurring breeding species in the state. A total of 246 species of birds has bred in Wyoming. The first phase of MWB is to ensure that count-based data are obtained for all species that can be monitored effectively through a habitat-based approach, and that species-specific tracking or census programs are employed for those species requiring more specialized techniques. The second phase should include demographic studies to determine the possible reasons for known declines and to develop management information. Herein we develop a plan for Phase I, the count-based monitoring of all of Wyoming's regularly breeding bird species. This plan was developed using information drawn from BBS data, WY-PIF, and Partners In Flight (PIF) priority scores (Table 16).

MWB has been drafted as a state-based plan, seeking funding only from agencies within Wyoming and focusing solely on habitats within the state. However, an ecoregional approach would provide more meaningful and complete monitoring data on bird populations and would be more cost-effective for states. Therefore, we would like to expand this program to the Bird Conservation Region (BCR) level. BCRs are more ecologically-appropriate management units for birds because they encompass distinct ecoregions in North America that host similar bird communities (NABCI Committee 2000). Partners In Flight has adopted the BCR as the focus unit for ranking conservation priorities among bird species, and the North American Bird Conservation Initiative (NABCI) has stressed the need for regionally-based approaches to bird conservation involving cooperative partnerships within BCRs (NABCI Committee 2000).

Wyoming is comprised of four BCRs: the Northern Rockies (BCR 10), Badlands and Prairies (BCR 17), Shortgrass Prairie (BCR 18), and Southern Rockies/Colorado Plateau (BCR 16), each of which extends into neighboring states. A BCR level plan would require that all states occupying significant portions of the BCR contribute proportionately to fund monitoring efforts in the BCR. Such a plan would be more cost-effective because it would eliminate duplicate efforts by states to obtain independent data sets from habitats they share with other states, while still providing meaningful data on bird populations that could be used at the state level.

Background

Although analyses of BBS data have indicated population declines in some bird species (Robbins et al. 1986), we do not believe that there are wholesale declines in birds as reported by some media, individuals, initiatives, or environmental groups. However, population trend data for many western bird species are lacking (see Table 16).

Using WY-PIF priority scores and criteria established by Carter et al. (2000), we have determined that >68% of Wyoming's regularly-breeding species are not adequately monitored by the BBS (Table 18). Of the species that are well monitored by the BBS, some species have populations that are declining, some increasing, and some stable (Table 18). If proportions of increasing, decreasing, and stable species are roughly the same in the list of unmonitored species as they are in the list of monitored species, then it is likely that a considerable number of population declines are currently undetected. Furthermore, because declines are more difficult to detect than increases (variance increases as populations decline), the proportion of declining species in the unmonitored list is probably even higher. For these reasons, a comprehensive monitoring program for Wyoming is clearly needed.

Statistical Targets and Assumptions

Monitoring should be efficient, low-level, and permanent, and we have designed this program with these points in mind. To monitor correctly, one needs a target -- a threshold of population change over time that balances statistical rigor with cost-effectiveness. It is desirable to detect a fairly small population change (particularly, a negative one) in a fairly short amount of time. However, the sample sizes required would probably be prohibitively costly. Therefore, as our target, we selected a minimum rate of population change of -3.0% per year and a maximum time period of 30 years in which to detect population changes (see Butcher 1992 and Robbins et al. 1993 for similar trend detection targets). We used the formula:

$$\textit{cumulative change} = ([(\textit{annual change}/100)+1]^{n-1} - 1)(100)$$

to calculate total population loss over a 30-year period with an annual decline of 3.0%. This equates to a 58.7% loss of a population in 30 years, which is probably not large

enough to trigger listing under the Endangered Species Act. It is, however, advance warning enough to trigger action.

Along with this target one must determine what levels of statistical rigor (i.e. power and significance) are appropriate. We selected a statistical probability of p=0.10 (Askins et al. 1990, Butcher 1992) to indicate a significant population change. A statistical probability of p=0.10 gives moderate protection against Type I error (finding trends that are false). For MWB, we provided only moderate protection because it is often more useful and practical for wildlife managers to determine the direction and magnitude of a trend than establish its significance at a very high level (i.e., traditionally, p=0.05). Similarly, we set power at 0.8 (Butcher 1992, Downes et al. 2000), which gives moderate protection against Type II error (failing to find trends that are real).

Considering cost and the need to have a sufficient number of well-dispersed sampling units, we initially designed this program with 30 samples (i.e. transects) per habitat. Then, using pilot data from 1998, we tested this number of samples and confirmed that 30 would be sufficient to meet our target for detecting population changes.

With these assumptions, we used the computer program MONITOR (Patuxent Wildlife Research Center 2000) to model the efficiency of 30 pilot transects run in each of three habitats in 1998 (Leukering and Carter 1999). Specifically, we used MONITOR to determine the threshold for the coefficient of variation (CV; Standard Deviation/Mean) associated with point-transect data that will generate useful monitoring information. A CV reflects the overall variability of data scaled against the mean; that is, species with large abundances but high variability have CVs similar to those of species with low abundance and low variability. CVs are a function of factors inherent to a species (its abundance and variability in nature) and statistical considerations such as sample size and method of sampling. MONITOR indicates that for species with associated CVs of less than 1.00, we will be able to detect 3.0% per year declines within 30 years of monitoring, with a statistical significance of p=0.1 and power of 0.8. For species with CVs of less than 0.50, MONITOR indicates that we will be able to detect declines of 3.0% per year within 12 years.

It is the nature of trend data that increases can be detected more quickly than can decreases of equal magnitude. Therefore, with these thresholds we should be able to detect positive trends more quickly than negative trends. Additionally, for species with either large rates of population change or very low CVs, we will be able to detect trends in as few as six years.

Methods

MWB will employ a variety of survey techniques (e.g. point transects, line transects, and colony counts) to obtain trend and status data on Wyoming's birds. Each technique is detailed in Leukering and Levad (2000) and summarized in Table 19. An underlying tenet of MWB is to allocate more effort to those species for which Wyoming is an important breeding area and little effort to species that are peripheral to the area. While most species can be monitored through use of a single technique, the ecologies of some species are such that they are not adequately surveyed through randomized sampling efforts. Therefore, not all species will be monitored by the same technique, nor will every species be monitored. Game species and federally-listed Threatened or Endangered (T&E) species will not receive specific attention under MWB, as monitoring programs already exist for these species under other mandates. We believe monitoring efforts under MWB should focus on those species currently not monitored under any program. However, data generated by MWB on these species will be available and could be used to supplement other management information for these species.

Although we use the term "monitoring" loosely throughout most of this plan, in the strictest sense, "monitoring" is possible only for those species for which we can obtain a sufficient number of samples (i.e. those species with CVs of <1.00) to meet high levels of statistical rigor when testing for population change. For some species that occur in low relative abundance across the landscape, "monitoring" will not be possible without greatly increasing the amount of funds and effort devoted toward those species. Instead, we intend to "track" populations of low-abundance or localized species, with the implication being that any trends detected for these species will have low statistical power (CVs of >1.00). For data obtained through species-specific techniques, "monitoring" will be possible for those species for which we are able to locate and survey all known breeding locations in a given year (e.g. Eared Grebe, Great Blue Heron, and Franklin's Gull). For rare or local species whose breeding locations are not known with complete certainty, we will "track" populations using counts at known breeding locations (e.g. Purple Martin and Scott's Oriole).

MWB relies primarily on transect-based techniques, through which we expect to monitor approximately 35% of Wyoming's breeding bird species and track an additional 35% (Table 20). Through the use of species-specific techniques, we expect to monitor 6% and track an additional 10% of Wyoming's breeding birds (Table 20). The remaining 14% of species are designated T&E or game species not covered under MWB.

Standard distance-sampling techniques (Buckland et al. 1993) are used during all transect surveys, and density estimates of bird species are derived using program DISTANCE (Thomas et al. 1998). We have become painfully aware of the many problems associated with sampling bird populations and believe that distance-sampling techniques may be useful in sorting out problems of detectability that could result from

myriad factors, including changes to the habitat over the term of this program. We do not intend to use these techniques to develop densities as an end product, but rather as a tool to derive an index that is not confounded by detectability issues. In the event that distance sampling techniques do not prove to be useful, we will analyze our data using more traditional techniques (e.g. via fixed radii).

All diurnal transects are located at randomly-selected sites without bias toward or against roads; starting points and transect bearings are determined randomly. All technicians are highly-skilled field ornithologists and are trained at the beginning of the season to ensure that they fully understand the field protocol and that their distance-estimation skills meet our requirements (within 10% of true value).

Partners

The magnitude of this plan requires that numerous agencies and organizations participate to fully implement all aspects of the program. For this plan, partners (real or potential) include the Bureau of Land Management, U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service, Wyoming Game and Fish Department, Audubon Wyoming, Wyoming Department of Agriculture, Wyoming Natural Diversity Database, Wyoming Partners In Flight, and Rocky Mountain Bird Observatory.

Products

Annual summaries of results and periodic trend analyses will be provided to all participating agencies via paper reports, publications, and the World Wide Web. Raw data will be made available to the Wyoming Natural Diversity Database (WYNDD) by the end of the calendar year in which it was collected, whereby WYNDD will add them to previous data and distribute to all contributing participants.

Funding/Cost

For MWB, we estimate that count-based data for each habitat will cost about $10,500 per year (Table 21). This figure includes only the costs to obtain transect-based data from each habitat and does not include funds for species-specific monitoring. However, when multiple habitats are included in the budget, the synergistic effects of per-habitat funding (i.e. overlap in data management, analysis, report writing, etc.) should provide sufficient funds to cover the cost of most species-specific monitoring techniques. In Colorado, the program has been funded to address 16 habitats, which provides sufficient funds to address most species with the appropriate technique.

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Table 16. Species list with PIF priority scores, habitat, and suggested methods for monitoring each of Wyoming's breeding bird species. Only local scores are included here; global scores are not. Scores provided are: AI = area importance, PT = population trend, PTU = population trend uncertainty (not included in total). Total score is not a sum of scores provided.

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Common Loon	3	3	8	18	Wetlands	Expert survey	Tracked
Pied-billed Grebe	3	3	6	14	Wetlands	Colony count	Tracked
Horned Grebe	3	3	8	16	Wetlands	Colony count	Tracked
Red-necked Grebe	3	3	8	17	Wetlands	Expert survey	Tracked
Eared Grebe	2	3	6	13	Wetlands	Colony count	Monitored
Western Grebe	3	3	6	20	Wetlands	Colony count	Monitored
Clark's Grebe	3	3	8	20	Wetlands	Colony count	Monitored
American White Pelican	3	3	6	21	Wetlands	Expert survey	Monitored
Double-crested Cormorant	2	3	6	13	Wetlands	Colony count	Monitored
American Bittern	2	3	7	17	Wetlands	Line transect	Tracked
Great Blue Heron	3	3	5	14	Plains/Basin Riparian	Colony count	Monitored
Snowy Egret	3	3	8	15	Wetlands	Colony count	Monitored
Cattle Egret	3	3	8	13	Wetlands	Colony count	Monitored
Black-crowned Night-Heron	3	3	8	15	Wetlands	Colony count	Monitored
White-faced Ibis	3	3	8	17	Wetlands	Colony count	Monitored
Turkey Vulture	2	2	3	11	Specialized Habitats	Point transect	Tracked
Canada Goose	5	3	5	15	Wetlands	N/A	Tracked
Trumpeter Swan	3	3	8	26	Wetlands	Expert survey	Monitored

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Wood Duck	3	3	8	18	Plains/Basin Riparian	N/A	Tracked
Gadwall	3	3	5	15	Wetlands	N/A	Tracked
American Wigeon	4	3	5	17	Wetlands	N/A	Tracked
Mallard	3	3	5	13	Wetlands	N/A	Tracked
Blue-winged Teal	2	2	2	13	Wetlands	N/A	Tracked
Cinnamon Teal	3	4	4	19	Wetlands	N/A	Tracked
Northern Shoveler	2	3	6	14	Wetlands	N/A	Tracked
Northern Pintail	2	3	5	13	Wetlands	N/A	Tracked
Green-winged Teal	4	3	5	15	Wetlands	N/A	Tracked
Canvasback	3	3	8	19	Wetlands	N/A	Tracked
Redhead	2	3	7	19	Wetlands	N/A	Tracked
Ring-necked Duck	4	3	7	20	Wetlands	N/A	Tracked
Lesser Scaup	3	3	6	16	Wetlands	N/A	Tracked
Harlequin Duck	3	3	8	20	Montane Riparian	Expert survey	Tracked
Bufflehead	3	3	8	18	Wetlands	N/A	Tracked
Common Goldeneye	3	3	8	15	Wetlands	N/A	Tracked
Barrow's Goldeneye	3	3	6	22	Wetlands	N/A	Tracked
Hooded Merganser	2	3	8	20	Wetlands	N/A	Tracked
Red-breasted Merganser	2	3	8	15	Wetlands	N/A	Tracked
Common Merganser	5	3	5	17	Montane Riparian	N/A	Tracked
Ruddy Duck	2	3	7	17	Wetlands	N/A	Tracked
Osprey	3	3	6	16	Wetlands	State-wide survey	Tracked

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Bald Eagle	3	3	8	18	Montane Riparian	N/A	Tracked
Northern Harrier	4	3	5	19	Plains/Basin Riparian	Point transect	Tracked
Sharp-shinned Hawk	3	3	8	16	High Elevation Conifer	Point transect	Tracked
Cooper's Hawk	3	3	8	16	Aspen	Point transect	Tracked
Northern Goshawk	4	3	7	19	Mid Elevation Conifer	Point transect	Tracked
Swainson's Hawk	3	3	5	21	Plains/Basin Riparian	Point transect	Tracked
Red-tailed Hawk	4	1	1	12	Plains/Basin Riparian	Point transect	Tracked
Ferruginous Hawk	4	3	5	23	Shortgrass Prairie	Point transect	Tracked
Golden Eagle	5	3	5	19	Specialized Habitats	Point transect	Tracked
American Kestrel	5	2	1	14	Urban/Agricultural	Point transect	Tracked
Merlin	3	3	8	15	Low Elevation Conifer	Point transect	Tracked
Prairie Falcon	5	3	5	23	Specialized Habitats	Point transect	Tracked
Peregrine Falcon	3	3	8	19	Specialized Habitats	Expert survey	Tracked
Gray Partridge	3	3	8	11	Mountain-foothills Shrub	N/A	Tracked
Chukar	3	3	8	11	Mountain-foothills Shrub	N/A	Tracked
Ring-necked Pheasant	3	5	2	13	Urban/Agricultural	N/A	Tracked
Ruffed Grouse	4	3	7	19	Aspen	N/A	Tracked
Sage Grouse	5	3	5	26	Shrub-steppe	N/A	Tracked
Blue Grouse	3	3	8	21	Montane Riparian	N/A	Tracked
White-tailed Ptarmigan	3	3	8	20	Alpine Tundra	Statewide survey	Tracked
Sharp-tailed Grouse	3	3	8	19	Mountain-foothills Shrub	N/A	Tracked
Wild Turkey	3	3	6	18	Plains/Basin Riparian	N/A	Tracked

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Northern Bobwhite	3	3	8	18	Plains/Basin Riparian	N/A	Tracked
Virginia Rail	3	3	8	16	Wetlands	Line transect	Tracked
Sora	2	3	6	13	Wetlands	Line transect	Tracked
American Coot	3	3	5	12	Wetlands	N/A	Tracked
Sandhill Crane	4	1	2	20	Wetlands	Statewide survey	Tracked
Snowy Plover	3	3	8	20	Wetlands	Statewide survey	Tracked
Killdeer	4	2	4	16	Plains/Basin Riparian	Line transect	Monitored
Mountain Plover	4	3	6	28	Shortgrass Prairie	Statewide survey	Tracked
Black-necked Stilt	3	3	8	16	Wetlands	Statewide survey	Tracked
American Avocet	2	4	3	21	Wetlands	Line transect	Tracked
Willet	3	2	3	18	Wetlands	Statewide survey	Tracked
Spotted Sandpiper	5	2	2	14	Plains/Basin Riparian	Line transect	Monitored
Upland Sandpiper	2	2	4	18	Shortgrass Prairie	Point transect	Tracked
Long-billed Curlew	2	3	6	21	Shortgrass Prairie	Statewide survey	Tracked
Common Snipe	4	3	5	15	Wetlands	Point transect	Tracked
Wilson's Phalarope	3	5	2	22	Wetlands	Line transect	Tracked
Franklin's Gull	3	3	8	22	Wetlands	Colony count	Monitored
Ring-billed Gull	2	3	6	13	Wetlands	Colony count	Monitored
California Gull	3	3	5	18	Wetlands	Colony count	Monitored
Caspian Tern	3	3	8	15	Wetlands	Expert survey	Tracked
Forster's Tern	2	3	7	19	Wetlands	Expert survey	Monitored
Black Tern	3	3	8	18	Wetlands	Expert survey	Monitored

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Rock Dove	3	3	5	11	Urban/Agricultural	Point transect	Tracked
Mourning Dove	3	2	1	10	Plains/Basin Riparian	Point transect	Monitored
Black-billed Cuckoo	2	3	7	18	Plains/Basin Riparian	Expert survey	Tracked
Yellow-billed Cuckoo	3	3	8	18	Plains/Basin Riparian	Line transect	Tracked
Barn Owl	3	3	8	17	Urban/Agricultural	Nocturnal transect	Tracked
Eastern Screech-Owl	3	3	8	18	Plains/Basin Riparian	Nocturnal transect	Tracked
Western Screech-Owl	3	3	8	18	Plains/Basin Riparian	Nocturnal transect	Tracked
Northern Pygmy-Owl	3	3	8	17	Mid Elevation Conifer	Nocturnal transect	Tracked
Great Horned Owl	3	4	4	14	Plains/Basin Riparian	Nocturnal transect	Tracked
Burrowing Owl	2	4	3	19	Shortgrass Prairie	Colony count	Tracked
Great Gray Owl	3	3	8	18	Mid Elevation Conifer	Nocturnal transect	Tracked
Long-eared Owl	3	3	8	16	Plains/Basin Riparian	Nocturnal transect	Tracked
Short-eared Owl	3	3	6	20	Shortgrass Prairie	Nocturnal transect	Tracked
Boreal Owl	3	3	8	18	High Elevation Conifer	Nocturnal transect	Tracked
Northern Saw-whet Owl	3	3	8	15	Aspen	Nocturnal transect	Tracked
Common Nighthawk	4	4	4	17	Shortgrass Prairie	Point transect	Tracked
Common Poorwill	3	3	6	19	Mountain-foothills Shrub	Nocturnal transect	Monitored
Chimney Swift	3	3	8	18	Urban/Agricultural	Point transect	Tracked
White-throated Swift	3	3	6	17	Specialized Habitats	Point transect	Tracked
Black-chinned Hummingbird	2	3	8	20	Plains/Basin Riparian	Point transect	Monitored
Calliope Hummingbird	5	3	7	23	Mid Elevation Conifer	Point transect	Tracked
Broad-tailed Hummingbird	2	2	3	18	Montane Riparian	Point transect	Monitored

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Rufous Hummingbird	2	3	7	20	Mid Elevation Conifer	Point transect	Tracked
Belted Kingfisher	2	3	6	14	Plains/Basin Riparian	Line transect	Monitored
Lewis' Woodpecker	3	3	8	23	Plains/Basin Riparian	Point transect	Tracked
Red-headed Woodpecker	2	3	6	18	Plains/Basin Riparian	Point transect	Tracked
Red-naped Sapsucker	3	2	2	20	Aspen	Point transect	Tracked
Williamson's Sapsucker	3	3	7	21	Mid Elevation Conifer	Point transect	Tracked
Downy Woodpecker	2	3	6	13	Plains/Basin Riparian	Point transect	Monitored
Hairy Woodpecker	3	3	5	15	Mid Elevation Conifer	Point transect	Monitored
Three-toed Woodpecker	4	3	7	20	Mid Elevation Conifer	Point transect	Tracked
Black-backed Woodpecker	3	3	8	21	Mid Elevation Conifer	Point transect	Tracked
Northern Flicker	5	4	4	16	Plains/Basin Riparian	Point transect	Monitored
Olive-sided Flycatcher	2	3	6	17	High Elevation Conifer	Point transect	Monitored
Western Wood-Pewee	3	2	1	15	Plains/Basin Riparian	Point transect	Monitored
Willow Flycatcher	3	4	4	20	Montane Riparian	Point transect	Tracked
Least Flycatcher	2	3	6	16	Plains/Basin Riparian	Point transect	Tracked
Hammond's Flycatcher	2	3	7	20	High Elevation Conifer	Point transect	Monitored
Dusky Flycatcher	3	2	3	19	Low Elevation Conifer	Point transect	Monitored
Gray Flycatcher	3	3	8	21	Juniper Woodland	Point transect	Tracked
Cordilleran Flycatcher	3	3	6	20	Montane Riparian	Point transect	Monitored
Eastern Phoebe	3	3	8	16	Plains/Basin Riparian	Expert survey	Tracked
Say's Phoebe	4	3	5	18	Shrub-steppe	Point transect	Tracked
Ash-throated Flycatcher	2	3	7	16	Juniper Woodland	Point transect	Tracked

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Cassin's Kingbird	3	3	8	22	Juniper Woodland	Point transect	Tracked
Western Kingbird	3	1	1	15	Plains/Basin Riparian	Point transect	Tracked
Eastern Kingbird	3	2	1	14	Plains/Basin Riparian	Point transect	Monitored
Loggerhead Shrike	3	3	5	18	Shrub-steppe	Point transect	Tracked
Plumbeous Vireo	3	3	6	20	Mid Elevation Conifer	Point transect	Monitored
Warbling Vireo	4	2	2	17	Plains/Basin Riparian	Point transect	Monitored
Red-eyed Vireo	2	3	7	14	Plains/Basin Riparian	Point transect	Monitored
Gray Jay	3	5	2	17	High Elevation Conifer	Point transect	Monitored
Steller's Jay	2	3	6	15	High Elevation Conifer	Point transect	Monitored
Blue Jay	2	3	7	12	Plains/Basin Riparian	Point transect	Tracked
Western Scrub-Jay	3	3	8	18	Juniper Woodland	Point transect	Tracked
Pinyon Jay	2	3	6	17	Juniper Woodland	Point transect	Tracked
Clark's Nutcracker	4	3	5	18	High Elevation Conifer	Point transect	Monitored
Black-billed Magpie	4	5	1	19	Plains/Basin Riparian	Point transect	Monitored
American Crow	2	2	1	9	Urban/Agricultural	Point transect	Tracked
Common Raven	3	2	4	11	Specialized Habitats	Point transect	Monitored
Horned Lark	5	4	4	15	Shrub-steppe	Point transect	Monitored
Purple Martin	3	3	8	16	Aspen	Statewide survey	Tracked
Tree Swallow	3	2	4	14	Aspen	Point transect	Tracked
Violet-green Swallow	3	2	4	16	Aspen	Point transect	Tracked
Northern Rough-winged Swallow	4	4	4	18	Plains/Basin Riparian	Point transect	Tracked
Bank Swallow	2	3	5	13	Plains/Basin Riparian	Point transect	Tracked

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Cliff Swallow	4	2	4	12	Specialized Habitats	Point transect	Tracked
Barn Swallow	3	2	4	11	Urban/Agricultural	Point transect	Tracked
Black-capped Chickadee	2	5	2	15	Plains/Basin Riparian	Point transect	Monitored
Mountain Chickadee	3	5	2	18	High-elevation Conifer	Point transect	Monitored
Juniper Titmouse	3	3	8	21	Juniper Woodland	Point transect	Monitored
Bushtit	3	3	8	16	Juniper Woodland	Point transect	Tracked
Red-breasted Nuthatch	2	2	2	12	High Elevation Conifer	Point transect	Monitored
White-breasted Nuthatch	2	3	6	14	High Elevation Conifer	Point transect	Monitored
Pygmy Nuthatch	3	3	8	20	Low Elevation Conifer	Point transect	Monitored
Brown Creeper	3	3	8	16	Mid Elevation Conifer	Point transect	Monitored
Rock Wren	3	5	1	18	Specialized Habitats	Point transect	Tracked
Canyon Wren	3	4	3	18	Specialized Habitats	Point transect	Tracked
Bewick's Wren	3	3	8	18	Juniper Woodland	Point transect	Monitored
House Wren	3	2	4	11	Plains/Basin Riparian	Point transect	Monitored
Marsh Wren	3	4	3	20	Wetlands	Line transect	Monitored
American Dipper	3	3	7	20	Montane Riparian	Point transect	Tracked
Golden-crowned Kinglet	3	3	6	17	High Elevation Conifer	Point transect	Monitored
Ruby-crowned Kinglet	3	2	4	14	High Elevation Conifer	Point transect	Monitored
Blue-gray Gnatcatcher	3	3	8	15	Juniper Woodland	Point transect	Monitored
Eastern Bluebird	3	3	8	15	Plains/Basin Riparian	Point transect	Tracked
Western Bluebird	3	3	8	19	Juniper Woodland	Point transect	Tracked
Mountain Bluebird	4	2	1	17	Mountain-foothills Shrub	Point transect	Tracked

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Townsend's Solitaire	3	2	3	17	Aspen	Point transect	Tracked
Veery	2	4	3	18	Montane Riparian	Point transect	Monitored
Swainson's Thrush	2	2	2	14	Mid Elevation Conifer	Point transect	Monitored
Hermit Thrush	3	2	2	15	High Elevation Conifer	Point transect	Monitored
American Robin	3	2	1	10	Plains/Basin Riparian	Point transect	Monitored
Gray Catbird	2	4	4	16	Plains/Basin Riparian	Point transect	Tracked
Northern Mockingbird	2	3	7	10	Plains/Basin Riparian	Expert survey	Tracked
Sage Thrasher	5	2	1	19	Shrub-steppe	Point transect	Monitored
Brown Thrasher	2	3	6	17	Plains/Basin Riparian	Point transect	Tracked
American Pipit	3	3	8	14	Alpine Tundra	Point transect	Monitored
Cedar Waxwing	2	3	7	13	Mountain-foothills Shrub	Point transect	Tracked
European Starling	3	3	5	11	Urban/Agricultural	Point transect	Monitored
Orange-crowned Warbler	2	3	6	13	Montane Riparian	Point transect	Tracked
Virginia's Warbler	3	3	8	24	Mountain-foothills Shrub	Point transect	Monitored
Yellow Warbler	4	2	1	13	Plains/Basin Riparian	Point transect	Monitored
Yellow-rumped Warbler	4	3	5	14	High Elevation Conifer	Point transect	Monitored
Black-throated Gray Warbler	3	3	8	22	Juniper Woodland	Point transect	Monitored
Townsend's Warbler	3	3	8	20	High Elevation Conifer	Point transect	Monitored
American Redstart	2	4	3	15	Plains/Basin Riparian	Expert survey	Tracked
Ovenbird	2	3	7	17	Plains/Basin Riparian	Statewide survey	Tracked
MacGillivray's Warbler	3	1	2	17	Montane Riparian	Point transect	Monitored
Common Yellowthroat	2	5	2	15	Wetlands	Point transect	Monitored

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Wilson's Warbler	2	3	6	15	Montane Riparian	Point transect	Monitored
Yellow-breasted Chat	2	3	5	16	Plains/Basin Riparian	Point transect	Monitored
Western Tanager	3	2	4	17	Mid Elevation Conifer	Point transect	Monitored
Green-tailed Towhee	4	2	1	19	Mountain-foothills Shrub	Point transect	Monitored
Spotted Towhee	2	3	5	16	Mountain-foothills Shrub	Point transect	Monitored
Chipping Sparrow	3	5	1	16	Mid Elevation Conifer	Point transect	Monitored
Clay-colored Sparrow	2	3	6	18	Shrub-steppe	Point transect	Tracked
Brewer's Sparrow	5	5	1	23	Shrub-steppe	Point transect	Monitored
Field Sparrow	2	3	7	17	Shortgrass Prairie	Statewide survey	Tracked
Vesper Sparrow	5	4	4	18	Shrub-steppe	Point transect	Monitored
Lark Sparrow	3	4	4	18	Shrub-steppe	Point transect	Monitored
Black-throated Sparrow	3	3	8	17	Shrub-steppe	Point transect	Tracked
Sage Sparrow	5	2	2	22	Shrub-steppe	Point transect	Monitored
Lark Bunting	4	4	4	22	Shortgrass Prairie	Point transect	Monitored
Savannah Sparrow	3	3	5	13	Shortgrass Prairie	Point transect	Monitored
Baird's Sparrow	3	3	8	26	Shortgrass Prairie	Point transect	Tracked
Grasshopper Sparrow	3	5	1	19	Shortgrass Prairie	Point transect	Monitored
Fox Sparrow	2	3	7	14	Montane Riparian	Point transect	Tracked
Song Sparrow	2	2	1	10	Plains/Basin Riparian	Point transect	Monitored
Lincoln's Sparrow	2	2	4	13	Montane Riparian	Point transect	Monitored
White-crowned Sparrow	3	2	4	12	Montane Riparian	Point transect	Monitored
Dark-eyed Junco	3	3	7	14	Mid Elevation Conifer	Point transect	Monitored

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
McCown's Longspur	3	2	4	26	Shortgrass Prairie	Point transect	Monitored
Chestnut-collared Longspur	2	3	6	21	Shortgrass Prairie	Point transect	Monitored
Rose-breasted Grosbeak	2	3	8	17	Plains/Basin Riparian	Expert survey	Tracked
Black-headed Grosbeak	3	1	2	18	Mid Elevation Conifer	Point transect	Monitored
Blue Grosbeak	2	3	7	15	Plains/Basin Riparian	Point transect	Tracked
Lazuli Bunting	3	3	5	19	Montane Riparian	Line transect	Monitored
Indigo Bunting	3	3	8	14	Plains/Basin Riparian	Statewide survey	Tracked
Dickcissel	3	3	8	21	Shortgrass Prairie	Point transect	Tracked
Bobolink	2	3	7	19	Shortgrass Prairie	Statewide survey	Tracked
Red-winged Blackbird	3	2	1	11	Wetlands	Line transect	Monitored
Western Meadowlark	4	2	1	16	Shortgrass Prairie	Point transect	Monitored
Yellow-headed Blackbird	2	3	5	17	Wetlands	Line transect	Monitored
Brewer's Blackbird	4	3	5	14	Urban/Agricultural	Point transect	Monitored
Common Grackle	2	2	4	10	Plains/Basin Riparian	Line transect	Tracked
Brown-headed Cowbird	2	2	4	9	Urban/Agricultural	Point transect	Tracked
Orchard Oriole	2	3	7	17	Plains/Basin Riparian	Line transect	Tracked
Bullock's Oriole	3	2	2	17	Plains/Basin Riparian	Line transect	Monitored
Scott's Oriole	3	3	8	21	Juniper Woodland	Statewide survey	Tracked
Gray-crowned Rosy-Finch	2	3	8	16	Alpine Tundra	Point transect	Tracked
Black Rosy-Finch	3	3	8	22	Alpine Tundra	Point transect	Monitored
Brown-capped Rosy-Finch	3	3	8	23	Alpine Tundra	Point transect	Monitored
Pine Grosbeak	2	3	7	15	High Elevation Conifer	Point transect	Monitored

Common Name	AI	PT	PTU	PIF Score	Habitat	Technique	Result
Cassin's Finch	3	2	4	17	Mid Elevation Conifer	Point transect	Monitored
House Finch	2	5	2	12	Urban/Agricultural	Point transect	Monitored
Red Crossbill	4	3	6	17	High Elevation Conifer	Point transect	Tracked
White-winged Crossbill	3	3	8	16	High Elevation Conifer	Point transect	Tracked
Pine Siskin	3	3	5	12	High Elevation Conifer	Point transect	Tracked
American Goldfinch	2	3	5	12	Plains/Basin Riparian	Point transect	Tracked
Evening Grosbeak	3	3	8	14	Mid Elevation Conifer	Point transect	Monitored
House Sparrow	2	3	5	10	Urban/Agricultural	Point transect	Monitored

Table 17. Designations by habitat of potential partners with numbers of species expected to be monitored or tracked in each habitat. [a]

Habitat	Agency [b]	Expected Number of Species Monitored or Tracked [c]
	Uniform-block Habitats [d]	
Alpine Tundra	National Park Service	19
Juniper Woodland	Bureau of Land Management	28
Mountain-foothills Shrub	Bureau of Land Management	31
Shortgrass Prairie	Bureau of Land Management	33
Shrub-steppe	Bureau of Land Management	28
Aspen	U.S. Forest Service	39
High Elevation Conifer	U.S. Forest Service	39
Low Elevation Conifer	U.S. Forest Service	37
Mid Elevation Conifer	U.S. Forest Service	37
	Non-uniform-block Habitats [e]	
Plains/Basin Riparian	WY Department of Agriculture	31
Montane Riparian	WY Game and Fish Department	39
Wetlands	U.S. Fish and Wildlife Service	21
	Dispersed, Non-uniform, and/or Anthropogenic Habitats [f]	
Specialized Habitats	WY Game and Fish Department	
Urban/Agricultural	WY Department of Agriculture	

[a] Many species occur in several habitats. Therefore, we expect to obtain monitoring data on these species in each of the habitats in which they occur in reasonable abundance. These numbers are based on results from "Monitoring Colorado's Birds" 2000 data.

[b] Agencies which manage a majority (based on total acreage) of a particular habitat are listed next to that habitat. However, all participating agencies will benefit from "Monitoring Wyoming's Birds" due to the availability of monitoring data to all.

[c] See Methods for distinction between "monitored" vs. "tracked".

[d] Uniform-block habitats are those that we believe will be well sampled with random allocation of point transects.

[e] Non-uniform-block habitats are those that will require extra effort or somewhat different counting techniques due to the widespread, but localized or narrow aspects of those habitats.

[f] These habitats are not vegetation-based, are found across large elevational gradients, and host species specific to the habitat, but not necessarily the associated vegetation type. We do not anticipate allocating transects to these habitats; funding for these will be dispersed among other habitats, devoted to species-specific techniques, and/or used to interpret BBS data.

Table 18. Partners In Flight Breeding Bird Survey population trend scores for Wyoming's breeding birds by habitat. Scores of 4 and 5 indicate declines, 1 and 2 indicate increases or stable populations, and a score of 3 denotes unknown status.

Habitat	Population Trend Score					Number of Species
	1	2	3	4	5	
Wetlands	1	3	46	3	2	55
Plains/Basin Riparian	2	12	31	5	2	52
High Elevation Conifer	1	2	14	0	2	19
Mid Elevation Conifer	1	3	13	0	1	18
Shortgrass Prairie	0	3	10	3	1	17
Montane Riparian	1	3	10	2	0	16
Juniper Woodland	0	0	12	0	0	12
Urban/Agricultural	0	4	6	0	2	12
Shrub-steppe	0	2	5	3	1	11
Specialized Habitats	0	3	4	1	1	9
Mountain-foothills Shrub	0	2	7	0	0	9
Aspen	0	4	4	0	0	8
Alpine Tundra	0	0	5	0	0	5
Low Elevation Conifer	0	1	2	0	0	3
Totals	**6**	**42**	**169**	**17**	**12**	**246**

Table 19. Glossary of survey techniques.

Term	Definition
	Transect-based Efforts
Line transect (Plains/Basin Riparian)	Thirty "float" transects [1 mile (1.6 km) in length] using line-transect methodology (Buckland et al. 1993). Starting points are randomly located on navigable rivers (<5500 feet in elevation) selected at random from available sites. Density estimates for bird species are derived using program DISTANCE (Thomas et al. 1998).
Line transect (Wetlands)	Thirty line transects [985 feet (300 m) in length] using line-transect methodology (Buckland et al. 1993). Start points are randomly located in wetland stands randomly selected from available sites. Density estimates for bird species are derived using program DISTANCE (Thomas et al. 1998).
Nocturnal transect	Forty-five road-based transects [19 miles (30 km) in length; 1 mile (1.6 km) between stops] in montane areas (i.e. BCR 16) using point-transect methodology (Buckland et al. 1993). Start points were determined systematically by overlaying grid intersections and selecting the closest point on a road to each intersection, utilizing only secondary and tertiary roads that are accessible during the requisite seasons. Density estimates for bird species are derived using program DISTANCE (Thomas et al. 1998). Each transect was allocated to early, mid, and/or late season (March/April, June, and September, respectively) in order to survey for different species. The fall transects were conducted solely to obtain data on Boreal and Northern Saw-whet Owls at a season in which roads are accessible in their high elevation habitats (Stahlecker 1997). We attempted to do these transects in BCR 18, but the resultant data were too few for analysis.
Point transect	Thirty 15-point transects [820 feet (250 m) between points] in each of 12 habitats, following point-transect methodology (Buckland et al. 1993). Habitat stands were selected at random from available stands within a habitat type. Start points and transect bearings were determined randomly. Counts duration at points is five minutes. Individual transects are the sampling units. Density estimates for bird species are derived using program DISTANCE (Thomas et al. 1998).

Table 19. Continued.

Term	Definition
	Species-specific Efforts
Colony count	A count of all nesting individuals at colony sites. For colonially-breeding herons, this can take the form of one of two methods: 1) actual counts of occupied nests, or 2) counts of adults observed at the colony site, depending on the species and colony site access. Counts are seasonally timed to maximize the number of breeding adults and minimize the number of transient individuals.
Expert survey	We receive information from birders across the state as to locations and numbers of accidental and peripheral breeders. Little or no effort is expended by RMBO in obtaining this information. This includes information gathered from government agencies on species for which surveys are already conducted.
Statewide survey	A statewide estimate of all individuals of a target species, based on counts during prime breeding period at all known breeding localities.
	Unmonitored Species
N/A	This designation implies that these species are either game species or are federally Threatened & Endangered species for which specific legislatively mandated monitoring programs already exist. MWB does not specifically target efforts at these species, which enables us to avoid duplication of effort and focus on currently unmonitored species.

Table 20. Number and percent of regularly-breeding bird species that MWB will monitor and track per survey method.

Method	No. Species Monitored (%)	No. Species Tracked (%)	Total	Percent of Total (n=246)
	Transect-based Techniques			
Point transect	76	69	145	58.9
Line transect	8	8	16	6.5
Nocturnal transect	1	10	11	4.5
Total, transect-based techniques	85 (34.5)	87 (35.4)	172	69.9
	Species-specific Techniques			
Statewide survey	1	14	15	6.1
Colony count	15	4	19	7.7
Expert survey	0	6	6	2.4
Total, special techniques	16 (6.5)	24 (9.8)	40	16.3
	Not Monitored Under MWB			
Threatened & Endangered	0	1	1	0.4
Game species	0	33	33	13.4
Total, political designations	0	34 (13.8)	34	13.8
Total	**101**	**145**	**246**	**100.0**

Table 21. Proposed budget to perform monitoring in one habitat under MWB based on "Monitoring Colorado's Birds" 2000 figures.

Item	Cost
Personnel	
45 days [a] (2.25 months) of technician time ($1700/month)	$3,825
Organization/analysis/report (senior staff for 3 weeks @ $2,800/month)	$2,100
Taxes and benefits (12.46%)	$738
Personnel subtotal	$6,663
Logistics	
Mileage (3,300 miles x 0.28/mile)	$924
Lodging (18 nights @ $40/night)	$720
Field food (45 days x $15/day)	$675
Logistics subtotal	$2,319
Indirect/overhead (15.10%)	$1,356
Total (per habitat)	$10,338

[a] Field personnel conduct 1 transect per day in the morning, scout the next day's transect in the afternoon and, whenever possible, conduct species-specific surveys in the afternoon. Staff time includes pre-season training and post-season data entry.

Research Needs

Research needs will become more apparent once the inventory and monitoring needs have been met. Therefore, research needs will be addressed in a later version of the Wyoming Bird Conservation Plan.

Riparian Habitat Group

Montane Riparian

1) Describe the habitat:

a) Historic conditions: Habitat was greatly influenced by beaver; dominant species probably included willows, alder, dogwood, mountain maple, and water birch; more of an aspen component as stringers came down to and blended with actual riparian habitat.

b) Present conditions: Dominated by willows, alder, dogwood, mountain maple, and water birch; can include narrowleaf cottonwood, spruce, and sedges/rushes; occurs in a mountain setting. Changes associated with historic and present conditions are not as great as in Plains/Basin Riparian. Conifers are more of an associated component as aspen stringers become crowded out. Less beaver influence and more focused grazing and browsing by both wildlife ungulates and livestock.

2) Identify the issues:

a) Use: Recreation and accessibility have increased over historic use; increased road intrusion, receives more focused use by all user groups (livestock, wildlife, recreation).

b) Access: Where there is access for humans, areas that have less use are due to topographic limitations; accessible areas are heavily used.

c) Problems: Increased recreation (outfitters/guides, pack trips, hikers, off-road vehicles, etc.), incompatible livestock grazing, and timber harvest operations (road building, sedimentation, down-cutting, channelization, and habitat loss due to impacts).

d) What has been the cause of change to the habitat: Higher density of trees causing transpiration and reducing the underground aquifer; fire suppression; beaver removal; and increased human use.

3) Best Management Practices:

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

Riparian Best Management Practices would appear here in this section, but were already presented in the Plains/Basin Riparian habitat section.

4) Highest priority bird species and their habitat requirements (note: see Tables 6-9 for a description of status information for each species)**:**

Bald Eagle (*Haliaeetus leucocephalus*), Level I, CA, M, Score = 21, AI = 3, PT = 3, would appear here based on priority, but this species will not be addressed in the Wyoming Bird Conservation Plan because issues, management strategies, and population goals are already addressed in the Bald Eagle Recovery Plan.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Calliope Humming-bird (CAHU) *Stellula calliope* Level II M, R Score = 23 AI = 5 PT = 3	~Meadows, parks, and thickets within conifers and alders ~Riparian corridors are important during migration	~May be most common in second growth after fire or logging (promotes flowers for feeding) ~Uses understory and midstory levels in the canopy	~Elevation 4,500 to 8,500 feet (data from Big Horn Mountains)	~Dead twigs for perching ~Edge effect important ~Early, mid, and late succession ~Patchy habitat	~Breeding restricted to Big Horn Mountains and NW Wyoming ~Usually responds negatively to grazing ~May feed at sapsucker wells ~Often reuses old nest ~Winters in Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Harlequin Duck (HARD) *Histrionicus histrionicus* Level II M, P Score = 20 AI = 3 PT = 3		~Dense streamside shrubs ~Overhanging vegetation	~Remote mountain streams ~Good water quality	~Sections of stream with low gradient (<5%), braided channels, sections with swift currents ~Mid and late succession	~Strong fidelity to breeding streams and natal areas ~Requires abundant aquatic insects ~Arrives in WY late April; by mid July most males and nonbreeding females depart; females with young depart from mid August to late September ~Winters in coastal North America

Willow Flycatcher (*Empidonax traillii*), Level II, M, Score = 20, AI = 3, PT = 4, would appear here based on priority, but this species was already addressed in the Plains/Basin Riparian habitat section.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Hammond's Flycatcher (HAFL) *Empidonax hammondii* Level II M Score = 20 AI = 2 PT = 3	~Conifers ~Aspen ~Willow riparian	~High structure ~Well-developed ground cover	~Elevation >6,500 feet	~Late succession ~Old stands (80 to 90 years) of >25 acres	~May be adversely affected by logging ~Nests high in canopy ~Winters in Mexico and Central America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Cordilleran Flycatcher (COFL) *Empidonax occidentalis* Level II M Score = 20 AI = 3 PT = 3	~Conifers ~Aspen ~Especially near water	~Both low and high structure ~Dense canopy closure and shady conditions ~Forages beneath tree crowns ~>2 snags per acre	~Drainages important to create cool microclimate	~Trees of mid to late succession	~Winters in Mexico and Central America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
American Dipper (AMDI) *Cinclus mexicanus* Level II M Score = 20 AI = 3 PT = 3	~Stream-side habitat is not important	~Not important	~Clear, unpolluted water ~Streams rarely exceed 50 feet wide and 7 feet deep	~Stream bottom with rocks, sand, and gravel ~Cliff or rock wall (or bridge) near stream for nest placement	~Winters in North America

Broad-tailed Hummingbird (*Selasphorus platycercus*), Level II, M, Score = 18, AI = 2, PT = 2, would appear here based on priority, but this species was already addressed in the Plains/Basin Riparian habitat section.

MacGillivray's Warbler (*Oporornis tolmiei*), Level II, M, Score = 17, AI = 3, PT = 1, would appear here based on priority, but this species was already addressed in the Plains/ Basin Riparian habitat section.

5) Biological objectives and recommendations:

Calliope Hummingbird

Found in all mountainous areas of Wyoming, although most sightings are from the western portion of the state. Frequents meadows and canyons, riparian aspen stands and willow thickets, and other shrubby areas within coniferous forests in the mountains. Prefers timbered stands near water with a low to intermediate canopy cover. Builds a small lichen and moss cup nest covered with spider's silk, from 2 to 70 feet above ground on a branch with small knots of dead mistletoe or pine cones, which resemble the nest, frequently within riparian areas. May reuse old nest. Eggs [2, 0.5 inch (12 mm)] are white. Feeds mainly on nectar, preferably from red flowers, but also eats small insects and spiders. Winters in Mexico. Populations respond negatively to incompatible livestock grazing that eliminates or degrades vertical diversity needed for nesting and foraging. Other species that may benefit from habitat management for this species include the Harlequin Duck, Northern Goshawk, Williamson's Sapsucker, Black-backed Woodpecker, Rufous Hummingbird, Three-toed Woodpecker, Cordilleran Flycatcher, Western Tanager, and Cassin's Finch.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Calliope Hummingbird in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Manage stands for an open to intermediate canopy cover to ensure growth of flowering plants as a food source for Calliope Hummingbirds.

2) Reduce impacts to flowering plants from recreation, grazing, and wildlife foraging.

3) Maintain conifer stands near water with low to intermediate canopy cover for Calliope Hummingbird nesting sites.

Recommendations

1) Implement forest management practices that encourage a variety of seral stages, including those that perpetuate some early successional plant communities.

2) Monitor impacts to flowering plants from recreation, grazing, and wildlife foraging and modify management, if necessary, to ensure flowering plants are available as a food source to Calliope Hummingbirds.

Harlequin Duck

Found only in the northwestern corner of Wyoming. Prefers cold, shallow, rapid mountain streams. Nests on the ground or in a tree cavity. Nest is a mass of down concealed in a rock crevice or cavity along a stream. Eggs [6 to 8, 2.3 inches (58 mm)] are pale buff or cream colored. Is a diving duck that eats crustaceans, mollusks, insects, and fish. Winters in marine waters along the Pacific coast. Nesting success is impacted by stream degradation due to sedimentation, channelization, logging, and incompatible livestock grazing. Other species that may benefit from habitat management for this species include the Bald Eagle, Calliope Hummingbird, Willow Flycatcher, American Dipper, Lazuli Bunting, Veery, and Bullock's Oriole.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Harlequin Duck in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain water quality in high elevation mountain habitats by eliminating or limiting habitat changes that are detrimental to Harlequin Ducks, such as tie hack logging, sediment loading, and development.

2) Avoid clearing debris from high elevation mountain streams to ensure Harlequin Duck nesting and feeding habitat is present.

Recommendations

1) In areas where Harlequin Ducks nest, ensure that old growth occurs in and around premier streams, and that recreation, grazing, forest management, and logging do not impact preferred nesting habitat.

2) In areas where Harlequin Ducks nest, maintain high water quality and stream stretches with high densities of invertebrates.

Willow Flycatcher

The Willow Flycatcher is also a priority species in Plains/Basin Riparian habitat, and was addressed in that section.

Hammond's Flycatcher

Found in the western and south-central mountains of Wyoming. Inhabits tall, moist, closed-canopy montane conifer forests, sometimes with deciduous understory, such as aspen. Nest site is cool and well shaded. Builds a cup nest of bark strips, grasses, and plant down lined with hair, moss, and feathers in the fork of a small tree or on a horizontal branch of a large conifer or deciduous tree, usually 25 to 40 feet above ground. Eggs [3 to 4, 0.7 inch (18 mm)] are creamy white. Feeds exclusively on insects, usually flying insects caught in the air, in the middle portions of tall conifers and aspens. Winters in southern Arizona, Mexico, and Central America. Logging may adversely affect this species by removing nesting habitat and altering microsite climate. Other species that may benefit from habitat management for this species include the Northern Goshawk, Black-backed Woodpecker, Blue Grouse, Clark's Nutcracker, Mountain Chickadee, Western Tanager, and Cassin's Finch.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Hammond's Flycatcher in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain dense coniferous forests that are well shaded with a deciduous/aspen component in higher elevations where Hammond's Flycatchers occur.

Recommendations

1) Leave stands of mature and climax conifers adjacent to aspen groves in higher elevations where Hammond's Flycatchers occur.

Cordilleran Flycatcher

Found throughout most of the mid elevation mountains of Wyoming in a variety of wooded habitats, but prefers moist, shaded forests. Also inhabits canyon bottoms and riparian woodlands. Requires a sheltered nest site near water. Builds a moss-lined cup nest of small twigs and rootlets in a variety of sites including a cavity in a small tree, streambank, roots of an upturned tree, cliff ledge, and building eaves. Nests from ground level up to 30 feet above ground. Eggs [3 to 4, 0.7 inch (17 mm)] are white to creamy and spotted with browns. Is a rare cowbird host. Feeds mainly on insects and spiders caught in the air or gleaned while hovering, but also eats a few seeds. Winters in Mexico. Is negatively affected by loss of mid to late successional tree stands due to logging, fire, and development. Other species that may benefit from habitat management for this species include the Northern Goshawk, Calliope Hummingbird, Williamson's Sapsucker, Black-backed Woodpecker, Three-toed Woodpecker, Warbling Vireo, and Cassin's Finch.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Cordilleran Flycatchers have been detected on 29 BBS routes in Wyoming, including 7 routes on which they were observed a minimum of 3 years.

a) Maintain Cordilleran Flycatchers on the 29 BBS routes on which they were observed (Figure 10).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 22).

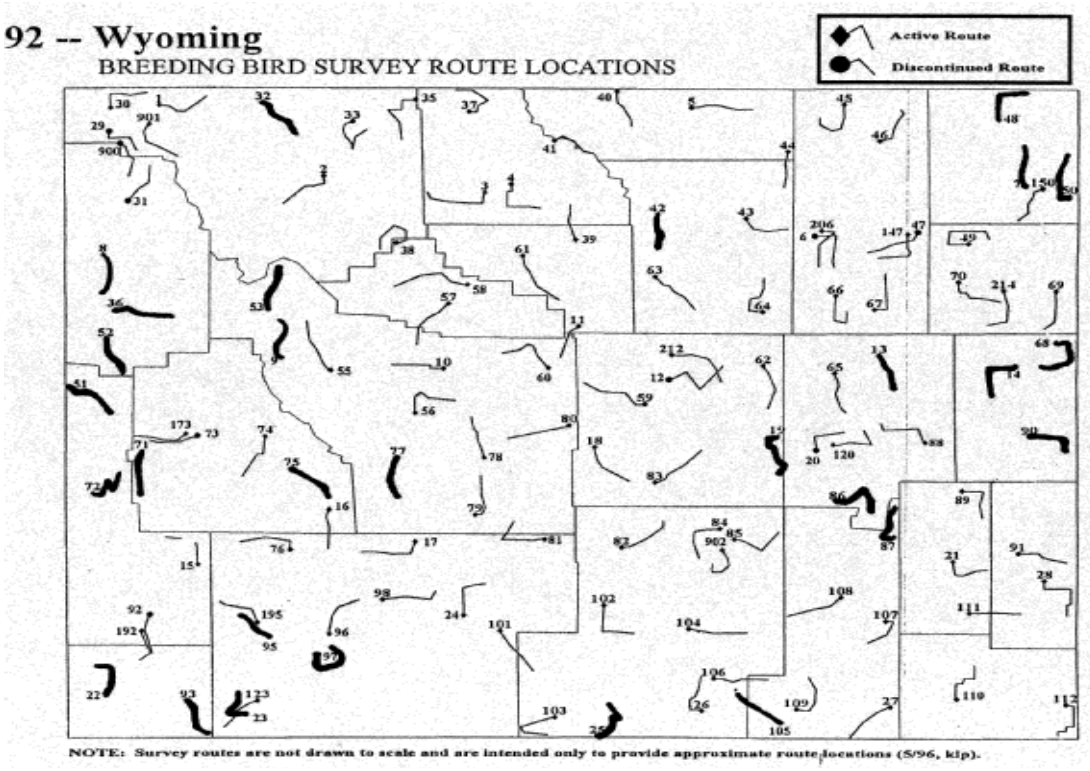

Figure 10. Bold lines indicate Breeding Bird Survey routes on which Cordilleran Flycatchers have been observed from 1968 through 1998.

Table 22. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Cordilleran Flycatchers were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
007 Sundance	4	1.96
008 Colter Bay	1	0.08
009 Dubois	2	0.37
013 Bill	1	0.17
014 CHANGED TO 214	1	0.04
019 Brookhurst	1	0.07
022 Cumberland	2	0.21
023 CHANGED TO 123	1	0.14
025 Savery	1	0.40
032 Hunter Peak	1	0.08
036 Moose	4	0.74
042 Crazy Woman	2	1.00
048 Seely	1	0.11
050 Moskee	2	1.50
051 Alpine	3	0.80
052 Wilson	1	0.05
053 Horse Creek	1	0.06
068 Riverview	(1)	0.27
071 Soda Lake	5	0.57
072 Buckskin Mountain	1	0.20
075 Big Sandy	1	0.10
077 Fiddler Lake	1	0.14
086 Warbonnet	2	1.00
087 Fletcher Park	3	0.59
090 Lusk	(2)	0.46
093 Mountain View	(2)	2.56
095 CHANGED TO 195	(2)	2.25
097 Rock Springs	(2)	1.67
105 Fox Park	2	0.29

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the maximum number of stops out of 50 on which species was observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Where Cordilleran Flycatchers occur, manage coniferous forests to include trees of mid to late succession; >2 snags per acre; diverse plant structure; and moist, shaded microsites, including sheltered sites near water for nesting.

Recommendations

1) Implement forest management practices that provide moist, shaded microsites and a variety of seral stages, especially moderately old and older trees with dense canopy closure, for Cordilleran Flycatcher foraging and nesting sites.

American Dipper

Found throughout the mountains of Wyoming, except in the Black Hills. Requires clear, rapidly flowing mountain streams, and inhabits coniferous forests up to timberline. Builds an oven-like nest with a side entrance, insulated with moss and grass. Nest is usually built over water, either under an overhanging rock, behind a waterfall, under roots, or under a bridge in a damp location. Eggs [4 to 5, 1 inch (26 mm)] are white. Feeds on aquatic invertebrates and snails taken from rocks under the water, and also takes very small fish. Is a year-round resident in Wyoming, but moves to lower elevations with open water during the winter. Nesting and foraging is impacted by stream degradation due to sedimentation, channelization, logging, and incompatible livestock grazing. Other species that may benefit from habitat management for this species include the Harlequin Duck, Bald Eagle, Calliope Hummingbird, Willow Flycatcher, Lazuli Bunting, Veery, and Bullock's Oriole.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the American Dipper in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain fast flowing, clear mountain streams with abundant invertebrates in areas where American Dippers occur by eliminating or limiting detrimental habitat changes, such as logging, sediment loading, and development.

Recommendations

1) Manage for high water quality and abundant invertebrates in areas occupied by American Dippers during both the breeding and non-breeding seasons [as a reference, one pair of American Dippers will defend a stretch of stream up to 1,050 feet (320 m) in length during the breeding season].

2) In areas occupied by American Dippers, avoid activities such as logging and development that cause degradation or sedimentation of aquatic habitat.

Broad-tailed Hummingbird

The Broad-tailed Hummingbird is also a priority species in Plains/Basin Riparian habitat, and was addressed in that section.

MacGillivray's Warbler

The MacGillivray's Warbler is also a priority species in Plains/Basin Riparian habitat, and was addressed in that section.

6) Inventory, monitoring, and research needs:

Inventory and Monitoring Needs

"Monitoring Wyoming's Birds: The Plan for Count-based Monitoring" would appear here, but was previously presented under Inventory and Monitoring Needs in the Plains/Basin Riparian habitat section.

Research Needs

Research needs will become more apparent once the inventory and monitoring needs have been met. Therefore, research needs will be addressed in a later version of the Wyoming Bird Conservation Plan.

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, 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 (flowering plants). 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, 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 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, 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 vehicles, 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 napweed, thistles, and leafy spurge; cheatgrass; yellow sweet clover; 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 American 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 (stock ponds and reservoirs, guzzlers, and stock tanks). Riparian forest development along streambeds within the shortgrass prairie has created linear forests that enable many species to move farther onto (and even across) the grasslands, causing contact and potential hybridization between distinct but closely related species. 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 (however, 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 (*Stipa* spp.) and decrease the shorter grasses (*Fescue* spp.). Fencing has changed the way the land is being used.

3) 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 11). (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.

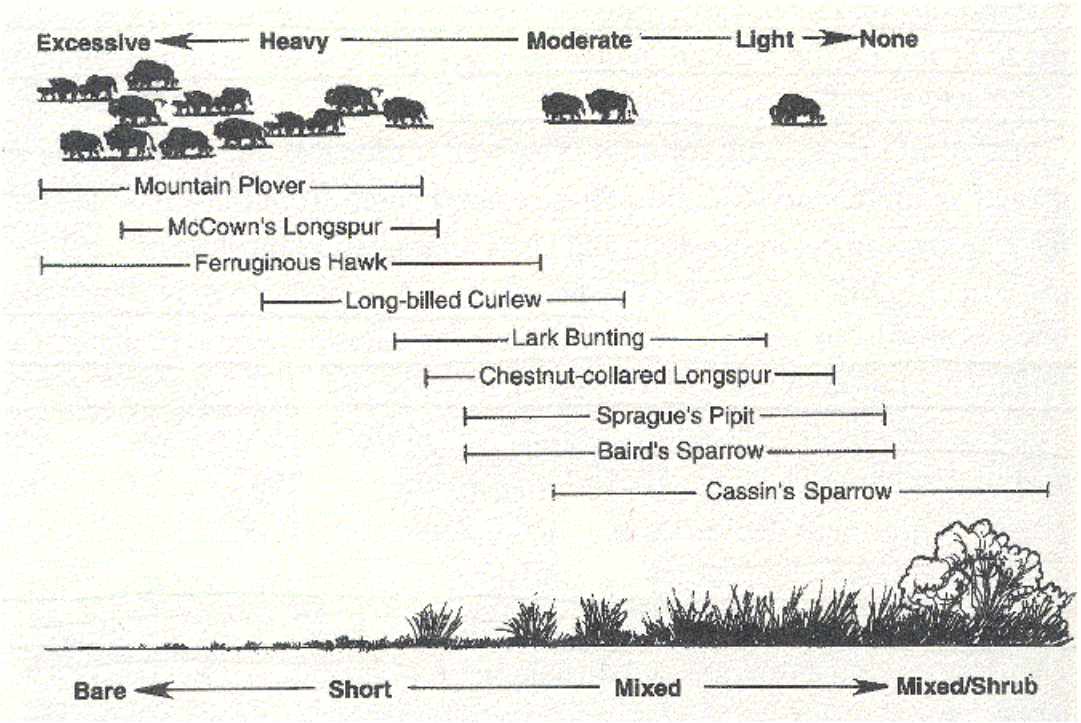

Figure 11. Distribution of different species of prairie birds across grasslands subject to different intensities of grazing (from Sampson and Knopf 1996).

A simple set of guidelines for grassland management in Wyoming will not work for all species of birds using those habitats. A variety of habitats 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 more dense. 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.

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 level, 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 level, 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 level, 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 12).

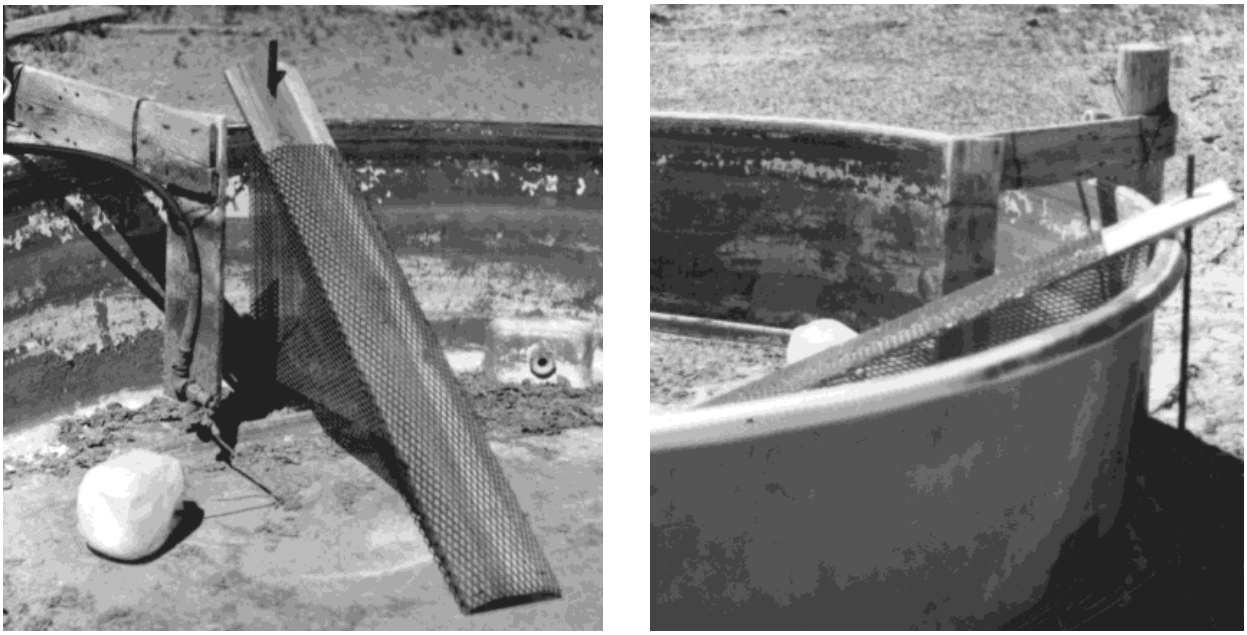

Figure 12. Escape ramps placed in stock tanks and troughs to prevent drowning of small birds and mammals (photographs courtesy of Mark Gorges, Bureau of Land Management).

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 (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.

Agricultural

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 agricultural 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) for management of undesirable weeds and arthropods. 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 agricultural 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 Burrowing 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, please 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 1st 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 agriculture, 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 rehabilitation 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 non-native weeds in your grassland through intensive mowing, hand-pulling, grazing, or herbicides. In some sites, prescribed burning may enhance native plant growth and reduce non-native, 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 supervisor 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 either done 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 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 wide, or 50 feet wide or more for downwind fire lines).

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.

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4) Highest priority bird species and their habitat requirements (note: see Tables 6-9 for a description of status information for each species)**:**

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Mountain Plover (MOUP) *Charadrius montanus* Level I CA, M, R Score = 28 AI = 4 PT = 3	~Shortgrass prairie ~Mid-grass grasslands ~Sagebrush-grasslands	~Vegetation height of ≤4 inches ~Low structure	~Slope <12%	~Early succession ~At least 30% bare ground around nest	~Heavy livestock grazing may be beneficial ~Selectively inhabits prairie dog towns ~Sensitive to disturbance during nesting ~Double-clutches ~Winters in Mexico

Note: Baird's Sparrow would have appeared here, but the AI (Area Importance) score for this species was reduced from 3 to 2 by WY-PIF participants because of the current peripheral and limited breeding range of this species in Wyoming. Therefore, the Baird's Sparrow will not be included as a priority species in the Wyoming Bird Conservation Plan, Version 1.0.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
McCown's Longspur (MCLO) *Calcarius mccownii* Level I CA, M Score = 26 AI = 3 PT = 2	~Shortgrass prairie ~Mid-grass grasslands ~Basin-prairie shrublands	~Low structure ~Shrub component must be both low density and low height ~Open landscape with low vegetation height		~Early succession ~45 to 80% grass cover and 15 to 25% bare ground for nesting	~Livestock grazing may be beneficial ~Uncommon cowbird host ~Winters in Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Ferruginous Hawk (FEHA) *Buteo regalis* Level I CA, M Score = 23 AI = 4 PT = 3	~Vegetation that supports rabbit, ground squirrel, prairie dog, and pocket gopher populations	~Vegetation height of 6 to 24 inches	~Elevation 4,500 to 7,500 feet	~Open landscape ~Level or rolling terrain ~Rock outcrops, hills, buttes, cliff tops, or isolated trees (if available) for nest site placement ~Tree nests are 6 to 40 feet above ground ~Prefer 250 acres or more for nesting	~Very susceptible to human disturbance during nesting (lower reproductive success with increased disturbance) ~Will use artificial nest structures ~Recommend a 1 mile buffer around the nest from 1 April through 31 July ~Frequent nest site fidelity ~Moderate livestock grazing may be beneficial for prey abundance ~Fire can be beneficial (leave 15% in undisturbed condition on a landscape scale) ~Winters in Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Long-billed Curlew (LBCU) *Numenius americanus* Level I CA, M Score = 21 AI = 2 PT = 3	~Moist meadow grasslands ~Shortgrass prairie ~Mid-grass grasslands ~Sagebrush grasslands ~Eastern WY = blue grama, fringed sagewort, hairy golden aster, little bluestem, prairie sand reed, Idaho fescue	~Short vegetation for nesting (≤4 to 12 inches) ~Bare ground component needed ~Low structure with some taller patchiness to provide necessary shade	~Flat to moderate topography	~Late succession prairie and grassland ~5% in tall vegetation state for chick survival ~5 acres per breeding pair ~Nests are ≥750 feet apart	~Abundant invertebrate prey needed ~Sensitive to habitat fragmentation ~Pre-nesting grazing may be beneficial ~Winters in coastal areas to Central America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Short-eared Owl (SEOW) *Asio flammeus* Level I CA Score = 20 AI = 3 PT = 3	~Grasslands ~Shrub-steppe	~High and low structure ~Open, large grasslands ~Dense vegetation to support prey base ~Vegetation height of ≤1.6 feet	~Elevation <7,000 feet	~Both early and late succession ~Fire may increase nesting cover and cover for prey base	~Presence of rodents, especially *Microtus* spp., necessary ~Long-term or heavy livestock grazing can be detrimental ~Abundance of prey may cause population irruption ~Winters in Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Burrowing Owl (BUOW) *Athene cunicularia* Level I CA, M Score = 19 AI = 2 PT = 4	~Shortgrass prairie ~Mid-grass grasslands ~Basin-prairie shrublands ~Buffalograss, blue grama, sandberg bluegrass, needle-and-thread grass	~Low structure		~Early succession ~Fragmented habitat is detrimental and may cause competition ~Limited ability to disperse	~Mainly associated with prairie dog towns ~Livestock grazing can be beneficial ~Strong nest site (burrow) fidelity ~Eliminating burrowing mammals is problematic ~Winters in Mexico and Central America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Upland Sandpiper (UPSA) *Bartramia longicauda* Level I CA, M Score = 18 AI = 2 PT = 2	~Shortgrass prairie ~Mid-grass grasslands ~Prairie junegrass, Kentucky bluegrass, green needlegrass, needle-and-thread grass, little bluestem, crested wheatgrass	~Tall enough to conceal nests (typically 6 to 12 inches or more), with up to 50% forbs, few shrubs, and little bare ground ~Moderate to dense litter cover ~Patchiness - shorter vegetation for foraging, taller vegetation for nesting, and moderate vegetation for brood-rearing		~Fire can create desired habitat patchiness	~Nests are concealed by grass ~Use rock piles, stumps, or fence posts for displaying ~Heavy livestock grazing can be detrimental, but low to moderate grazing can create habitat patchiness ~Winters in South America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Lark Bunting (LARB) *Calamospiza melanocorys* Level II M Score = 22 AI = 4 PT = 4	~Highly variable vegetation associations (prairie grasslands and shrublands)	~Open grasslands with a mix of short and tall grass and scattered shrubs ~Sagebrush shrub-steppe with grassy openings ~Nest in areas with 60 to 70% low grass cover and 10 to 15% bare ground ~10 to 30% shrub or tall grass cover needed for nest protection and perch sites		~Will not nest in areas with less than 30% grass cover or more than 60% bare ground	~Nest concealment is important ~Heavy livestock grazing can be detrimental, but low to moderate grazing can create habitat patchiness ~Numbers can be highly variable between years ~Winters in Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Dickcissel (DICK) *Spiza americana* Level II M, P Score = 21 AI = 3 PT = 3	~Mid-grass grasslands	~Dense cover of grasses and forbs ~Moderately deep layer of ground litter		~Is area sensitive; to maintain a moderate population a minimum of 25 to 75 acres of optimal habitat is needed	~Heavy livestock grazing can be detrimental, but low to moderate grazing and light burning can be beneficial ~Common cowbird host ~Winters in Mexico, Central America, and South America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Chestnut-collared Longspur (CCLO) *Calcarius ornatus* Level II M Score = 21 AI = 2 PT = 3	~Shortgrass prairie ~Mid-grass grasslands ~Basin-prairie shrublands ~Avoids nesting in cultivated fields	~High and low structure ~Denser, more vegetated prairie than McCown's Longspur ~Uses large rock, shrub, or fence post for singing perch	~Moist areas preferred	~High and low succession	~Heavy livestock grazing of shortgrass prairie can be detrimental, but moderate grazing in taller grasslands can be beneficial ~In WY, breeds only in the eastern portion ~Winters in Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Grass-hopper Sparrow (GRSP) *Ammodra-mus savannarum* Level II M Score = 19 AI = 3 PT = 5	~Mid-grass grasslands ~Grassy areas within basin-prairie shrublands ~Moist meadow grasslands	~High structure ~Continuous, tall herbaceous cover and conspicuous singing perches ~Ground cover and thatch ~Limited (5%) or no canopy cover		~Late succession ~Up to 35% bare ground for foraging ~Avoids areas with >35% shrub cover ~Burn after the breeding season to suppress woody cover ~Prefers large tracts for nesting	~Heavy livestock grazing can be detrimental, but low to moderate grazing and light burning can be beneficial ~Sensitive to fire prior to nesting ~Cyclic populations due to wet/dry cycles ~Uncommon cowbird host ~Winters in South America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Bobolink (BOBO) *Dolichonyx oryzivorus* Level II M Score = 19 AI = 2 PT = 3	~Mid-grass grasslands ~Irrigated or moist meadows ~Alfalfa	~High structure ~Dense stands of tall vegetation (both native and cultivated) for nests		~Late succession ~Prefers large areas of habitat (e.g. areas >75 acres had more than two times the density of males than areas <25 acres)	~Heavy livestock grazing can be detrimental, but low to moderate grazing and light burning can be beneficial ~Nests in cultivated areas may be destroyed by agricultural operations; modifying operations can increase nest success ~Uncommon cowbird host ~Winters in South America

5) Biological objectives and recommendations:

Mountain Plover

Found in shortgrass prairie and shrub-steppe habitats across Wyoming. Inhabits arid shortgrass prairies dominated by blue grama and buffalo grass with scattered clumps of cacti and forbs; is also found in low and open vegetation, such as prairie dog towns and saltbush habitats of the shrub-steppe of central and western Wyoming. Nests in a shallow depression on the ground, sometimes lined with grass, in flat terrain with very short grass and a high proportion of bare ground, frequently in prairie dog towns. Eggs [3, 1.5 inches (38 mm)] are dark olive or buff, marked with dark brown or black blotches. Gleans its food from the ground. Feeds primarily on insects such as beetles, grasshoppers, crickets, and ants, and also on spiders. Obtains sufficient water from its food. Winters in southern Baja, California and northern Mexico. Populations have declined due to conversion of native shortgrass prairie to cropland, urbanization (especially on the wintering grounds), eradication of prairie dogs, oil and gas development, and plowing and planting on the nesting grounds (nests are destroyed by planting or tilling, or are abandoned when crops grow taller than a few inches). Other species that may benefit from habitat management for this species include the McCown's Longspur, Long-billed Curlew, Burrowing Owl, and Horned Lark.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Mountain Plovers have been detected on 21 BBS routes in Wyoming, including 3 routes on which they were observed a minimum of 3 years.

a) Maintain Mountain Plovers on the 21 BBS routes on which they were observed (Figure 13).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 23).

3) Increase monitoring in suitable habitat where monitoring is presently not being conducted and maintain monitoring in areas where it is currently in place.

4) Manage populations for an upward trend within the preferred habitat on a landscape scale by implementing recommendations in the grassland Best Management Practices and working with Bird Conservation Region partners.

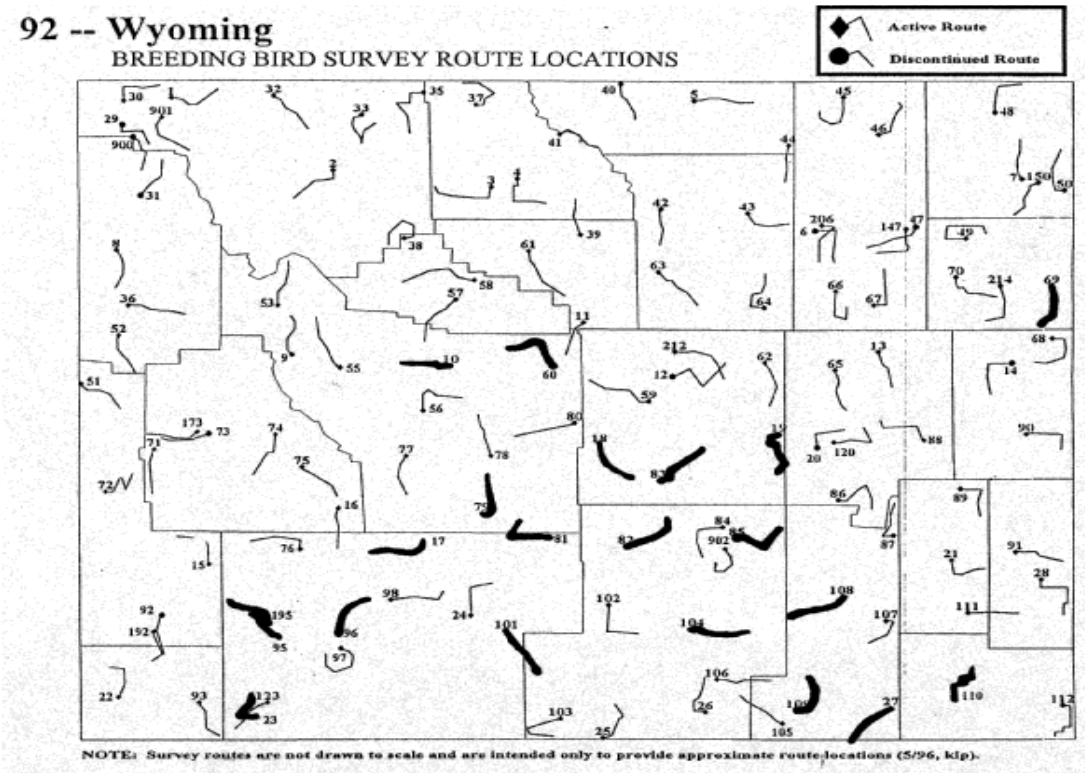

Figure 13. Bold lines indicate Breeding Bird Survey routes on which Mountain Plovers have been observed from 1968 through 1998.

Table 23. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Mountain Plovers were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
010 Midvale	1	0.14
017 Bear Creek	2	1.48
018 Ervay	1	0.13
019 Brookhurst	1	0.04
023 CHANGED TO 123	1	0.14
027 Buford	1	0.27
060 Lysite	2	0.33
069 Newcastle	1	0.10
079 Sweetwater	1	0.26
081 Bairoil	2	0.20
082 Lamont	1	0.25
083 Pathfinder	1	0.07
085 Shirley	3	2.36
095 CHANGED TO 195	1	0.38
096 Reliance	1	0.13
101 Wamsutter	2	0.50
104 Walcott	2	0.25
108 Rock River	5	1.86
109 Harmony	7	3.00
110 Cheyenne	(2)	0.35
195 Seedskadee	1	0.38

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the maximum number of stops out of 50 on which species was observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Minimize loss of shortgrass prairie habitat by reducing urban and suburban sprawl, habitat fragmentation, and habitat conversion.

2) On a landscape scale, maintain portions of shortgrass prairie habitat in low structure, an early seral stage, and with some bare ground in a mosaic that is well distributed throughout this habitat type.

3) Manage prairie dog colonies to enhance Mountain Plover habitat.

Recommendations

1) Monitor grass height, and use a combination of grazing and prescribed burning to eliminate woody vegetation that grows higher than the native grasses and to maintain habitat in an early successional stage.

2) Vary grazing pressure on a landscape level by interspersing areas of heavy, light, and non-grazing. Graze shortgrass or mixed grass habitats at moderate to heavy intensities in summer, late winter, or early spring in areas where Mountain Plovers occur. Employ high intensity grazing from mid-February through mid-May at specific nesting sites used by Mountain Plovers to maintain preferred vegetation structure at these sites.

3) Conduct prescribed burning in late summer or early fall to promote vegetation and habitat characteristics required by Mountain Plovers.

4) Reduce or eliminate prairie dog control in areas inhabited by Mountain Plovers.

5) Avoid fragmenting existing tracts of shortgrass prairie habitat.

6) Avoid tilling existing shortgrass prairie habitat and seeding with exotic grasses.

7) Limit insect control, especially for grasshoppers, beetles, crickets, and ants, in areas where Mountain Plovers occur.

8) Avoid tree planting in shortgrass prairie habitat. This also fragments grassland habitats, and can increase parasitism by cowbirds and predation by crows, grackles, and jays.

9) Protect areas traditionally used by Mountain Plovers, as some individuals return to the same sites year after year.

10) Restrict oil, gas, and recreational activities near Mountain Plover habitat during the peak breeding season (April through July).

11) Fix leaking or overflowing livestock water tanks in areas managed for Mountain Plovers.

Baird's Sparrow

The AI (Area Importance) score for this species was reduced from 3 to 2 by WY-PIF participants because of the current peripheral and limited breeding range of this species in Wyoming. Therefore, the Baird's Sparrow will not be included as a priority species at this time. However, other species that would respond similarly to management for this species includes the Dickcissel, Bobolink, Grasshopper Sparrow, and Sprague's Pipit.

McCown's Longspur

Found in open, dry, sparsely vegetated areas across most of Wyoming. Prefers shortgrass prairie and basin-prairie shrubland habitats, and also inhabits plowed and stubble fields, grazed pastures, dry lakebeds, and other sparse, bare, dry ground. Builds a simple grass cup nest on the ground in a shallow, natural or scraped depression at the base of grass or cactus. Eggs [3 to 4, 0.8 inch (20 mm)] are white or light gray to olive, marked with light brown, purple, or gray blotches. Is an uncommon cowbird host. Forages on the ground on weed and grass seeds and insects, especially grasshoppers. Winters south to northern Mexico. Population declines and range contractions are due to loss of breeding and wintering habitat from fire suppression and conversion of prairie habitat to cropland and urbanization. Other species that may benefit from habitat management for this species include the Mountain Plover, Long-billed Curlew, Burrowing Owl, and Horned Lark.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate McCown's Longspurs have been detected on 27 BBS routes in Wyoming, including 15 routes on which they were observed a minimum of 3 years.

a) Maintain McCown's Longspurs on the 27 BBS routes on which they were observed (Figure 14).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 24).

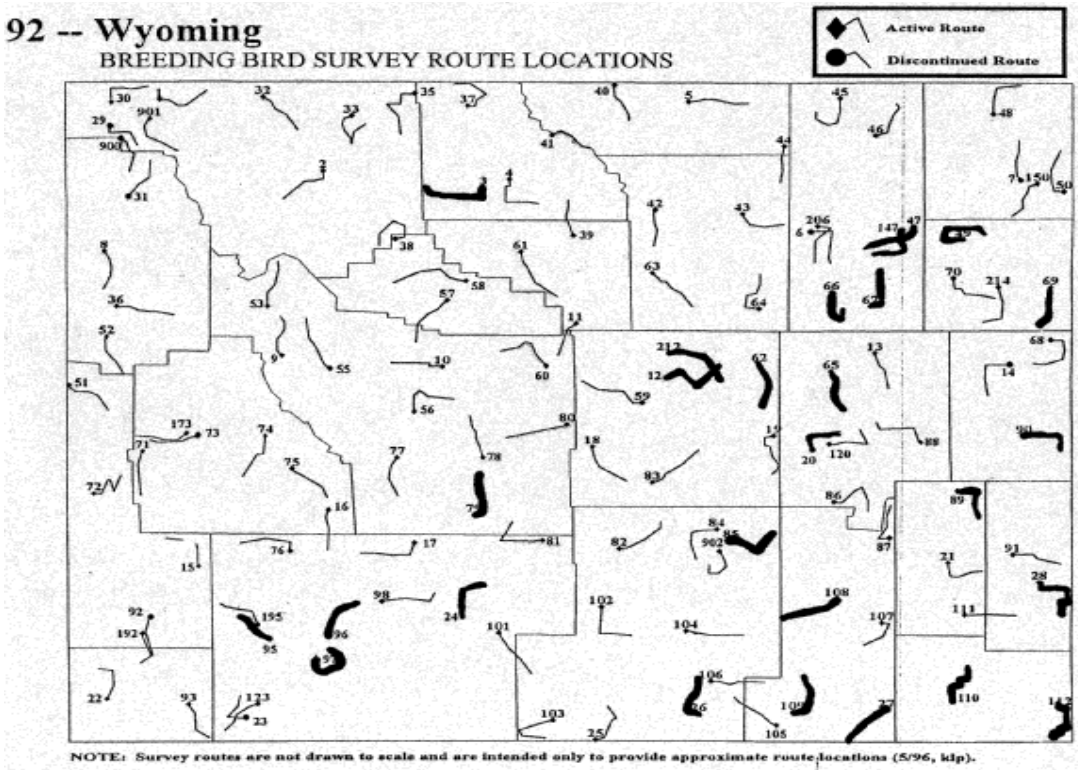

Figure 14. Bold lines indicate Breeding Bird Survey routes on which McCown's Longspurs have been observed from 1968 through 1998.

Table 24. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which McCown's Longspurs were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
003 Otto	1	0.27
012 CHANGED TO 212	2	0.12
020 CHANGED TO 120	(2)	3.30
024 Patrick Draw	2	0.25
026 Riverside	(1)	0.33
027 Buford	3	1.18
028 Yoder	(2)	1.00
047 CHANGED TO 147	10	2.29
049 Upton	2	0.46
062 Teapot Dome	1	0.43
065 Harland Flats	18	13.40
066 Pine Tree	17	29.67
067 Highlight	5	3.60
069 Newcastle	7	1.00
079 Sweetwater	5	13.78
085 Shirley	11	11.64
089 Meadowdale	1	0.11
090 Lusk	6	4.15
095 CHANGED TO 195	1	0.25
096 Reliance	1	0.13
097 Rock Springs	1	0.13
108 Rock River	23	45.29
109 Harmony	32	28.13
110 Cheyenne	23	15.06
112 Pine Bluff	6	3.77
147 Rozet	4	2.50
212 Bucknum	1	0.17

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the maximum number of stops out of 50 on which species was observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Minimize loss of shortgrass prairie habitat by reducing urban and suburban sprawl, habitat fragmentation, and habitat conversion.

2) Within the shortgrass prairie habitat on a landscape scale, maintain portions in low structure, an early seral stage, and with some bare ground in a mosaic that is well distributed throughout this habitat type. McCown's Longspurs prefer territories of 1 to 4 acres (0.5 to 1.5 ha) in size with 45 to 80% grass cover and 15 to 25% bare ground.

Recommendations

1) Use prescribed burning in late summer or early fall to reduce shrub density and structure.

2) Across a landscape level, use grazing as a tool to maintain areas of short grass and open ground. Livestock grazing should occur in the spring prior to the breeding season. Avoid grazing vegetation that is already sparse and short, especially where precipitation is typically low.

3) Avoid fragmenting existing tracts of shortgrass prairie habitat.

4) Avoid tilling existing shortgrass prairie habitat and seeding with exotic grasses, or converting native prairie to cropland. McCown's Longspurs do not nest successfully in tall, non-native grasses or croplands.

5) Protect areas traditionally used by McCown's Longspurs, as some individuals return to the same sites year after year.

6) Limit insect control, especially grasshoppers, in areas where McCown's Longspurs occur.

<u>Ferruginous Hawk</u>

Found across Wyoming in open basin and grassland habitats. Inhabits prairies, plains, deserts, and grasslands. Builds a bulky platform stick nest 3 feet across and 2 feet tall on the ground, usually on a knoll, rock outcrop, or streambank, adjacent to open areas such as grasslands or shrublands. May use the same nest year after year, adding more sticks each year – some Ferruginous Hawk nests are over 10 feet tall. Will also nest up to 40 feet above ground in trees that provide a commanding view. Eggs [2 to 4, 2.4 inches (61 mm)] are white or off-white and marked with brown blotches. Swoops down and pounces on prey from the air. Feeds mostly on small mammals, especially ground squirrels, prairie dogs, and jackrabbits, but will also eat small birds, snakes, lizards, and large insects. Winters south to central Mexico. Population declines are due to conversion of native prairie to cropland or other uses, conversion of native prairie to non-native vegetation, urbanization, and disturbance of nesting birds. Other species that may benefit from habitat management for this species include the Swainson's Hawk, Red-tailed Hawk, Rough-legged Hawk, Golden Eagle, American Kestrel, Mountain Plover, Mourning Dove, Great Horned Owl, Burrowing Owl, Western Kingbird, Eastern Kingbird, and Loggerhead Shrike.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Ferruginous Hawks have been detected on 69 BBS routes in Wyoming, including 40 routes on which they were observed a minimum of 3 years.

a) Maintain Ferruginous Hawks on the 69 BBS routes on which they were observed (Figure 15).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 25).

3) Continue gathering population trend and productivity data from on-going inventory and monitoring studies in the Rawlins area and in northeast and east-central Wyoming.

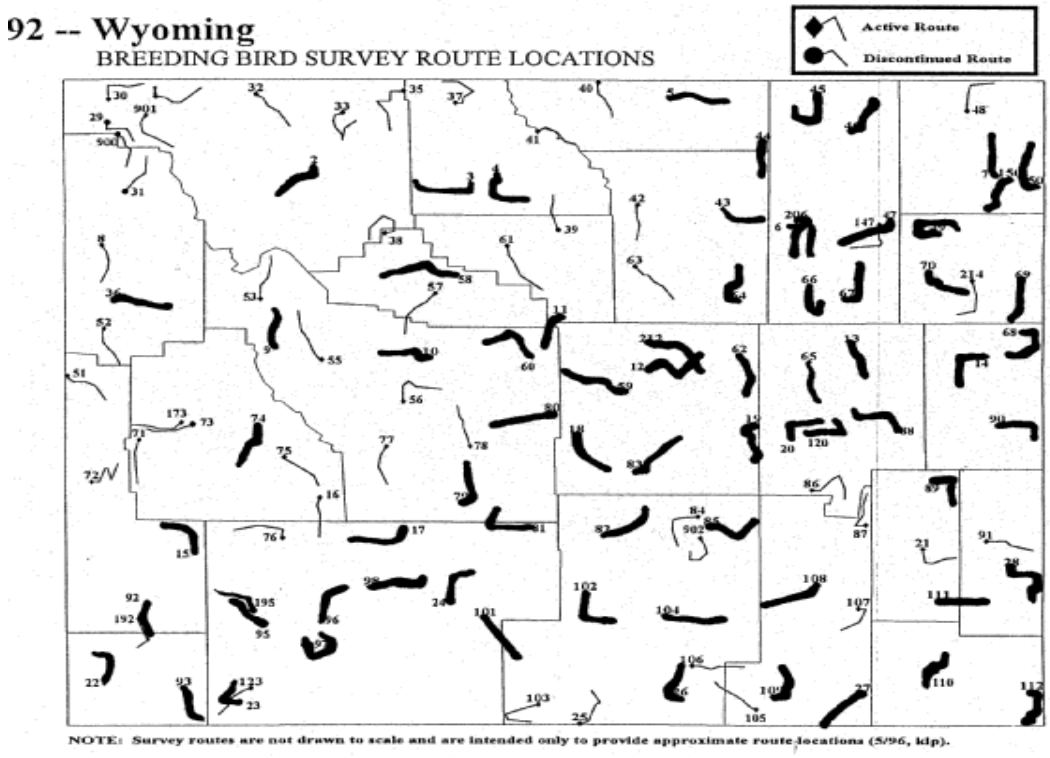

Figure 15. Bold lines indicate Breeding Bird Survey routes on which Ferruginous Hawks have been observed from 1968 through 1998.

Table 25. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Ferruginous Hawks were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
002 Cody	1	0.09
003 Otto	1	0.09
004 Basin	1	0.05
005 Wyarno	1	0.12
006 CHANGED TO 206	(2)	0.46
007 Sundance	1	0.17
009 Dubois	1	0.07
010 Midvale	1	0.21
011 Nowood	2	0.88
012 CHANGED TO 212	2	0.68
013 Bill	2	0.83
014 CHANGED TO 214	1	0.48
015 Fontenelle	1	0.07
017 Bear Creek	1	0.24
018 Ervay	2	0.25
019 Brookhurst	1	0.07
020 CHANGED TO 120	2	0.20
022 Cumberland	1	0.14
023 CHANGED TO 123	(2)	0.14
024 Patrick Draw	1	0.15
026 Riverside	2	0.25
027 Buford	1	0.18
028 Yoder	2	0.29
036 Moose	1	0.04
043 Schoonover	1	0.17
044 Arvada	1	0.08
045 Recluse	1	0.20
046 Soda Well	1	0.18
047 CHANGED TO 147	2	1.29
049 Upton	1	0.27
050 Moskee	2	0.29
058 Gebo	1	0.10
059 Arminto	2	0.50
060 Lysite	2	0.44
062 Teapot Dome	1	0.29
064 Sussex	2	0.86
065 Harland Flats	2	0.80
066 Pine Tree	2	1.67
067 Highlight	5	2.30
068 Riverview	1	0.20
069 Newcastle	2	0.90
070 Raven	1	0.43

Table 25. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
074 Boulder	1	2.00
079 Sweetwater	2	0.37
080 Gas Hills	3	3.00
081 Bairoil	1	1.10
082 Lamont	1	0.33
083 Pathfinder	2	0.67
085 Shirley	5	2.00
088 Shawnee	1	0.44
089 Meadowdale	1	0.33
090 Lusk	2	0.15
092 CHANGED TO 192	1	0.17
093 Mountain View	1	0.11
095 CHANGED TO 195	(3)	1.25
096 Reliance	(2)	0.63
097 Rock Springs	1	0.40
098 Black Rock	3	1.75
101 Wamsutter	4	2.33
102 Rawlins	2	1.11
104 Walcott	1	0.50
108 Rock River	6	2.571
109 Harmony	3	1.75
110 Cheyenne	6	3.06
111 Chugwater	1	0.08
112 Pine Bluff	1	0.23
120 Welch	3	1.55
150 Government Valley	1	0.43
195 Seedskadee	1	0.13
206 Caballa Creek	2	1.00
212 Bucknum	1	0.33

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the maximum number of stops out of 50 on which species was observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Minimize loss of shortgrass prairie habitat by reducing urban and suburban sprawl, habitat fragmentation, and habitat conversion.

Recommendations

1) Avoid converting existing tracts of shortgrass prairie habitat to cropland; this is considered a main factor in Ferruginous Hawk population declines.

2) Limit the amount of oil and gas development, mining, and habitat fragmentation in areas where Ferruginous Hawks occur.

3) Limit control of small mammals in areas where Ferruginous Hawks occur, especially ground squirrel, prairie dog, and rabbit populations.

4) Avoid disturbing nest sites from April 1st through July 31st (this species is sensitive to human disturbance during nesting).

5) Limit fire within Ferruginous Hawks nesting areas.

6) Protect nesting areas traditionally used by Ferruginous Hawks, as some individuals return to the same territories year after year.

Long-billed Curlew

Scattered across Wyoming, although most sightings occur in the western portion of the state. Inhabits a variety of grassland types ranging from moist meadow grasslands to agricultural areas to dry prairie uplands, usually near water. Commonly perches on shrubs, dirt mounds, cow pies, rocks, stumps, fence posts, or on other elevated sites during the breeding season. Nests on the ground in a slight hollow near water, usually in a flat area among short grasses. Eggs [4, 2.6 inches (65 mm)] are green, olive, or buff and marked with dark brown blotches. Feeds mainly on insects and aquatic invertebrates. Is a ground foraging omnivore during the breeding season but becomes a shoreline gleaner insectivore during the nonbreeding season. Winters along beaches and mud flats south to Central America. Population declines are due to loss of suitable habitat as grasslands are converted to cropland or urban developments. Other species that may benefit from habitat management for this species include the Mountain Plover, Short-eared Owl, and Horned Lark.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Long-billed Curlews have been detected on 25 BBS routes in Wyoming, including 8 routes on which they were observed a minimum of 3 years.

a) Maintain Long-billed Curlews on the 25 BBS routes on which they were observed (Figure 16).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 26).

3) Continue on-going monitoring on specific survey routes in northwestern Wyoming, and implement monitoring in other breeding sites within the state identified by "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

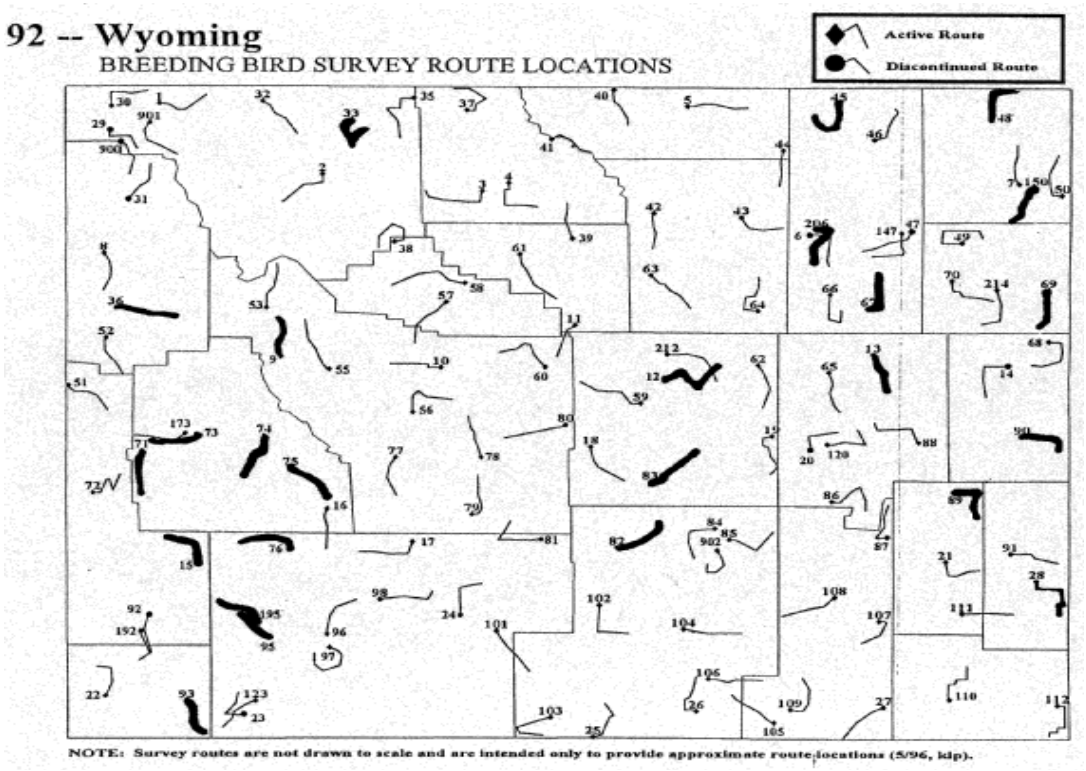

Figure 16. Bold lines indicate Breeding Bird Survey routes on which Long-billed Curlews have been observed from 1968 through 1998.

Table 26. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Long-billed Curlews were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
009 Dubois	1	0.04
012 CHANGED TO 212	1	0.08
013 Bill	1	0.17
015 Fontenelle	1	0.14
028 Yoder	1	0.05
033 Clark	3	1.25
036 Moose	3	0.87
045 Recluse	3	0.40
048 Seely	1	0.22
067 Highlight	1	0.10
069 Newcastle	2	0.90
071 Soda Lake	1	0.29
073 CHANGED TO 173	1	0.43
074 Boulder	(1)	0.50
075 Big Sandy	4	3.20
076 Farson	1	0.50
082 Lamont	1	0.50
083 Pathfinder	1	0.07
089 Meadowdale	1	1.67
090 Lusk	1	1.31
093 Mountain View	(2)	3.89
095 CHANGED TO 195	(1)	0.25
150 Government Valley	2	0.43
195 Seedskadee	1	0.13
206 Caballa Creek	1	0.71

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the maximum number of stops out of 50 on which species was observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Maintain large blocks of suitable habitat in areas managed for Long-billed Curlews (this species is sensitive to habitat fragmentation).

2) Maintain a mosaic of short vegetation [≤ 4 to 12 inches (10 to 30 cm)], bare ground, and low structure for nesting, with 5% of the vegetation in a taller state for shade and chick survival.

3) Ensure that 5 acres (2 ha) per breeding pair and abundant invertebrate prey are available for successful nesting.

Recommendations

1) Avoid tilling existing shortgrass prairie habitat and seeding with exotic grasses, or converting native prairie to cropland or urban development. Land conversion is considered a main factor in population declines.

2) Across a landscape level, use livestock grazing as a tool to maintain areas of short grass and open ground and areas where large acreages of grasslands are allowed to go to a climax stage for Long-billed Curlews and other species that require vegetation in both early and late successional stages. Pre-nesting grazing, rotational grazing, and rest rotational grazing may be beneficial to create these conditions.

3) Conduct prescribed burning in late summer or early fall to promote vegetation and habitat characteristics preferred by Long-billed Curlews (i.e. reduced shrub cover and increased habitat openness).

4) Protect areas traditionally used by Long-billed Curlews, as many individuals return to the same sites year after year.

5) Restrict oil, gas, and recreational activities near Long-billed Curlew habitat during the peak breeding season (April through July).

<u>Short-eared Owl</u>

Scattered across Wyoming in open grassland, shrub-steppe, and marsh habitats. Special habitat needs include extensive open grasslands with an abundance of rodents. Nests in a depression on the ground lined with grass and feathers from the female's breast. Nest is often concealed by low vegetation. Eggs [4 to 7, 1.5 inches (39 mm)] are white. Hunts for prey at dawn and dusk using low searching flight, and swoops on prey from the air. Feeds primarily on rodents, but will also eat small birds and insects. Winters south to central Mexico. Populations are threatened by rapid urbanization, industrialization, and intensive agriculture in both breeding and wintering habitats. Human disturbance of nesting and wintering areas can also be a problem. Intensive grazing around wetlands can be detrimental to breeding sites. Habitat fragmentation can accentuate the impacts of population fluctuations of their prey. Other species that may benefit from habitat management for this species include the Ferruginous Hawk, Upland Sandpiper, Horned Lark, Western Meadowlark, Vesper Sparrow, and Savannah Sparrow.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Short-eared Owls have been detected on 27 BBS routes in Wyoming, including 1 route on which they were observed a minimum of 3 years.

a) Maintain Short-eared Owls on the 27 BBS routes on which they were observed (Figure 17).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 27).

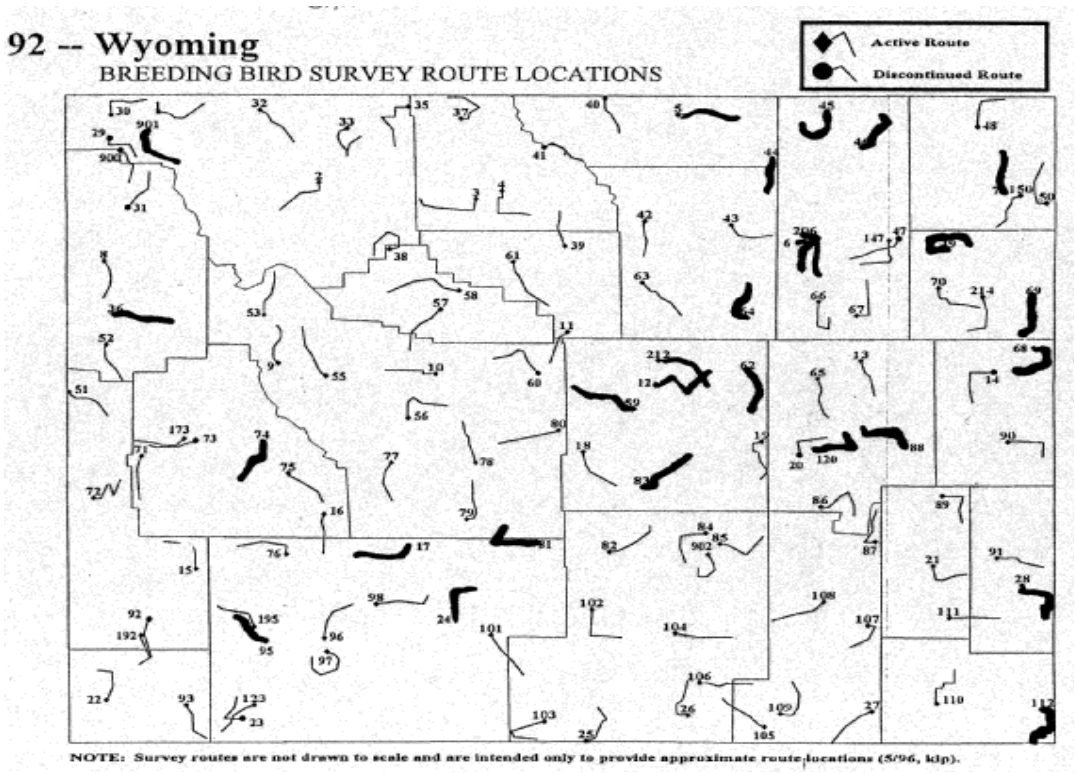

Figure 17. Bold lines indicate Breeding Bird Survey routes on which Short-eared Owls have been observed from 1968 through 1998.

Table 27. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Short-eared Owls were observed from 1968 through 1998.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
005 Wyarno	7	0.56
006 CHANGED TO 206	1	0.46
007 Sundance	1	0.04
012 CHANGED TO 212	2	0.32
017 Bear Creek	1	0.04
024 Patrick Draw	1	0.15
028 Yoder	1	0.05
036 Moose	1	0.13
044 Arvada	1	0.15
045 Recluse	1	0.27
046 Soda Well	1	1.71
049 Upton	2	0.18
059 Arminto	2	0.20
062 Teapot Dome	1	1.00
064 Sussex	3	0.57
068 Riverview	2	0.20
069 Newcastle	2	0.30
074 Boulder	1	0.13
081 Bairoil	1	0.10
083 Pathfinder	1	0.13
088 Shawnee	2	0.56
095 CHANGED TO 195	1	0.13
112 Pine Bluff	1	0.08
120 Welch	1	0.10
206 Caballa Creek	1	0.29
212 Bucknum	5	1.33
901 Yellowstone, YNP	2	0.18

Habitat Objectives

1) Minimize the amount of loss of shortgrass prairie habitat, and reduce urban and suburban sprawl and habitat fragmentation.

Recommendations

1) Avoid fragmenting existing tracts of shortgrass prairie habitat.

2) Avoid using pesticides for rodent, insect, and grasshopper control in areas where Short-eared Owls occur.

3) The breeding season for Short-eared Owls may run into late August, so mowing could be a major factor in nest failure since they often nest in taller grasses. In hayfields where Short-eared Owls occur, 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 this late nester. Consider growing alfalfa for seed or use late maturing legumes instead of traditional alfalfa management; this would allow cuttings to be delayed.

4) Across a landscape level, use livestock grazing as a tool to maintain areas of short grass and open ground and areas where large acreages of grasslands are allowed to go to a climax stage for species that require both early and late succession (e.g. Short-eared Owl and Long-billed Curlew).

5) Protect existing shortgrass prairie habitat through conservation easements, land purchases, and development of farm and ranch programs that emphasize habitat conservation.

Burrowing Owl

Found across Wyoming in open habitats with burrowing mammals. Prefers open prairie, grassland, desert, and shrub-steppe habitats, and may also inhabit agricultural areas. Depends largely on mammals that dig burrows (especially prairie dogs and ground squirrels) in open areas with short vegetation for nesting, roosting, and for escape. Nest is located underground at the end of a burrow 4 to 12 feet long, and is usually lined with plants or dried manure, probably either to disguise its scent or to help absorb water. Eggs [7 to 9, 1.2 inches (31 mm)] are white and nest-stained. Commonly perches on burrow mounds, fence posts, and shrubs. Hunts by ground foraging, hovering, flying from a perch, or by flycatching. Primarily eats insects, but also takes small mammals and some birds and reptiles. Winters south to northern Central America. Population declines are due to loss of habitat to urbanization and conversion of native grasslands to croplands or to taller, non-native grasslands, and removal of prairie dogs and ground squirrels. Other species that may benefit from habitat management for this species include the Swainson's Hawk, Red-tailed Hawk, Ferruginous Hawk, Rough-legged Hawk, Golden Eagle, Mountain Plover, and Horned Lark.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Burrowing Owls have been detected on 18 BBS routes in Wyoming, including 7 routes on which they were observed a minimum of 3 years.

a) Maintain Burrowing Owls on the 18 BBS routes on which they were observed (Figure 18).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 28).

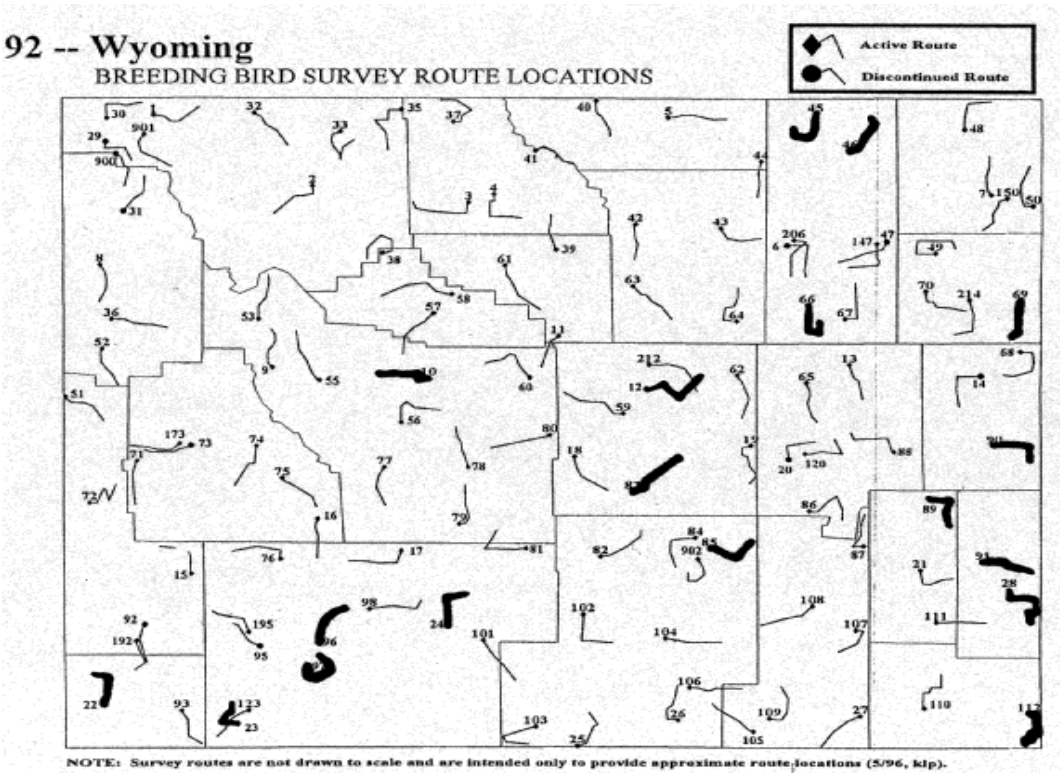

Figure 18. Bold lines indicate Breeding Bird Survey routes on which Burrowing Owls have been observed from 1968 through 1998.

Table 28. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Burrowing Owls were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
010 Midvale	1	0.07
012 CHANGED TO 212	2	0.16
022 Cumberland	1	0.07
023 CHANGED TO 123	(1)	0.36
024 Patrick Draw	1	0.30
028 Yoder	2	0.52
045 Recluse	1	0.07
046 Soda Well	1	0.18
066 Pine Tree	(2)	0.67
069 Newcastle	1	0.20
083 Pathfinder	1	0.13
085 Shirley	3	0.64
089 Meadowdale	1	0.33
090 Lusk	2	0.39
091 Lingle	2	2.17
096 Reliance	1	0.13
097 Rock Springs	1	0.07
112 Pine Bluff	1	0.54

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the maximum number of stops out of 50 on which species was observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Maintain prairie dog colonies where Burrowing Owls are present via conservation easements and voluntary agreements with landowners, and habitat management plans with land managers.

2) Maintain habitat conditions within ¼ to ½ mile (0.4 to 0.8 km) of known Burrowing Owl nest sites in an undisturbed manner.

3) Protect all known nest burrows, as the same burrow will often be reused in subsequent years.

4) Retain inactive prairie dog burrows to provide roosting sites and future nesting sites for Burrowing Owls.

5) Maintain a buffer zone of ¼ to ½ mile (0.4 to 0.8 km) around Burrowing Owl nest burrows. Limit insecticide use, rodent control, and human disturbances in these buffer zones.

Recommendations

1) Across a landscape level, use livestock grazing and prescribed burning as management tools to maintain areas of short grass and open ground for Burrowing Owls and associated species.

2) Do not eliminate burrowing mammals, especially prairie dogs and ground squirrels, within preferred Burrowing Owl habitat, especially within ¼ to ½ mile (0.4 to 0.8 km) of known nest sites. Burrowing Owls require prairie dog or ground squirrel burrows for shelter, nesting, and raising their young. Once prairie dogs or ground squirrels are removed from a colony, burrows deteriorate rapidly and dense vegetation encroaches the site. Burrowing Owls cannot breed successfully without these burrowing mammals, and eventually stop breeding at sites from which they have been eliminated.

3) Preserve traditional Burrowing Owl nesting sites. Although Burrowing Owls may not reuse the same nest burrow, they often reuse the same nesting sites.

4) Burrowing Owl reproductive success is affected by the abundance of prey. To ensure adequate prey is available, avoid controlling insects (particularly grasshoppers, crickets, and beetles) in areas where Burrowing Owls occur, especially within ¼ to ½ mile (0.4 to 0.8 km) of known nest sites. If insecticides are absolutely necessary, postpone their use until after the end of July, when young owls have left the care of parent birds.

5) Minimize human disturbances within ¼ to ½ mile (0.4 to 0.8 km) of known Burrowing Owl nest sites.

6) Avoid fragmenting habitat in known Burrowing Owl nesting areas. Small habitat patches may allow predators to find nests easily.

7) In hayfields where Burrowing Owls occur, 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 Burrowing Owl. Consider growing alfalfa for seed or use late maturing legumes instead of traditional alfalfa management; this would allow cuttings to be delayed.

Upland Sandpiper

Requires open grasslands, so breeds in the eastern half of Wyoming, but has been observed in open grassland habitats in north central and northwest Wyoming. Prefers Great Plains grasslands, dryland grass pastures, hayfields, and alfalfa fields. Nests in a grass-lined depression on the ground, usually concealed by a grass arch. Eggs [4, 1.8 inches (45 mm)] are cream to pinkish-buff and marked with brown speckles and blotches on the large end of the egg. Is a rare cowbird host. Gleans insects and seeds from the ground, and prefers to feed where grasses are low and open enough to provide visibility, and where grasshoppers and crickets are most abundant. Also eats weevils, ants, berries, waste grain, and seeds of grasses and weeds. Winters south to central South America. Population declines are due to loss of habitat to urbanization and conversion of grasslands to woodlands and cultivated croplands. Other species that may benefit from habitat management for this species include the Sharp-tailed Grouse, Dickcissel, Chestnut-collared Longspur, Grasshopper Sparrow, Bobolink, and Western Meadowlark.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Upland Sandpipers have been detected on 30 BBS routes in Wyoming, including 13 routes on which they were observed a minimum of 3 years.

a) Maintain Upland Sandpipers on the 30 BBS routes on which they were observed (Figure 19).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 29).

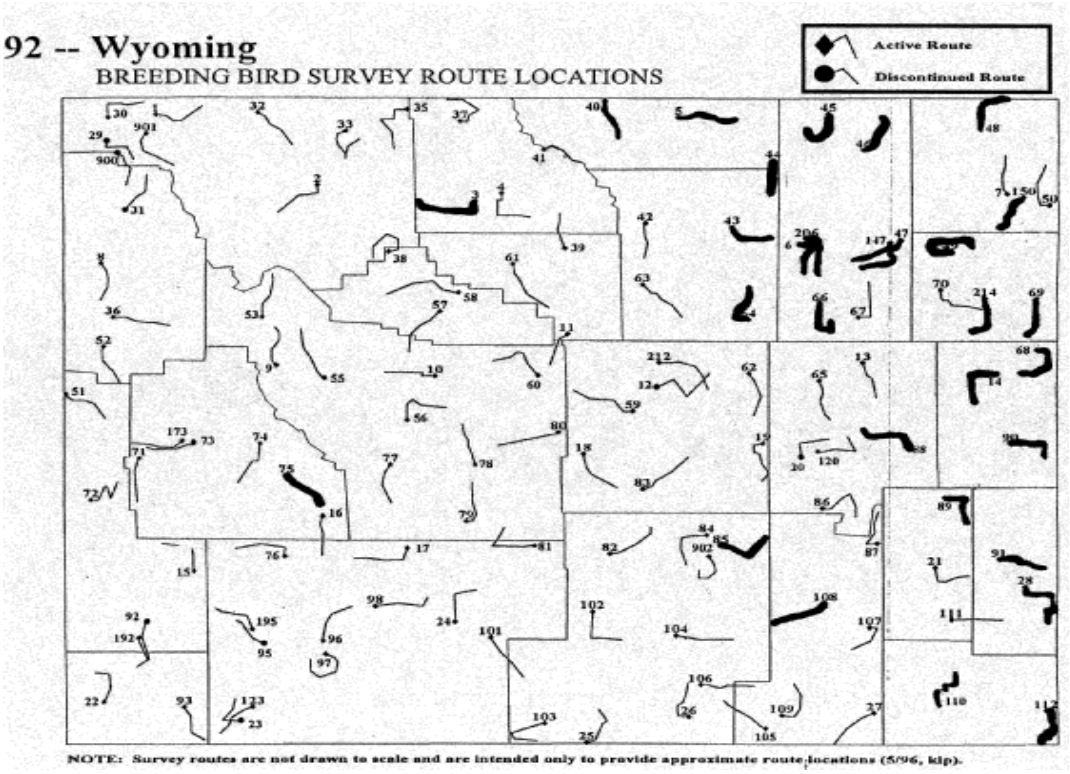

Figure 19. Bold lines indicate Breeding Bird Survey routes on which Upland Sandpipers have been observed from 1968 through 1998.

Table 29. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Upland Sandpipers were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
003 Otto	1	0.09
005 Wyarno	2	2.00
006 CHANGED TO 206	1	0.09
014 CHANGED TO 214	2	0.30
028 Yoder	7	2.10
040 Dayton	1	0.06
043 Schoonover	1	0.17
044 Arvada	3	0.54
045 Recluse	6	2.80
046 Soda Well	6	2.47
047 CHANGED TO 147	1	0.43
048 Seely	7	4.56
049 Upton	2	0.55
064 Sussex	1	0.43
066 Pine Tree	1	0.33
068 Riverview	1	0.13
069 Newcastle	3	1.50
075 Big Sandy	(2)	0.50
085 Shirley	3	0.09
088 Shawnee	4	1.56
089 Meadowdale	6	3.11
090 Lusk	7	7.46
091 Lingle	1	0.11
108 Rock River	1	0.14
110 Cheyenne	1	0.06
112 Pine Bluff	1	0.62
147 Rozet	1	0.50
150 Government Valley	2	1.00
206 Caballa Creek	1	0.14
214 Hampshire	1	0.20

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the maximum number of stops out of 50 on which species was observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Maintain large tracts of contiguous grassland habitat and avoid fragmenting existing grassland tracts so area-sensitive species, like the Upland Sandpiper, can nest successfully. To benefit area-sensitive birds, tracts should be no smaller than 125 acres (50 ha), and preferably 250 acres (101 ha) or more, and should be located within 1 mile (1.6 km) of each other.

2) Maintain a mosaic of short grass for feeding and courtship, interspersed with taller grasses and forbs for nest concealment and brood-rearing cover, and rock piles, fence posts, or stumps for display perches.

Recommendations

1) High intensity livestock grazing can be detrimental to this species, but low to moderate grazing can create desired patchiness. Across a landscape level, use grazing practices that allow large acreages of grasslands to go to a climax successional stage for Upland Sandpipers and associated species. Avoid season-long grazing and grazing in known or suspected Upland Sandpiper nesting sites so cover needed for nest concealment is not removed. Use a rotational grazing system with two or more grazing units to increase grass height and density within and among units, and delay grazing until mid to late June to retain existing nests.

2) In hayfields where Upland Sandpipers nest, 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. If mowing must be done prior to mid-July, use a flush bar to allow birds time to escape, and leave small areas of uncut hay as refuges for young birds.

3) Avoid using pesticides in Upland Sandpiper nesting areas. If pesticides must be used, delay application until late July to give birds time to complete their nesting cycle.

4) In areas known to support nesting Upland Sandpipers, conduct prescribed burns in the fall to avoid loss of nesting cover. To retain adequate residual cover for nesting the following spring, burns should be relatively small so a portion of the area contains nesting cover at all times. Annually burn 20 to 30% of grassland tracts <200 acres (80 ha) in size. Small fragments should have <50% of their area burned at any one time and, if next to other fragments, should be burned in a rotating fashion so unburned fragments are adjacent to burned fragments.

5) Use no-till or minimum-till practices, rather than annual tillage practices, so that nesting habitat is undisturbed during the breeding season. Delay first tillage until late June or early July to avoid destroying nests.

6) Protect taller grasses that grow around moist sites. These may be the only areas where Upland Sandpipers and associated species can successfully nest on the shortgrass prairie.

Lark Bunting

Found throughout Wyoming in open habitats with relatively short, herbaceous vegetation. Inhabits mixed shortgrass prairie and other areas of predominately low growth. Also uses areas with taller grasses, disturbed grasslands, sagebrush-grassland and shrub-steppe habitats, mountain-foothill shrublands, and agricultural areas. Builds a cup nest of fine grasses on the ground, often sheltered by overhanging vegetation and placed next to a shrub or other tall vegetation. Eggs [4 to 5, 0.9 inches (22 mm)] are pale blue or greenish-blue, sometimes with reddish-brown spots. Is an uncommon cowbird host. Forages on the ground for insects, especially grasshoppers, and also eats grass and forb seeds. Winters south to central Mexico. Since the 1800s, range contractions and population declines have occurred across the Lark Bunting's range. Other species that may benefit from habitat management for this species include the Chestnut-collared Longspur, Western Meadowlark, Short-eared Owl, Burrowing Owl, Upland Sandpiper, Horned Lark, and Ferruginous Hawk.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Lark Buntings have been detected on 99 BBS routes in Wyoming, including 60 routes on which they were observed a minimum of 3 years.

a) Maintain Lark Buntings on the 99 BBS routes on which they were observed (Figure 20).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 30).

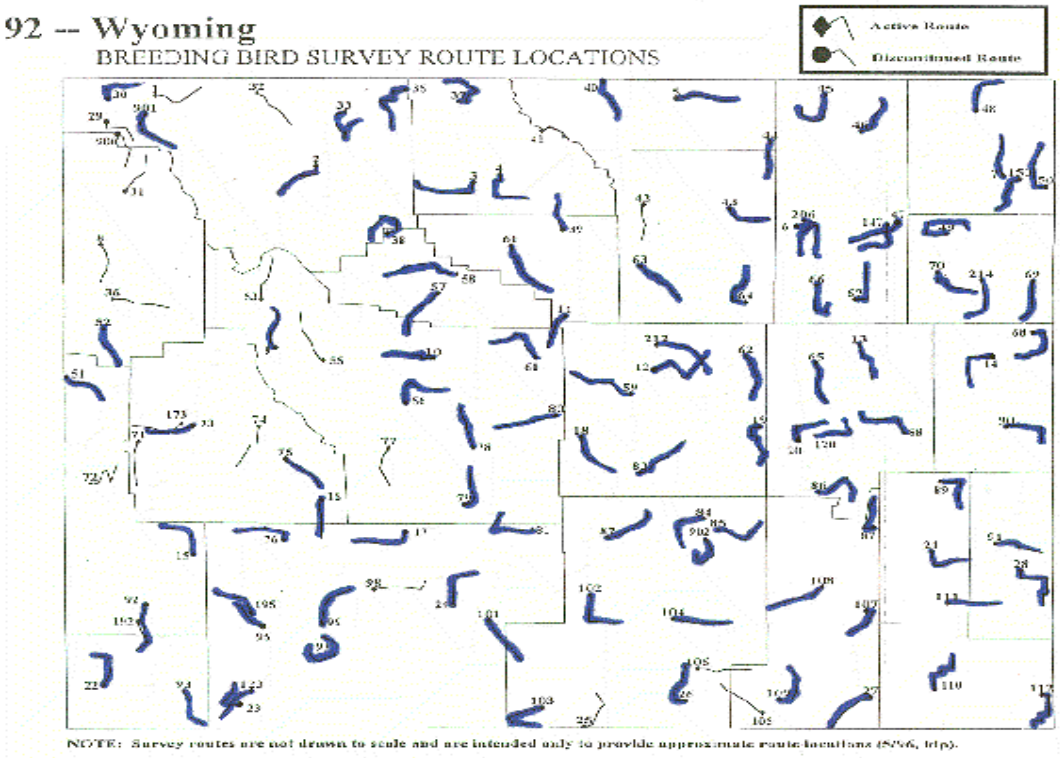

Figure 20. Bold lines indicate Breeding Bird Survey routes on which Lark Buntings have been observed from 1968 through 1998.

Table 30. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Lark Buntings were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
002 Cody	16	7.64
003 Otto	43	82.68
004 Basin	14	11.43
005 Wyarno	36	128.64
006 CHANGED TO 206	(708)	340.10
007 Sundance	1	0.26
009 Dubois	8	139.00
010 Midvale	42	94.87
011 Nowood	10	16.00
012 CHANGED TO 212	30	57.20
013 Bill	49	192.83
014 CHANGED TO 214	7	26.62
015 Fontenelle	1	0.07
016 Elk Horn	5	10.75
017 Bear Creek	7	4.12
018 Ervay	(1)	39.56
019 Brookhurst	31	97.14
020 CHANGED TO 120	(353)	199.30
021 Dwyer	19	107.25
022 Cumberland	1	1.14
023 CHANGED TO 123	(2)	0.93
024 Patrick Draw	20	4.55
026 Riverside	(7)	2.75
027 Buford	(2)	1.64
028 Yoder	19	56.62
030 Mammoth, YNP	1	2.00
033 Clark	8	0.75
035 Frannie	6	6.33
037 Lovell	8	3.20
038 Meeteetse	20	22.43
039 Ten Sleep	20	37.75
040 Dayton	7	1.88
043 Schoonover	50	169.42
044 Arvada	16	40.62
045 Recluse	50	85.87
046 Soda Well	37	73.29
047 CHANGED TO 147	42	112.71
048 Seely	3	2.67
049 Upton	49	220.46
050 Moskee	1	0.21
051 Alpine	1	0.10
052 Wilson	1	0.05

Table 30. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
056 Ethete	39	148.50
057 Anchor	14	21.00
058 Gebo	47	109.30
059 Arminto	29	70.90
060 Lysite	31	69.89
061 Worland	41	60.00
062 Teapot Dome	27	86.43
063 Mayoworth	31	55.44
064 Sussex	32	73.14
065 Harland Flats	49	127.80
066 Pine Tree	49	264.78
067 Highlight	49	203.70
068 Riverview	36	130.40
069 Newcastle	45	187.00
070 Raven	50	229.57
073 CHANGED TO 173	1	7.00
075 Big Sandy	4	3.00
076 Farson	10	23.50
078 Sand Draw	47	129.67
079 Sweetwater	23	14.63
080 Gas Hills	12	19.33
081 Bairoil	7	4.60
082 Lamont	8	3.08
083 Pathfinder	35	52.47
084 Leo	(2)	4.00
085 Shirley	23	19.91
086 Warbonnet	2	0.29
087 Fletcher Peak	1	0.24
088 Shawnee	45	178.44
089 Meadowdale	39	182.56
090 Lusk	50	197.62
091 Lingle	8	6.50
092 CHANGED TO 192	1	0.33
093 Mountain View	(1)	0.78
095 CHANGED TO 195	1	0.75
096 Reliance	1	0.13
097 Rock Springs	5	0.67
101 Wamsutter	31	26.33
102 Rawlins	22	13.33
103 Baggs	4	4.50
104 Walcott	25	13.67
107 Sybille Canyon	13	29.71
108 Rock River	12	11.00
109 Harmony	8	12.36

Table 30. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
110 Cheyenne	50	230.53
111 Chugwater	38	120.58
112 Pine Bluff	34	135.46
120 Welch	49	202.00
123 Flaming Gorge	12	2.50
147 Rozet	33	75.50
150 Government Valley	15	8.14
195 Seedskadee	2	0.25
206 Caballa Creek	50	214.00
212 Bucknum	26	83.00
214 Hampshire	38	145.00
901 Yellowstone, YNP	2	0.27
902 Pryor Flats	4	5.00

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the maximum number of stops out of 50 on which species was observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Maintain a mosaic of short grass for feeding and courtship interspersed with taller grasses and forbs for nest concealment, brood-rearing cover, and perch sites.

2) Maintain areas where Lark Buntings occur with no less than 30% grass cover and no more than 60% bare ground. Where Lark Buntings are known to nest, maintain areas with 60 to 70% low grass cover, 10 to 15% bare ground, and 10 to 30% shrub or tall grass cover.

3) Maintain large areas of grassland where Lark Buntings occur. Lark Buntings avoid small grassland patches, and their density increases with increasing area of contiguous grassland.

Recommendations

1) In known Lark Bunting breeding areas, avoid intensive summer grazing so cover and taller vegetation are retained for nest protection and prey availability. Heavy grazing during the winter and light grazing during the summer may be compatible.

2) Short-term rotational grazing can create habitat patchiness needed by Lark Buntings and other species. Avoid long-term grazing in shortgrass prairie habitat.

3) Avoid controlling insects, especially grasshoppers, where Lark Buntings are known to nest to ensure adequate prey is available.

4) In agricultural areas where Lark Buntings occur, retain crop residue on the soil surface to harbor insect prey and provide cover for nest sites.

5) In hayfields where Lark Buntings occur, 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. If mowing must be done prior to mid-July, use a flush bar to allow birds time to escape.

6) Minimize the number of field operations that destroy nests and, where possible, use methods that destroy fewest nests (e.g. subsurface tillage).

7) In areas known to support nesting Lark Buntings, conduct prescribed burns in the fall to avoid loss of nesting cover. To retain adequate residual cover for nesting the following spring, burns should be relatively small so a portion of the area contains nesting cover at all times.

Dickcissel

Found scattered across Wyoming in grassland habitat, but breeding in Wyoming is documented only in the eastern portion. Requires dense herbaceous cover and song perches. Generally inhabits grasslands having taller grasses, forbs, or shrubs, but also uses alfalfa and hayfields. Builds a bulky cup nest of stems, grass, and leaves lined with rootlets, fine grass, and hair in vegetation up to 2 feet above ground. Eggs [4, 0.8 inch (21 mm)] are pale blue. Is a common cowbird host. Forages on the ground for insects, grain, and grass and forb seeds. Young birds consume 70% grain, grass, and forb seeds and 30% insects; adults are the reverse. Winters from southwest Mexico south to northern South America. Many Dickcissel nests are destroyed by mowing machines; nest parasitism by Brown-headed Cowbirds can be locally significant; and heavy livestock grazing can be detrimental to nests, young, and prey availability. On the grasslands of northern Venezuela where Dickcissels winter, native grasslands have been highly modified by ranching and grain production. Other species that may benefit from habitat management for this species include the Upland Sandpiper, Bobolink, Grasshopper Sparrow, Baird's Sparrow, Chestnut-collared Longspur, and Sprague's Pipit.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Dickcissel in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Manage for dense grass, heavy forb cover, and a moderately deep litter layer in areas where Dickcissels occur.

2) Due to the Dickcissel's area-sensitivity, manage for at least 25 to 75 acres (10 to 30 ha) of grassland habitat in the above condition to maintain a moderate population of nesting pairs.

Recommendations

1) High intensity livestock grazing can be detrimental to this species, but disturbance from low to moderate grazing and light burns can be used as habitat management tools. Areas should remain undisturbed long enough for grass and forb cover to become dense and a moderately heavy layer of ground litter to build up before succession is set back by disturbance.

2) Rest large blocks of land during the nesting season to reduce the impact of cowbird parasitism on Dickcissels and associated species.

3) In hayfields where Dickcissels occur, 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. Consider growing alfalfa for seed or use late maturing legumes instead of traditional alfalfa management; this would allow cuttings to be delayed.

4) Avoid mowing grass habitats annually to ensure growth of dense grass and a heavy cover of forbs and to allow ground litter to build up. If mowing must occur, it should be done in the fall after the nesting season.

5) If disturbances are periodic, such as every three to five years, and rotated among tracts within a management unit, habitat for Dickcissels and associated species will always be provided.

6) In areas known to support nesting Dickcissels, conduct prescribed burns in the fall to avoid loss of nesting cover. To retain adequate residual cover for nesting the following spring, burns should be relatively small (no more than 20 to 30% of the area) so a portion of the area contains nesting cover at all times. Burning is preferable to mowing or haying because vegetation recovers more quickly after burning.

7) Planted cool season grass/legume cover, such as that provided by Conservation Reserve Program lands, can also provide suitable habitat for this and associated species.

8) Control cowbird nest parasitism by managing livestock and residential development.

Chestnut-collared Longspur

Scattered across grassland habitats, mainly in the eastern half of Wyoming. Inhabits shortgrass and open mixed-grass prairies with scattered shrubs. Builds a cup nest of fine grass in a shallow depression on the ground, usually concealed by a clump of grass. May prefer nest sites in moist areas. Eggs [3 to 5, 0.8 inch (19 mm)] are creamy white and marked with dark brown speckles and blotches. Is an uncommon cowbird host. Forages on the ground on insects, mainly beetles, grasshoppers, and spiders; also eats grass, forb, and sedge seeds. Winters south to northcentral Mexico. Contraction of breeding range and population declines are due to conversion of native grasslands to croplands and habitat loss to urbanization. Other species that may benefit from habitat management for this species include the Swainson's Hawk, Ferruginous Hawk, Burrowing Owl, Upland Sandpiper, Grasshopper Sparrow, Bobolink, Lark Bunting, Dickcissel, and Western Meadowlark.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Chestnut-collared Longspur in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain some cover vegetation for nest concealment in known Chestnut-collared Longspurs nesting areas.

2) In areas where Chestnut-collared Longspurs breed, manage for required minimum patch size of 115 acres (46 ha) to maintain nesting habitat (high and low grass/forb structure with singing perches, especially in moist areas).

3) Minimize conversion of native shortgrass prairie and mixed-grass grasslands to cultivated agricultural lands. Chestnut-collared Longspurs will not nest in croplands.

Recommendations

1) High intensity livestock grazing in short grasslands can be detrimental to this species. Graze lightly or moderately in shortgrass habitat, leaving areas of vegetation at least 6 inches (15 cm) tall. Moderate grazing in taller grasslands can provide both high and low structure for Chestnut-collared Longspurs and associated species.

2) Use a twice-over rotation grazing system to create more suitable habitat for Chestnut-collared Longspurs than either season-long or short-duration grazing.

3) Protect known Chestnut-collared Longspur nesting sites, as birds will nest in the same area year after year.

4) Protect taller grasses that grow around moist sites. These may be the only areas where Chestnut-collared Longspurs and associated species can successfully nest on the shortgrass prairie.

5) In areas known to support nesting Chestnut-collared Longspurs, conduct prescribed burns in the fall to avoid loss of nesting cover. To retain adequate residual cover for nesting the following spring, burns should be relatively small so a portion of the area contains nesting cover at all times.

<u>Grasshopper Sparrow</u>

Scattered across Wyoming in grassland habitats, but breeds mainly in the eastern half of the state. Requires herbaceous cover and conspicuous perches. Inhabits shortgrass prairies, mixed grasslands, meadow grasslands, open sagebrush grasslands, and agricultural areas, and avoids areas containing more than 35% shrubs. Builds a grass cup nest in a slight depression on the ground, concealed by overhanging grass and forbs and arched or domed at the back. Eggs [4 to 5, 0.8 inch (19 mm)] are creamy white and sparsely marked with blotches of reddish-brown over shades of gray and purple. Is an uncommon cowbird host. Gleans food from the ground. Consumes a diet comprised of 63% insects from fall to spring; also eats spiders, snails, and seeds. Winters south to northern South America. Population declines are due to loss of habitat by urbanization, conversion of native grasslands to cropland, and incompatible livestock grazing. Other species that may benefit from habitat management for this species include the Upland Sandpiper, Vesper Sparrow, Dickcissel, Chestnut-collared Longspur, Bobolink, Western Meadowlark, and Sprague's Pipit.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Grasshopper Sparrows have been detected on 59 BBS routes in Wyoming, including 26 routes on which they were observed a minimum of 3 years.

a) Maintain Grasshopper Sparrows on the 59 BBS routes on which they were observed (Figure 21).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 31).

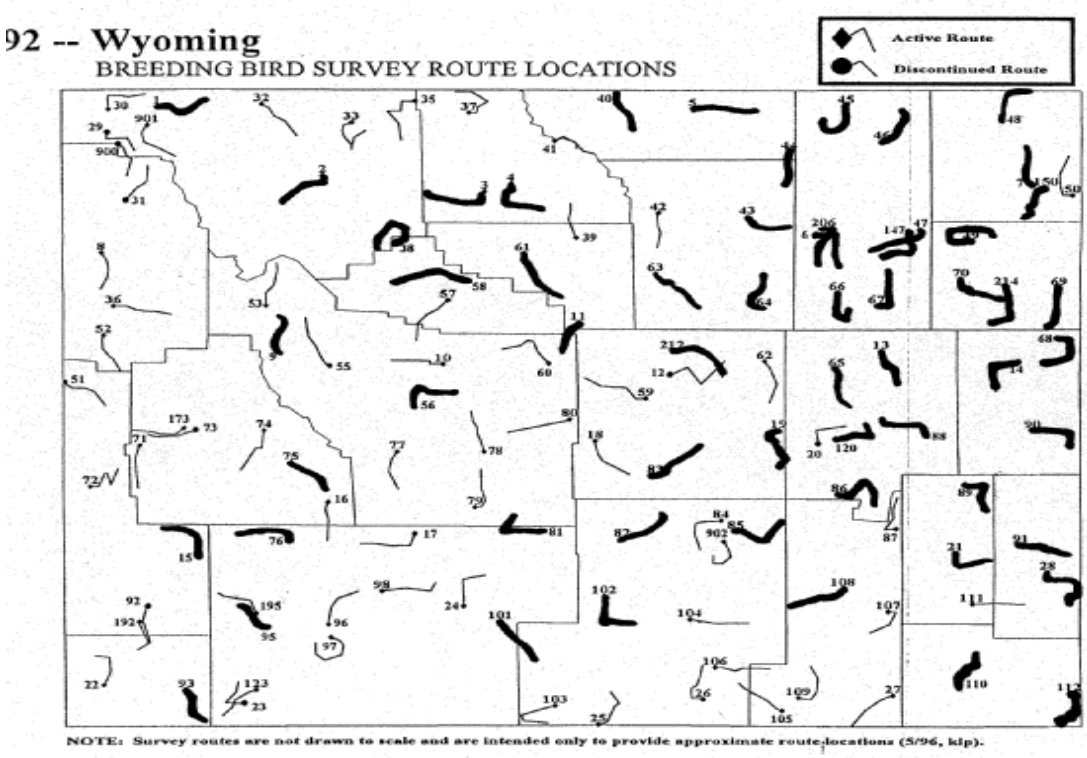

Figure 21. Bold lines indicate Breeding Bird Survey routes on which Grasshopper Sparrows have been observed from 1968 through 1998.

Table 31. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Grasshopper Sparrows were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
001 NE Entrance, YNP	2	0.60
002 Cody	4	0.46
003 Otto	(2)	0.46
004 Basin	1	0.10
005 Wyarno	4	0.56
006 CHANGED TO 206	(1)	0.27
007 Sundance	1	0.04
009 Dubois	2	0.33
011 Nowood	1	1.00
013 Bill	10	4.33
014 CHANGED TO 214	(2)	2.00
015 Fontenelle	4	0.29
019 Brookhurst	1	0.18
021 Dwyer	1	0.25
028 Yoder	4	0.76
038 Meeteetse	2	0.29
040 Dayton	3	0.71
043 Schoonover	8	3.75
044 Arvada	5	1.31
045 Recluse	21	6.87
046 Soda Well	15	6.94
047 CHANGED TO 147	2	1.29
048 Seely	19	3.44
049 Upton	27	21.91
056 Ethete	3	0.83
058 Gebo	2	1.30
061 Worland	7	3.14
063 Mayoworth	6	2.31
064 Sussex	6	1.57
065 Harland Flats	9	3.80
066 Pine Tree	5	1.89
067 Highlight	12	7.40
068 Riverview	22	17.07
069 Newcastle	34	29.60
070 Raven	21	15.29
075 Big Sandy	1	0.20
076 Farson	(1)	8.00
081 Bairoil	1	0.30
082 Lamont	3	0.67
083 Pathfinder	4	0.47
085 Shirley	1	0.18
086 Warbonnet	1	0.14

Table 31. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
088 Shawnee	27	17.22
089 Meadowdale	12	3.56
090 Lusk	23	9.92
091 Lingle	2	0.72
093 Mountain View	2	1.67
095 CHANGED TO 195	1	0.50
101 Wamsutter	1	0.17
102 Rawlins	1	0.11
108 Rock River	1	0.29
110 Cheyenne	17	5.59
112 Pine Bluff	13	4.39
120 Welch	2	0.35
147 Rozet	5	5.00
150 Government Valley	12	5.57
206 Caballa Creek	13	8.29
212 Bucknum	1	0.17
214 Hampshire	12	13.20

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the maximum number of stops out of 50 on which species was observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Manage for dense grass, heavy forb cover, thick litter depth, and minimal shrub canopy in areas where Grasshopper Sparrows occur.

2) In areas where Grasshopper Sparrows nest, manage for large tracts with grass height up to 18 inches (46 cm), overall bare ground of 1 to 2%, shrub canopy cover of 5% or less, and territory size of 10 to 20 acres (4 to 8 ha) per pair.

3) In grasslands where Grasshopper Sparrows nest, ensure that singing perches are available, while limiting shrub canopy cover. Singing perches provide a stage for defending territories and attracting mates, and are a critical habitat component for successful nesting for this species. However, Grasshopper Sparrows will avoid areas with greater than 35% shrub canopy cover.

Recommendations

1) High intensity livestock grazing can be detrimental to this species, but disturbance from low to moderate grazing and light burns can be used as habitat management tools. Areas should remain undisturbed long enough for grass and forb cover to become dense and thick layers of ground litter to build up before succession is set back by disturbance.

2) Delay grazing in shortgrass habitat until after the end of the nesting season (the end of July) to ensure that grass cover is available for successful nesting.

3) In hayfields where Grasshopper Sparrows occur, 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 Grasshopper Sparrow. Consider growing alfalfa for seed or use late maturing legumes instead of traditional alfalfa management; this would allow cuttings to be delayed. If mowing must be done prior to mid-July, use a flush bar to allow birds time to escape, and leave small areas of uncut hay as refuges for young birds.

4) Avoid mowing grass habitats annually to ensure growth of dense grass and a heavy cover of forbs and to allow ground litter to build up. If mowing must occur, it should be done in the fall after the nesting season.

5) Avoid burning large areas of shortgrass prairie habitats where Grasshopper Sparrows occur. The taller vegetation, singing perches, and ground litter needed by Grasshopper Sparrows and associated species take several years to reach heights that are suitable.

6) If disturbances are periodic, such as every three to five years, and rotated among tracts within a management unit, habitat for Grasshopper Sparrows and associated species will always be provided.

7) In areas known to support nesting Grasshopper Sparrows, conduct prescribed burns in the fall to avoid loss of nesting cover. To retain adequate residual cover for nesting the following spring, burns should be relatively small so a portion of the area contains nesting cover at all times.

8) Planted cool season grass/legume cover, such as that provided by Conservation Reserve Program lands, can also provide suitable habitat for this and associated species.

Bobolink

Found across most of Wyoming in grassland habitats. Requires large expanses of grass or forb cover. Prefers large, open areas of tall grass, alfalfa, clover, or grain crops; also inhabits native and introduced wet meadows, ungrazed to lightly grazed mixed-grass prairies, and fallow fields. Builds a flimsy cup nest of grass, stems, and rootlets in a depression on the ground. Nest is well-concealed with a dense cover of forbs or grass. Eggs [5 to 6, 0.8 inches (21 mm)] are gray to pale reddish-brown and marked with brown and purple blotches. Is an uncommon cowbird host. Gleans insects, spiders, and grass and forb seeds from the ground and vegetation. Winters in southern South America. Population declines are due to increasingly intensive haying practices, conversion from grass to alfalfa hay crops, and loss of hayfield breeding habitat to urbanization and reforestation. Hay cropping during incubation and early nestling stages results in 100% loss of offspring. Insecticide use in breeding areas both reduces and contaminates their primary food source, which impacts both juvenile and adult birds. Other species that may benefit from habitat management for this species include the Upland Sandpiper, Grasshopper Sparrow, Dickcissel, Chestnut-collared Longspur, and Sprague's Pipit.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Bobolink in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Manage for dense grass, heavy forb cover, and thick litter depth in areas where Bobolinks occur.

2) Manage for large areas [>75 acres (30 ha)] of preferred Bobolink habitat in areas where this species occurs.

Recommendations

1) High intensity livestock grazing can be detrimental to this species, but disturbance from low to moderate grazing and light burns can be used as habitat management tools. Across a landscape level, use grazing practices that allow large acreages of grasslands to go to a climax successional stage for Bobolinks and associated species. Areas should remain undisturbed long enough for grass and forb cover to become dense and heavy layers of ground litter to build up before succession is set back by disturbance.

2) In hayfields where Bobolinks occur, 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 Bobolinks. Consider growing alfalfa for seed or use late maturing legumes instead of traditional alfalfa management; this would allow cuttings to be delayed. If mowing must be done prior to mid-July, use a flush bar to allow birds time to escape, and leave small areas of uncut hay as refuges for young birds.

3) Avoid mowing grass habitats annually to ensure growth of dense grass and a heavy cover of forbs and to allow ground litter to build up. If mowing must occur, it should be done in the fall after the nesting season.

4) If disturbances are periodic, such as every three to five years, and rotated among tracts within a management unit, habitat for Bobolinks and associated species will always be provided.

5) In areas known to support nesting Bobolinks, conduct prescribed burns in the fall to avoid loss of nesting cover. To retain adequate residual cover for nesting the following spring, burns should be relatively small so a portion of the area contains nesting cover at all times.

6) Planted cool season grass/legume cover, such as that provided by Conservation Reserve Program lands, can also provide suitable habitat for this and associated species.

6) Inventory, monitoring, and research needs:

Inventory and Monitoring Needs

"Monitoring Wyoming's Birds: The Plan for Count-based Monitoring" would appear here, but was previously presented under Inventory and Monitoring Needs in the Plains/Basin Riparian habitat section.

Research Needs

Research needs will become more apparent once the inventory and monitoring needs have been met. Therefore, research needs will be addressed in a later version of the Wyoming Bird Conservation Plan.

Forest Habitat Group

Mid-elevation Conifer

1) Describe the habitat:

a) Historic conditions: Pure or mixed stands that included limber pine, Douglas fir, lodgepole pine, blue spruce, ponderosa pine, and aspen. Historically, the land surface was less forested, in an earlier successional stage, and had more canopy perforation; however, all tree species present today were represented historically. Less frequent (80 to 150 years) but more intense stand replacement fires occurred. The aspen component was greater due to more intense fires. Less ungulate use than in the present. Higher beaver concentrations and more influence than in the present.

b) Present conditions: Mixed conifer; pure or mixed stands that can include limber pine, Douglas fir, lodgepole pine, blue spruce, and/or ponderosa pine; can include aspen. In general, there is little understory among the early to mid seral lodgepole pine stands. Aspen component has decreased due to loss of fire.

2) Identify the issues:

a) Use: Timber harvesting, recreation, oil and gas extraction, grazing.

b) Access: The density of roads from logging and recreation has increased, allowing access to virtually all parts of this habitat type.

c) Problems: Fragmentation due to roads and trails, timber harvesting, rights-of-way, recreation, and home development; fire suppression; loss or reduction of aspen component; decreased snag (standing dead tree) density; changing structure of the understory due to grazing and home development; feral and domestic cats; avian displacement due to human activities.

d) What has been the cause of change to the habitat: Fire suppression; timber harvesting and related management; increased recreation, such as downhill ski areas and off-road vehicle use; increased human use.

3) Best Management Practices:

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

Note: forest Best Management Practices will be developed and added at a later date when time and funding allow.

4) Highest priority bird species and their habitat requirements (note: see Tables 6-9 for a description of status information for each species)**:**

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Northern Goshawk (NOGO) *Accipiter gentilis* Level I CA, M Score = 19 AI = 4 PT = 3	~Nest sites associated with pure and/or mixed stands of ponderosa pine, lodgepole pine, and Douglas fir intermingled with mature stands of aspen; in proximity to shrub/grass openings for foraging	~Mature stands of ≥50 acres and ≥70% canopy closure for successful breeding ~Dense canopy with interspersed small openings ~Snags, downed logs, and woody debris ~Open understory with a grass/ forb/shrub component	~Elevation 4,000 to 10,000 feet where habitat requirements are present ~Nests are often located near water and in areas with sufficient prey base	~High density of trees with ≥8 inches dbh ~Near water ~Prefer NE aspect for nest site on bench or gradual slope ~Within 400 yards of 1 acre clearings ~Aspen stands by running water or pine stands within 500 yards of running water	~Aspen regeneration via forest management techniques (e.g. fire, thinning) is needed ~Sensitive to disturbance at nest site from nest construction through 20 days post-hatch ~Prey availability may primarily dictate the portions of populations that migrate and selection of wintering areas

Note: Calliope Hummingbird (*Stellula calliope*), Level II, M, R, Score = 23, AI = 5, PT = 3, would appear here based on priority, but this species was already addressed in the Montane Riparian habitat section.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Williamson's Sapsucker (WISA) *Sphyrapicus thyroideus* Level II M Score = 21 AI = 3 PT = 3	~Mixed conifers (lodgepole pine; Douglas fir-spruce; lodgepole pine-spruce-fir; spruce) and tall aspens	~High structural layers ~Late succession		~Territory size of 10 acres per pair ~Trees with ≥10 inches dbh ~Oregon recommends 150 snags per 100 acres for maximum population	~Snags or live trees infected with heart rot fungi for cavity nest sites

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Black-backed Wood-pecker (BBWO) *Picoides arcticus* Level II M Score = 21 AI = 3 PT = 3	~Mixed conifers (spruce, fir, Douglas fir, lodgepole pine)	~Burned forests and dense forests of mature/old growth ~Burned, swampy, cut-over, or beetle-killed where dead trees are numerous	~Highly responsive to processes (e.g. fire, spruce budworm outbreaks) that result in high concentrations of wood-boring insects invading dead trees ~Use of burned areas declines 3 to 5 years post-burn	~May require a dynamic mosaic of recent burns across a landscape to sustain populations ~Trees with ≥8 inches dbh	~Fire dependent ~ Snags, partially dead trees, or live trees infected with heart rot fungi for cavity nest sites ~Abundance of prey may cause population irruption

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Rufous Humming-bird (RUHU) *Selasphorus rufus* Level II M Score = 20 AI = 2 PT = 3	~Mixed conifers (spruce-fir-lodgepole pine; spruce-fir; lodgepole pine-fir), conifer/aspen (lodgepole pine -aspen), and willow/aspen ~Meadows, forest edges, and riparian thickets of coniferous woodlands	~Early successional, open shrub, and forested habitats			

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Three-toed Wood-pecker (TTWO) *Picoides tridactylus* Level II M Score = 20 AI = 4 PT = 3	~Mixed conifers (lodgepole pine-spruce; lodgepole pine-spruce-fir; spruce-fir) ~Burned conifer forests	~Post-fire with large stands of dead trees	~Use of burned areas declines 3 to 5 years post-burn	~Optimal habitat includes areas with 42 to 52 snags per 100 acres, occurring in clumps, with 12 to 16 inches dbh, 20 to 40 feet tall, and mostly with bark still present	~Fire dependent ~ Snags, partially dead trees, or live trees infected with heart rot fungi for cavity nest sites ~Feeds primarily (75%) on wood-boring insects found on dying or recently dead lodgepole pine and Engelmann spruce ~Abundance of prey may cause population irruption

Note: Cordilleran Flycatcher (*Empidonax occidentalis*), Level II, M, Score = 20, AI = 3, PT = 3, would appear here based on priority, but this species was already addressed in the Montane Riparian habitat section.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Plumbeous Vireo (PLVI) *Vireo plumbeus* Level II M Score = 20 AI = 3 PT = 3	~Conifer or coniferous/ deciduous forests ~Fairly dry or warm	~Low to medium canopy cover ~Dense mid-story and understory	~Forest stands with many small (0.4 acre) openings	~Uneven age structure	~Sensitive to forest fragmentation

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Townsend's Warbler (TOWA) *Dendroica townsendii* Level II M Score = 20 AI = 3 PT = 3	~Tall, mature/ old growth conifer forests of spruce, fir, Douglas fir, lodgepole pine ~Moist, shaded	~Favors dense forests of towering old growth			~Treetop insect feeder ~Sensitive to timber harvest and declines with an increase in timber removed

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Great Gray Owl (GGOW) *Strix nebulosa* Level II M Score = 18 AI = 3 PT = 3	~Montane conifer forests ~Tall aspens ~Often nests in Douglas fir forests, with nests most commonly in Douglas fir and lodgepole pine	~Mid to late successional stages of Douglas fir on flat land with herbaceous understory and 50 to 60% closure of canopy cover	~1 square mile home range in WY	~Hunts meadows within forests	~Nests in old goshawk and raven nests, depression in top of broken topped snag, and dwarf mistletoe platforms

Note: Broad-tailed Hummingbird (*Selasphorous platycercus*), Level II, M, Score = 18, AI = 2, PT = 2, would appear here based on priority, but this species was already addressed in the Plains/Basin Riparian habitat section.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Brown Creeper (BRCR) *Certhia americana* Level II M Score = 16 AI = 3 PT = 3	~Mixed conifers (lodgepole pine; Douglas fir-spruce; lodgepole pine-spruce-fir; spruce-fir; spruce)	~Non-fragmented stands		~Is area-sensitive; requires large blocks of intact habitat	~Snags for nesting with >8 inches dbh, broken tops, and >40% original bark intact ~Sensitive to timber harvest during the breeding season

5) Biological objectives and recommendations:

Northern Goshawk

Found across most of Wyoming in mixed coniferous forest habitat. Prefers to nest in Douglas fir and lodgepole pine forests and aspen stands, but forages in a variety of habitats. Builds a platform nest of sticks, lined with bark and fresh sprigs of evergreen, in a conifer or aspen, 20 to 60 feet above ground. Eggs [3 to 4, 2.3 inches (59 mm)] are bluish-white to off-white. Chases and catches its prey in midair or seeks prey in a low searching flight. Feeds mainly on birds and also small mammals. Winters south to northern Mexico. Habitat loss and conversion due to timber harvesting and urbanization can affect populations. Other species that may benefit from habitat management for this species include the Black-backed Woodpecker, Hammond's Flycatcher, Blue Grouse, Clark's Nutcracker, Mountain Chickadee, Western Tanager, and Cassin's Finch.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Northern Goshawk in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Develop a cooperative, statewide, interagency/non-governmental organization database on Northern Goshawk nest sites, with data sensitivity built in.

Habitat Objectives

1) Reintroduce disturbance into forest stands to provide nesting habitat through long-term management for aspen regeneration and stands of mature aspen.

2) Maintain adjacent shrub/grass communities to ensure high densities of prey species are available.

3) Maintain forest stands of $\geq$50 acres (20 ha) with $\geq$70% canopy closure and trees with >8 inches (20 cm) dbh in areas where Northern Goshawks occur.

Recommendations

1) Avoid disturbing nest sites from April 1st through August 15th (nest construction through 20 days after the young hatch).

2) Implement forest management techniques in areas managed for Northern Goshawks that favor mature aspen stands and aspen regeneration in ponderosa pine, lodgepole pine, and Douglas fir forests.

Calliope Hummingbird

The Calliope Hummingbird is also a priority species in Montane Riparian habitat, and was addressed in that section.

Williamson's Sapsucker

Found in the mountainous areas of Wyoming where coniferous forests and stands of aspen dominate. Inhabits mixed conifer forests of lodgepole pine, Douglas fir, and blue spruce, especially those that have burned, and stands of tall aspen trees. Excavates a cavity nest in conifer or aspen from 5 to 60 feet above ground. May reuse a nesting tree, but chisels a new hole each time. Eggs [5 to 6, 1 inch (24 mm)] are white. Gleans insects, especially ants, and tree sap from tree trunks and branches. Winters south to north-central Mexico. May be declining due to loss of snags and live trees with dead heartwood for nesting habitat. Is threatened by harvesting of mature conifer stands and incompatible logging practices. Clearcuts remove habitat; however, selective logging may be compatible, depending on the area and methods used. Other species that may benefit from habitat management for this species include the Great Gray Owl, Hammond's Flycatcher, Hairy Woodpecker, Black-backed Woodpecker, and Three-toed Woodpecker.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Williamson's Sapsucker in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain mature stands of mixed conifer and aspen forests in areas where Williamson's Sapsuckers occur.

2) Maintain forest stands of trees with a minimum dbh of 10 inches (25 cm) in areas where Williamson's Sapsuckers occur.

3) Maintain an average to maximum snag density of 0.05 to 1.5 snags per acre (0.4 ha) in areas where Williamson's Sapsuckers occur.

Recommendations

1) Due to a lack of information on this species, determine additional habitat requirements through inventory, monitoring, and research.

Black-backed Woodpecker

Currently nests only in the northwest and northeast corners of Wyoming. Is a fire dependent species that prefers mixed conifer forests of lodgepole pine, Douglas fir, blue spruce, and Englemann spruce-subalpine fir, especially forests that have recently burned. Excavates a cavity nest in a conifer snag, partially dead conifer, or live conifer with dead heartwood, usually 2 to 15 feet above ground. Eggs [4, 0.9 inch (22 mm)] are white. Feeds mostly on ants and the larvae of wood-boring insects gleaned from tree trunks and branches. Is a year-round resident in Wyoming. Habitat loss due to logging of mature/old growth forests, salvage logging of post-fire stands, and urbanization is a concern. Other species that may benefit from habitat management for this species include the Three-toed Woodpecker, Great Gray Owl, Northern Goshawk, Hammond's Flycatcher, Williamson's Sapsucker, Clark's Nutcracker, Mountain Chickadee, Western Tanager, and Cassin's Finch.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Black-backed Woodpecker in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain dense forests of mature/old growth mixed conifers with an element of disturbance (e.g. burned, beetle-killed, cutover) that leaves numerous decadent trees, snags, and fallen logs.

2) Retain larger diameter trees [$\geq$8 inches (20 cm) dbh] for cavity nest sites and retain all trees with existing nest cavities.

3) Prevent Black-backed Woodpecker habitat loss due to fire suppression, loss of mature and old growth forests, and removal of snags and insect-infested trees.

4) On a landscape scale, provide a continual supply (1 to 2% of the landscape) of recent stand replacement fires >100 acres (40 ha) in size, with at least 50% of that total unsalvaged after buning.

Recommendations

1) On a 3 to 5 year rotational basis, provide for the type of disturbances (e.g. fire or pathogenic producing) that provides a source of food and nest sites in mature and old growth mixed conifer forests in areas where Black-backed Woodpeckers occur.

2) In recently burned conifer forests, refrain from salvage logging for up to six years post-burn or until wood-boring insects decline.

3) To sustain Black-backed Woodpecker populations, establish management areas of 1,000 acres (405 ha) in preferred habitat, with no salvage sales allowed.

4) Implement forest management practices in areas where Black-backed Woodpeckers occur that retain all trees with nest cavities; retain snags in harvested areas; retain mature trees and a mix of healthy and diseased trees for nest sites; retain some tall, hard, dead trees for drumming sites; and retain patches of trees in a variety of decay stages for foraging, especially insect host trees and those susceptible to future insect occupancy.

5) Where salvage logging of burns is inevitable, remove trees from one area of the burn only, leaving another representative area intact that retains the full complement of snag dimensions for Black-backed Woodpeckers and other post-fire dependent species.

6) Avoid or minimize insecticide use in forest habitats to maintain a food source for Black-backed Woodpeckers (and other insectivores).

7) Due to incomplete information on this species, determine additional habitat requirements through inventory, monitoring, and research. In particular, more detailed information is needed on habitat use, diet, required snag density, and response to land management activities, especially forest harvest patterns and changes in fire regimes.

Rufous Hummingbird

Found across Wyoming during migration, but nests only in the northwestern corner of the state because Wyoming is on the eastern limit of its breeding range. Nests in mixed forests of lodgepole pine, Douglas fir, blue spruce, and aspen, and in riparian thickets within the forest. Builds a lichen-covered cup nest of plant down and spider's silk attached to a horizontal branch or drooping limb, from 1 to 15 feet above ground. Nests are built in conifer or deciduous trees, vines, or shrubs, and are often reused year after year. May nest in a loose colony of up to 10 nests. Eggs [2, 0.5 inches (13 mm)] are white. Feeds on nectar, insects, spiders, and tree sap. Winters south to south-central Mexico. Habitat alteration and simplification due to incompatible livestock grazing and recreation is a concern. Other species that may benefit from habitat management for this species include the Northern Goshawk, Cordilleran Flycatcher, Calliope Hummingbird, Cassin's Finch, and Western Tanager.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Rufous Hummingbird in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain a mosaic of mixed coniferous forests, meadows, and riparian shrub habitat in areas where Rufous Hummingbirds occur.

Recommendations

1) Inventory appropriate habitat to determine population and nesting status and specific habitat requirements of Rufous Hummingbirds in Wyoming.

Three-toed Woodpecker

Scattered across Wyoming in coniferous forests (except in the eastern third of the state). Inhabits mixed conifer forests of lodgepole pine, Douglas fir, blue spruce, and Englemann spruce-subalpine fir, especially those forests that have burned. Excavates a cavity nest in a conifer from 5 to 50 feet above ground. Eggs [4, 0.9 inch (23 mm)] are white. Feeds on insects, especially the larvae of wood-boring insects, and tree sap gleaned from tree trunks and branches. Is a year-round resident in Wyoming. Habitat loss due to logging of mature/old growth forests, salvage logging of post-fire stands, and urbanization is a concern. Other species that may benefit from habitat management for this species include the Williamson's Sapsucker, Black-backed Woodpecker, Clark's Nutcracker, Western Tanager, Northern Goshawk, Great Gray Owl, and Mountain Chickadee.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Three-toed Woodpecker in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain dense forests of mature/old growth mixed conifers with an element of disturbance (e.g. burned, beetle-killed, cutover) that leaves numerous decadent trees, snags, and fallen logs.

2) Retain larger diameter trees [≥12 inches (30 cm) dbh] for cavity nest sites and retain all trees with existing nest cavities.

3) Prevent Three-toed Woodpecker habitat loss due to fire suppression, loss of mature and old growth forests, and removal of snags and insect-infested trees.

4) On a landscape scale, provide a continual supply (1 to 2% of the landscape) of recent stand replacement fires >100 acres (40 ha) in size, with at least 50% of that total unsalvaged after buning.

Recommendations

1) On a 3 to 5 year rotational basis, provide for the type of disturbances (e.g. fire or pathogenic producing) that provides a source of food and nest sites in mature and old growth mixed conifer forests in areas where Three-toed Woodpeckers occur.

2) In recently burned coniferous forests, refrain from salvage logging for up to six years post-burn or until wood-boring insects decline.

3) To provide optimal habitat for Three-toed Woodpeckers, provide areas in mature/old growth mixed conifer forests that include clumps of 42 to 52 snags per acre that are 12 to 16 inches (30 to 41 cm) dhb and 20 to 40 feet (6 to 12 m) tall, with most of the bark still present.

4) Implement forest management practices in areas where Three-toed Woodpeckers occur that retain all trees with nest cavities; retain snags in harvested areas; retain mature trees and a mix of healthy and diseased trees for nest sites; retain some tall, hard, dead trees for drumming sites; and retain patches of trees in a variety of decay stages for foraging, especially insect host trees and those susceptible to future insect occupancy.

5) Where salvage logging of burns is inevitable, remove trees from one area of the burn only, leaving another representative area intact that retains the full complement of snag dimensions for Three-toed Woodpeckers and other post-fire dependent species.

6) Avoid or minimize insecticide use in forest habitats to maintain a food source for Three-toed Woodpeckers (and other insectivores).

7) Due to incomplete information on this species, determine additional habitat requirements through inventory, monitoring, and research. In particular, more detailed information is needed on habitat use, diet, required snag density, and response to land management activities, especially forest harvest patterns and changes in fire regimes.

<u>Cordilleran Flycatcher</u>

The Cordilleran Flycatcher is also a priority species in Montane Riparian habitat, and was addressed in that section.

Plumbeous Vireo

Scattered throughout the mountain foothills of Wyoming. Inhabits coniferous and mixed coniferous/deciduous forests, especially open forests with low to medium canopy cover and a dense shrub understory. Has a wide habitat tolerance, and uses openings caused by logging and fire. Favors rotation-age rather than old-growth forests, but is apparently sensitive to forest fragmentation. Builds a deep cup nest suspended by the upper rim from a forked twig of a horizontal conifer or deciduous tree branch, 4 to 30 feet above ground. Is a common cowbird host; if a cowbird egg is laid first, it often builds a second floor of the nest to cover it. Feeds on insects gleaned from twigs and foliage, or catches flying insects, and occasionally eats small fruits. Winters in South America. Increased opportunities for nest parasitism due to incompatible livestock grazing is a concern. Other species that may benefit from habitat management for this species include the Lewis' Woodpecker, Dusky Flycatcher, Swainson's Thrush, and Western Tanager.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Plumbeous Vireo in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain undergrowth in coniferous and mixed coniferous/deciduous forests.

2) Maintain small openings [about 0.3 acre (0.1 ha)] in coniferous and mixed coniferous/deciduous forests without fragmenting forests and removing undergrowth.

Recommendations

1) Manage for coniferous and coniferous/deciduous forests stands with many small openings [about 0.3 acre (0.1 ha)] and considerable undergrowth in areas where Plumbeous Vireos occur.

2) Avoid grazing in coniferous and deciduous forests where Plumbeous Vireos nest from April through July to reduce cowbird nest parasitism.

Townsend's Warbler

Scattered across most of Wyoming in coniferous forests. Inhabits dense, moist, shaded old growth and mature lodgepole pine, Douglas fir, Englemann spruce-subalpine fir, and mixed conifer forests. Builds a cup nest of grass, twigs, lichen, and feathers far out on a limb of a conifer, usually 8 to 15 feet above ground. Eggs [4 to 5, 0.7 inch (18 mm)] are white and marked with browns mainly toward the large end. Is a rare cowbird host. Feeds entirely on insects gleaned from vegetation near the treetops. Winters south through Mexico to Costa Rica. Populations are sensitive to timber harvesting, and decline with increases in the amount of mature and old growth forest habitat removed. Other species that may benefit from habitat management for this species include the Great Gray Owl, Boreal Owl, Hammond's Flycatcher, Plumbeous Vireo, Brown Creeper, and Golden-crowned Kinglet.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Townsend's Warbler in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain stands of tall, dense, mature/old growth mixed conifer forests in areas where Townsend's Warblers nest.

2) Avoid removing and fragmenting mature/old growth conifer forests through logging and human developments.

Recommendations

1) Inventory appropriate habitat to determine population and nesting status and specific habitat requirements of Townsend's Warblers in Wyoming.

2) Conduct thorough surveys for Townsend's Warblers in tall, dense, mature/old growth mixed conifer forests during the breeding season prior to any timber harvesting.

Great Gray Owl

Found mainly in the mountainous areas in the western one-third of Wyoming. Inhabits lodgepole pine, Douglas fir, Englemann spruce-subalpine fir, and mixed coniferous forests, and stands of tall aspens. Uses an abandoned hawk or eagle stick platform nest built in a dense conifer or on a broken topped snag. Eggs [2 to 4, 2.1 inches (54 mm)] are white. Feeds mostly on voles, but may take other small mammals and small birds. Hovers and pounces on its prey. Is a year-round resident in Wyoming. Populations are restricted by lack of available habitat and habitat loss due to logging. Other species that may benefit from habitat management for this species include the Northern Goshawk, Black-backed Woodpecker, Three-toed Woodpecker, Hammond's Flycatcher, and Townsend's Warbler.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Great Gray Owl in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Develop a cooperative, statewide, interagency/non-governmental organization database on Great Gray Owls nest sites, with data sensitivity built in.

Habitat Objectives

1) Maintain mid to late successional stages of mixed conifer and aspen stands with an herbaceous understory.

2) Use forest management practices that do not result in large-scale removal of montane coniferous forests.

3) Avoid removing and fragmenting montane coniferous forests through human developments.

Recommendations

1) Inventory appropriate habitat to determine population and nesting status and specific habitat requirements of Great Gray Owls in Wyoming.

2) Conduct thorough surveys for Great Gray Owls prior to any timber harvesting.

Broad-tailed Hummingbird

The Broad-tailed Hummingbird is also a priority species in Plains/Basin Riparian habitat, and was addressed in that section.

Brown Creeper

Scattered throughout Wyoming in coniferous forest habitats. Prefers non-fragmented stands of lodgepole pine, Douglas fir, blue spruce, Englemann spruce-subalpine fir, and mixed coniferous forests during the breeding season. Builds a hammock-like cup nest of bark shreds, feathers, sticks, and moss, under loose bark of a snag or live conifer tree, 5 to 15 feet above ground. Eggs [5 to 6, 0.6 inch (15 mm)] are white and lightly speckled with brown. Is a rare cowbird host. Gleans insects, spiders, nuts, and seeds from tree bark and branches. Is a year-round resident in Wyoming, and can be found at lower elevations during the winter. Is area-sensitive, and requires large blocks of mature/old growth mixed conifer habitat. Is intolerant of heavy logging or thinning. Populations are locally threatened by forest management practices that remove or fragment preferred habitat and that remove snags. Other species that may benefit from habitat management for this species include the Hairy Woodpecker, Hammond's Flycatcher, Townsend's Warbler, Golden-crowned Kinglet, and Red-breasted Nuthatch.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Brown Creeper in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Habitat Objectives

1) Maintain large, continuous, non-fragmented stands of mixed conifer forests.

2) Maintain large diameter snags and live trees for Brown Creeper nesting and foraging sites within mixed conifer forests. Larger diameter trees provide deeper bark furrows, which increase the available foraging substrate without substantially increasing the actual area over which a bird has to move in search of prey.

Recommendations

1) Implement forest management practices that provide large, continuous, non-fragmented stands of mixed coniferous forests in areas where Brown Creepers occur.

2) Implement forest management practices that provide snags with broken tops, >8 inches (20 cm) dbh, and >40% of the original bark intact for nesting in areas where Brown Creepers nest.

3) In areas where logging occurs, implement harvest rotations that increase the potential of the forest to produce or retain large snags (the lengthening of rotation periods to more than 100 years), retain large snags in clearcuts and thinning cuts and create snags from living trees in areas where large snags are not present, and maintain old stands of timber in riparian buffer zones.

4) Avoid or minimize insecticide use in forest habitats to maintain a food source for Brown Creepers (and other insectivores).

5) Determine the effects of forest management practices on Brown Creepers in Wyoming, since most research has taken place in other states where this species occurs.

6) Determine how landscape factors, disturbance, forest fragmentation, and various forest management practices impact Brown Creeper foraging, productivity, and survivorship.

6) Inventory, monitoring, and research needs:

<u>Inventory and Monitoring Needs</u>

"Monitoring Wyoming's Birds: The Plan for Count-based Monitoring" would appear here, but was previously presented under Inventory and Monitoring Needs in the Plains/Basin Riparian habitat section.

<u>Research Needs</u>

Research needs will become more apparent once the inventory and monitoring needs have been met. Therefore, research needs will be addressed in a later version of the Wyoming Bird Conservation Plan.

Shrubland Habitat Group

Shrub-steppe

1) Describe the habitat:

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

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

2) Identify the issues:

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

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

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

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

3) Best Management Practices:

Wyoming Partners In Flight Best Management Practices for Shrublands to Benefit Birds In Wyoming. (Excerpted from "Birds in a Sagebrush Sea", Paige and Ritter 1999.)

Introduction

Sagebrush country symbolizes the wild, wide-open spaces of the West. While the first impression may be a monotony of low shrubs, the over-reaching sky, a scattering of little brown birds darting away through the brush, and that heady, ever-present sage perfume, a closer look reveals just how complex and variable sagebrush landscapes can be. From shrublands to grasslands, wet meadows and woodland edges, a mosaic of habitats supports an abundance of birds, other animals, and native plants, some of them specially adapted to these semi-deserts.

Sagebrush habitats across the West have been greatly altered by a century of settlement, livestock grazing, agriculture, weed invasion, and changes in wildfire frequency. Across the United States, the populations of 63% of shrubland and shrub-dependent bird species and 70% of grassland species are declining. In the Intermountain West, more than 50% of grassland and shrubland species show downward trends (Sauer et al. 1996). The lack of quantitative information on many species' habitat needs reflects a severe shortage of ecological studies in sagebrush habitats. Thoughtful land management can help rejuvenate native sagebrush habitats and reverse the declines of sagebrush dependent species.

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

Ecology of Sagebrush Habitats

Sagebrush occurs in cold semi-deserts across the Intermountain West. In much of this region, winters are long, summers are hot and dry, and winds are persistent. In these semi-deserts, most of the annual precipitation comes as snow and early spring rain. Summer storms are brief and intense, and most summer rain runs off or evaporates.

The entire sagebrush region covers approximately 155.5 million acres (63 million ha) of the West. This broad zone is divided into two general vegetation types. The true "sagebrush steppe" type covers the northern portion of the Intermountain region, where sagebrush is co-dominant and grasses are few and sparse [44.5 million acres (18 million ha)] (West 1996). Across the sagebrush region, sagebrush habitat ranges from semi-arid grasslands with a scattering of sagebrush to arid sagebrush-dominated shrublands with few grasses.

Several species and subspecies of sagebrush grow in the west, but the species big sagebrush predominates, and has five known subspecies (West 1988, Kartesz 1994). It is often important to differentiate between sagebrush species and subspecies in order to classify rangeland types; understand site potential, palatability to livestock and wildlife, and response to fire; and manage vegetation. However, for many birds, the species of sagebrush is less important than its height, density, cover, and patchiness.

A wide variety of vegetation community types exist within the sagebrush landscape due to differences in soil, climate, topography, and other physical processes, and natural and human-induced disturbances. Usually a single species of sagebrush is dominant in a community, but communities differ widely in understory plants. Understories are usually dominated by one or more perennial bunchgrasses, such as bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, Thurber needlegrass, needle-and-thread, bottlebrush squirreltail, or Indian ricegrass. Forbs, such as phlox, milk-vetch, and fleabane, are less common, but can be abundant in moist areas.

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

Biological soil crust is an integral and usually overlooked component of sagebrush shrublands. It creates a rough crust on the soil surface in semi-arid habitats. Biological soil crust (also known as "cryptobiotic crust", "microbiotic crust", or "cryptogamic soil") is a fragile microfloral community composed of blue-green algae, bacteria, fungi, mosses, and lichens. The diversity and function of crust communities has been little understood and under appreciated (St. Clair et al. 1993). This crust may play an important role in dry regions by stabilizing soils from wind and water erosion, contributing to soil productivity, influencing nutrient levels, retaining moisture, altering soil temperature, and aiding seedling establishment (Belnap 1993, 1994; St. Clair and Johansen 1993; Kaltenecker 1997). Where crust communities are well established in a healthy shrubland, they help prevent the invasion of cheatgrass and, because crusts do not provide much fuel, they slow the spread of wildfire (Kaltenecker 1997).

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

Changes in Sagebrush Country

Early explorers of the Intermountain West encountered a landscape dominated by shrubs and found grasslands chiefly limited to hillsides and moist valley bottoms (Vale 1975). Sagebrush was widespread and dominant, and the boundaries of sagebrush habitats before European settlement were about the same as they are today.

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

Explorers' reports of abundant and widespread sagebrush probably indicate that fires were relatively infrequent in sagebrush habitats. Because bunchgrasses generally do not provide a continuous fuel layer to carry fire long distances, fires in presettlement times were probably patchy and small except in very dry years. Presettlement fire intervals have been estimated at 20 to 25 years in wetter region, and 60 to 110 years in the arid sagebrush steppe of southern Idaho (Tisdale and Hironaka 1981, Whisenant 1990). After a fire, big sagebrush must be re-established by wind-dispersed seed or seeds in the soil. Depending on the species, sagebrush can re-establish itself within 5 years of a burn, but a return to pre-burn densities can take 15 to 30 years (Bunting 1984,

Britton and Clark 1984). Before European settlement, then, spotty and occasional wildfire probably created a patchwork of young and old sagebrush stands across the landscape, interspersed with grassland openings, wet meadows, and other shrub communities.

Since presettlement times, sagebrush communities have suffered severe degradation and loss. The ecology, natural disturbance patterns, and vegetation communities have been altered by agricultural conversion, invasion of non-native plants, extensive grazing, development, sagebrush eradication programs, and changes in fire regimes.

The arrival of cattle and sheep in the Great Basin in the late 19th century triggered a rapid change in sagebrush plant communities (Yensen 1981, Dobkin 1994). Sites may have lost their native perennial grasses less than 15 years after livestock introduction. In addition, settlers burned off sagebrush to produce more grass for horses, sheep, and cattle and to clear the land for farming (R. McQuivey, personal communication). Today, grazing pressure has decreased considerably compared to the early 1900s. However, less than 1% of the sagebrush steppe remains untouched by livestock; roughly 20% is lightly grazed, 30% is moderately grazed and has remnants of native herbs, and 30% is heavily grazed with the native understory replaced by introduced annuals (West 1988, 1996). Sagebrush steppe can take time to recover from excessive grazing, especially on drier sites.

The effect of grazing in any region depends on season of use, intensity, type of livestock, and the plant species themselves (Tisdale and Hironaka 1981). In the Great Basin, for example, perennial bunchgrasses must grow quickly to set seed over the short growing season, so intensive spring grazing prevents the plants from reproducing, eventually eliminating the palatable native bunchgrasses (Mack and Thompson 1982). Where grazing removes the herbaceous understory altogether, the balance is tipped in favor of shrubs, allowing sagebrush to spread and creating overly dense sagebrush stands with a sparse understory of annuals and unpalatable perennials (Tisdale and Hironaka 1981).

Excessive grazing in the 19th and early 20th centuries also likely reduced crust communities throughout the Intermountain West, and it is difficult now to piece together their original extent and role in sagebrush habitats (Mack and Thompson 1982, St. Clair et al. 1993).

As well as affecting vegetation, grazing can influence bird communities in another way. The presence of livestock (particularly cattle and horses) creates feeding habitat for the Brown-headed Cowbird, a "nest parasite" that lays its eggs in the nests of other songbirds for the host parents to raise. This reduces the number of young that the host species population can produce in a year. Cowbirds feed on insects stirred up by

grazing herbivores, and parasitize nests in nearby shrublands and woodlands. A native of the Great Plains, the Brown-headed Cowbird adapted to follow the herds of migratory bison. With settlement and the spread of livestock throughout the West, the cowbird's range expanded, exposing new populations and species of songbirds to brood parasitism pressure. Cowbird parasitism may be a significant factor in the decline of some songbird populations.

From the 1930s through the 1960s, and to much lesser extent today, land managers controlled sagebrush on degraded rangeland by burning, plowing, chaining, disking, and spraying herbicides to increase livestock forage on sites where the native grasses had been lost. Many areas were seeded with crested wheatgrass, a non-native perennial bunchgrass, to provide forage. In addition to the thousands of acres where non-native grasses are mixed with sagebrush, approximately 10% of native sagebrush steppe has now been completely replaced by invasive annuals or by intentionally seeded non-native grasses (West 1988, 1996). Another 10% of the sagebrush steppe has been converted to dryland or irrigated agriculture (West 1988, 1996).

The greatest change to sagebrush plant communities came with the invasion of non-native annual grasses and forbs. Inadvertently introduced in the late 19th century, cheatgrass spread like an epidemic across the Intermountain West along transportation corridors and in the wake of grazing and agriculture, and reached its present geographic range by about 1928 (Mack 1981, Yensen 1981). Today, cheatgrass threatens to dominate 62 million acres (25 million ha) - more than half of the West's sagebrush region (Rich 1996).

Cheatgrass readily invades and rapidly colonizes disturbed sites and is a persistent resident, replacing native species (Mack 1981, Yensen 1981, Whisenant 1990). Other non-native species, such as medusahead, yellow star thistle, knapweed, tumble mustard, and halogeton, are also becoming increasing problems (Yensen 1980, West 1996). The presence of these invasive weeds also affects biological soil crusts.

Cheatgrass invasion fundamentally alters fire and vegetation patterns in sagebrush habitats by creating a bed of continuous, fine fuel that readily carries fire. Where cheatgrass dominates the understory, it carries fire over great distances, and the range burns far more frequently - at intervals of 3 to 5 years. Cheatgrass matures and dries earlier than native bunchgrasses, increasing the chance of fire earlier in the season (Young and Evans 1978, Whisenant 1990, Knick and Rotenberry 1997). Because sagebrush may take several years to mature before producing seed, repeated, frequent fires can eliminate sagebrush entirely. Cheatgrass dominance eventually creates a uniform annual grassland perpetuated by large, frequent fires and void of remaining patches of native plant communities (Whisenant 1990). Native shrubs, perennial grasses, and forbs can re-establish on a cheatgrass-dominated site over a course of

several years if fire is suppressed, rainfall is low (Hosten and West 1994), and there is a seed source for native species.

How to Help Birds in Sagebrush Habitats

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

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

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

The following management recommendations are voluntary and are meant to aid the land manager in enhancing habitat for sagebrush birds. These are based on our current knowledge of habitat requirements of sagebrush birds. Our main goal is to describe what birds need. Most of these suggestions will also benefit other wildlife species. You may find that certain recommendations are not appropriate for your situation, depending on your management goals, vegetation types, site potential, costs, and opportunities. But even if you can implement only a few of the recommendations, you can help improve habitat for birds.

General Sagebrush Habitat Management

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

1) Identify and protect those habitats that still have a thriving community of native understory and sagebrush plants. These may be managed as conservation easements (which do not necessarily exclude economic land uses), refuges, protected areas, sanctuaries, or research areas. Management should focus on restoring natural disturbance processes, such as fire, and removing invasive non-native plants.

2) Where possible, restore or rehabilitate degraded and disturbed sites to native plant communities.

3) 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 320 acres (130 ha).

4) Within extensive areas of sagebrush habitat, manage for a patchwork or mosaic of native plant communities across the local landscape. This may include stands of young and old sagebrush, openings (ranging from bare ground to short vegetation to high grass density), wet meadows, seeps, healthy riparian vegetation, and other interspersed shrub and woodland habitats. Mosaics support many bird species with different needs. Young, sparse stands support Vesper Sparrows and Lark Sparrows. Older, denser stands benefit Sage Grouse, Long-billed Curlews, and Burrowing Owls. Broad-leaved shrub thickets and riparian areas provide winter habitat for Sharp-tailed Grouse. Forested streamsides provide nest sites for Swainson's Hawks, and interspersed juniper woodlands supply nesting areas for Loggerhead Shrikes, Gray Flycatchers, Ferruginous Hawks, and Green-tailed Towhees.

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

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

7) 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.

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

Sagebrush

1) Avoid practices that permanently convert sagebrush shrubland to non-native grassland or farmland.

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

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

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

5) Use Tables 32 and 33 below to determine the sagebrush habitat components needed and nesting substrates used by sagebrush shrubland bird species of concern. These tables can help guide landowners and land managers in efforts to provide necessary habitat characteristics for sagebrush obligate and dependent species on patch, stand, and landscape scales.

Table 32. 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	X	X	X	X	X	X		
Sage Thrasher	X	X	X		X			
Sage Sparrow	X		X		X			
Brewer's Sparrow	X	X	X		X			
Shrubland Species								
Black-throated Sparrow		X	X					
Green-tailed Towhee	X	X	X				X	
Lark Sparrow		X	X	X			X	
Shrubland and Grassland Species								
Swainson's Hawk		X		X	X	X		X
Ferruginous Hawk		X		X	X		X	
Prairie Falcon		X		X			X	
Sharp-tailed Grouse	X	X	X	X		X		X
Loggerhead Shrike	X	X			X		X	X
Grassland Species								
Long-billed Curlew		X		X	X	X		
Burrowing Owl		X		X	X			
Short-eared Owl		X	X	X		X		
Vesper Sparrow		X	X	X				
Dry Woodland Species								
Gray Flycatcher	X						X	

Table 33. Nesting substrates for 17 sagebrush shrubland bird species of concern.

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

Understory Grasses and Forbs

Perennial bunchgrasses and native forbs provide food and cover for many sagebrush birds. Several species (e.g. Sage Grouse, Sharp-tailed Grouse, and Sage Sparrow) are more common and more productive where perennial grasses in sagebrush steppe are tall, dense, and healthy, and many species that nest on the ground or low in woody shrubs rely on grasses for nesting cover (Tables 30 and 31). Also, there is experimental evidence that shrub-steppe birds prefer to eat native grass seeds rather than cheatgrass or medusahead (Goebel and Berry 1976, Kelrick et al. 1986).

1) Wherever perennial bunchgrasses and native forbs persist, choose practices that stabilize or increase native grass and forb cover in balance with open to moderate (5 to 25%) sagebrush cover.

2) To maintain bluebunch wheatgrass vigor (its capacity for growth and reproduction), avoid grazing during the growing season until plants begin to cure. Bluebunch wheatgrass, one of the most widespread of native bunchgrasses, is particularly sensitive to heavy grazing during the growing season.

3) Rehabilitating sites depleted of native grasses and forbs may require seeding native species, temporarily eliminating or reducing livestock grazing, conducting appropriate fall-winter grazing, thinning sagebrush stands, creating small clearings, or other strategies.

4) Where reseeding disturbed and degraded sites, try to use local, native genotypes that are competitive with 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.

5) Maintain native forb diversity. Forbs are extremely important to the diets of Sage Grouse broods, pronghorn antelope, and other wildlife. Use practices that allow forb growth to continue through spring and summer, particularly in Sage Grouse breeding habitat. Some forbs that are especially valuable to Sage Grouse are common dandelion, yellow salsify, hawksbeard, prickly lettuce, mountain-dandelion, sweet-clover and other clover species, buckwheat, and common yarrow (J. Connelley, personal communication).

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

1) To maintain soil crusts, minimize soil disturbances. Crusts are sensitive to trampling by hikers, livestock, and vehicles. There is considerable debate over recovery times for biological soil crusts, from a few years for visual recovery of the crust structure to several decades for full community recovery; recovery times depend on the site and degree of disturbance (Cole 1990, Belnap 1993, Johansen et al. 1993).

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

1) 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.

2) 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. To maintain native bunchgrasses on a given unit, defer grazing until after crucial growth periods, waiting until grasses have begun to cure so seed-set can happen. However, deferred grazing can favor cheatgrass unless perennial grasses are a

significant component of the vegetation. In stands where cheatgrass and native perennial grasses are mixed, grazing during the dormant period may favor perennial species (Young 1992, Vallentine and Stevens 1994).

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

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

5) Maintain herbaceous cover for nest concealment by protecting the current season's growth through the nesting season and by managing for at least 50% of annual vegetative growth to remain through the following nesting season (Saab et al. 1995). For Sage Grouse, average grass height of at least 7 inches (18 cm), measured in May and early June, provides adequate herbaceous cover for successful nesting (Idaho Sage Grouse Task Force 1997). For Sharp-tailed Grouse, retain a residual cover of perennial grasses and forbs of at least 8 inches (20 cm) to provide sufficient nesting cover.

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

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

Water Developments

We cannot overstate the importance of healthy plant communities around streams, rivers, ponds, lakes, springs, seeps, wet meadows, and wetlands to birds and other wildlife, especially in arid country. These areas provide water, abundant insects and forbs for eating, and grasses and forbs for cover. Water developments for livestock or wildlife can use water that is already available (such as springs and seeps) or harvest water that is otherwise unavailable (such as wells and catchments). Be sure to evaluate the benefit of water developments against their effect on aquatic and riparian vegetation, the water table, and potential for attracting undesirable animals or plants.

1) Avoid practices that degrade or destroy natural water flow or the vegetation in and around wetland habitats. Restore and enhance natural riparian and aquatic habitats wherever possible.

2) 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).

3) 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 do not string fences across water. Limiting grazing to the plants' dormant season (November to March) can help prevent damage to these areas (C. Merker, personal communication).

4) 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.

5) Small birds sometimes drown in stock tanks and troughs. Provide escape ramps or floats to prevent drowning (Candelaria and Wood 1981) (Figure 22).

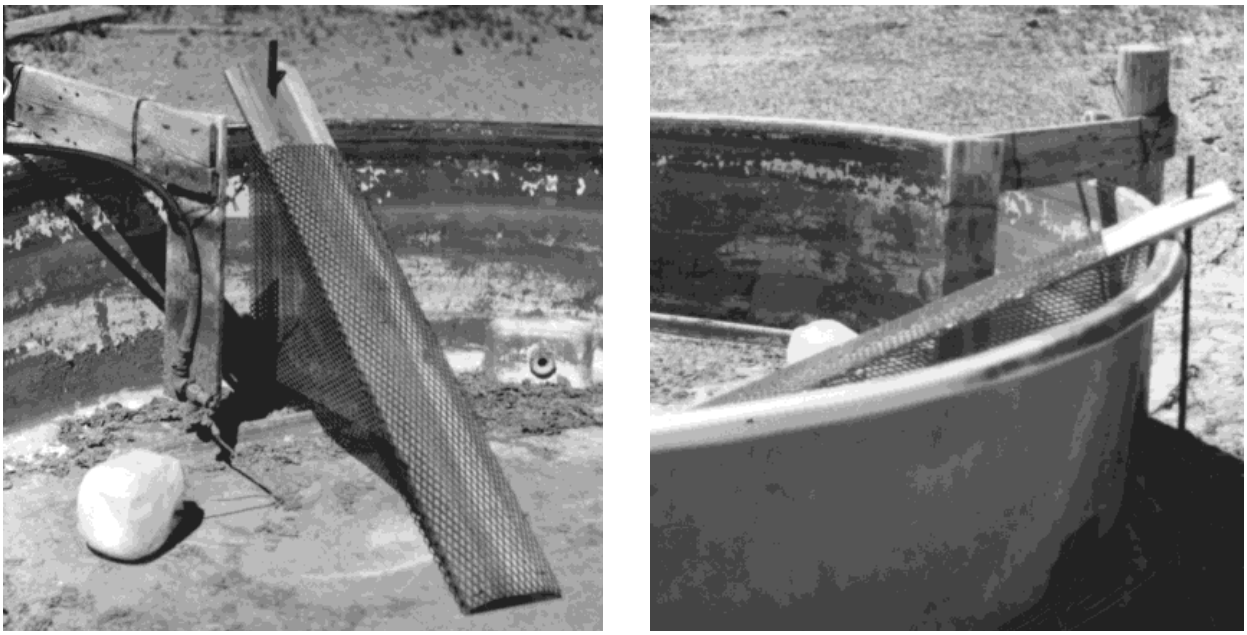

Figure 22. Escape ramps placed in stock tanks and troughs to prevent drowning of small birds and mammals (photographs courtesy of Mark Gorges, Bureau of Land Management).

Insecticides

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

In sagebrush shrublands, grasshoppers are traditionally viewed as a major pest, and poor range condition, drought, and certain weather patterns can lead to grasshopper outbreaks. Intensive insecticide control programs that eliminate grasshoppers, as well as beneficial insects, can trigger a rapid resurgence in pest species and actually increase the probability and duration of economically damaging grasshopper outbreaks (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 shrub-steppe and grassland birds in summer and early fall. Although birds cannot control large pest outbreaks once they have erupted, as predators they play an important role in preventing pest buildups (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.

1) Land managers concerned with maintaining productive bird populations should reduce insecticide use wherever possible.

2) Include birds in Integrated Pest Management plans for grasshopper and other insect control, along with natural pathogens, suitable crop and grazing practices, pest-resistant crop strains, minimal use of insecticides (George et al. 1995), and using less toxic forms of insecticides.

3) Reduce or avoid the direct toxic effects of insecticides on birds by using insecticide baits and natural pathogens (such as *Nosema locustae* for grasshoppers) instead of broad-spectrum insecticides. Target pest control toward key problem areas, and time applications to be effective in minimum doses. Avoid broadcast spraying. Use ground applications rather than aerial spraying to prevent drift into non-target areas.

4) Avoid applying pesticides to Sharp-tailed Grouse and 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).

5) Restrict use of insecticides to the minimum application rates on croplands that border sagebrush habitat. Organophosphate insecticides (dimethoate and methamidophos at maximum rates) have been shown to cause die-offs and sickness in 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.

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

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

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

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

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

Prescribed Fire and Wildfire

Burning over large areas to eradicate sagebrush is detrimental to birds in sagebrush habitats because it removes shrub cover. More alarmingly, it promotes the vegetation communities' conversion to 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. Wildfire suppression is the best management prescription in areas prone to cheatgrass invasion and to subsequent increase in fire frequency and loss of sagebrush. Prescribed fire can be used to fulfill fire's natural role where needed.

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

2) Burns should be timed to consider the development and susceptibility of desired plants. Mid-summer burns can devastate native perennial grasses and forbs because they destroy plants before they have reached maturity. Mid-summer fires also favor cheatgrass, and can increase erosion when the soil is exposed to severe 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).

3) 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).

4) In cheatgrass-dominated landscapes, greenstripping (placing fuelbreaks of fire-resistant vegetation at strategic locations on the landscape) offers an option for slowing the spread of wildfire and reducing the size of range fires (Pellant 1994). However, because greenstrips fragment sagebrush habitat and can bring in more non-native weeds if the seeding is unsuccessful (J. Rotenberry, personal communication), only use greenstripping in areas where there is a high threat of invasion of annual grasses and where there is a real threat to high-value sagebrush sites.

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

Habitat Fragmentation

Habitat fragmentation can result from land conversion to annual grassland or tilled cropland, mining, and development. These activities break sagebrush communities into small, and sometimes isolated, stands. Habitat fragmentation threatens sagebrush obligate species that evolved in a vast, continuous landscape of sagebrush habitat. Sagebrush obligates are not as productive in small stands of habitat as in large stands, and their numbers decline with increasing disturbance (Knick and Rotenberry 1995, Knick 1996). Nest predation and cowbird nest parasitism may also play a role in reducing bird productivity in fragmented sagebrush habitat, but have been studied very little (T. Rich, personal communication). 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, personal communication). In a study in Washington, Sage Sparrows were not found on patches smaller than about 320 acres (130 ha) (M. Vander Haegan, personal communication), so it is suggested that patches should be that size or larger (J. Rotenberry, personal communication).

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

2) Maintain existing larger stands of sagebrush and continuity between stands wherever possible. Avoid designs and practices that create or increase the amount of edge between sagebrush habitat and converted or highly altered land. These edges support cowbirds, nest predators, and invasive grasses and forbs, and they expose wildlife to insecticides, shooting, collisions with vehicles, and other hazards.

3) To benefit Sage Grouse and Sharp-tailed Grouse, maintain large expanses of sagebrush habitat. Summer Sage Grouse home ranges vary from 1 to 2.5 mile^2 (3 to 7 km^2), and may be larger in fragmented habitats. Sage Grouse winter home ranges may exceed 53 mile^2 (140 km^2). Large expanses of sagebrush across a landscape with stands of 10% to >20% canopy cover and tall shrubs [10 to 12 inches (25 to 30 cm)] provide winter habitat. Sharp-tailed Grouse require thousands of acres or hectares to support a self-sustaining population; large block of agriculture are not conducive to Sharp-tailed Grouse occupancy (Ulliman et al. 1998).

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

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

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

Invasion of 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.

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

2) Weed control with herbicides, biological agents, and mechanical techniques should be followed by reseeding and restoration of native plant species to prevent the reinvasion of weeds (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, personal communication).

3) In cheatgrass-dominated units, managers may have only two options – manage the unit as an annual grassland, or intensively control cheatgrass and reseed. Deferred grazing plans may favor cheatgrass if perennial grasses are not a significant component of the unit. Where cheatgrass dominates, heavy spring grazing before seed production may reduce cheatgrass and prepare a unit for reseeding with desirable perennial grasses (Vallentine and Stevens 1994).

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

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

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

3) Haying often destroys nests of Short-eared Owls, Vesper Sparrows, Sharp-tailed Grouse, and other ground nesting birds, and decreases cover for mammalian prey. If possible, delay haying until ground nesting birds have fledged. Most will have fledged by late July (Ivey 1996), depending on the area.

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

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

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

Mining and Oil/Gas Development

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

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

2) The impact of construction and operations on raptor nest sites can be effectively reduced through buffers and timing restrictions. Contact state or federal wildlife agencies for local advice on appropriate buffers and timing.

3) For successful grouse reproduction, Ulliman et al. (1998) and the Idaho Sage Grouse Task Force (1997) recommend no developments within 400 yards (365 m) of a lek and avoiding physical, mechanical, and loud noise disturbances within 0.5 mile (800 m) of a lek during the breeding season (March through May for Sage Grouse, March through June for Sharp-tailed Grouse) from one hour before sunrise to three hours after sunrise.

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

5) Ponds containing mining wastes should be closed off to exclude birds, bats, and other wildlife attracted to the water.

6) 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 of the sagebrush habitat.

7) Avoid planting monocultures. Carefully plan for a complex of vegetation that reflects the diversity of plant species and habitats in the surrounding area (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 re-establish this species. Providing topography similar to the surrounding area will provide microsites that promote a mosaic pattern.

8) Grasses and forbs compete with young shrubs, but a mixture of shrubs and herbaceous species can be established at lower seeding rates if they are seeded in separate strips (Richardson et al. 1986).

9) 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.

1) Large-scale planning should promote and maintain "open space" of native habitats as public parks and commons. Manage land use to maintain these openings as native vegetation communities.

2) When designing open space of native habitats, plan for large areas to increase interior habitat, minimize fragmentation, and reduce edges and ecotones between native and 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.

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

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

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

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

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

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4) Highest priority bird species and their habitat requirements (note: see Tables 6-9 for a description of status information for each species)**:**

Note: Mountain Plover (*Charadrius montanus*), Level I, CA, M, R, Score = 28, AI = 4, PT = 3, would appear here based on priority, but this species was already addressed in the Shortgrass Prairie habitat section.

Note: McCown's Longspur (*Calcarius mccownii*), Level I, CA, M, Score = 26, AI = 3, PT = 2, would appear here based on priority, but this species was already addressed in the Shortgrass Prairie habitat section.

Note: Ferruginous Hawk (*Buteo regalis*), Level I, CA, M, Score = 23, AI = 4, PT = 3, would appear here based on priority, but this species was already addressed in the Shortgrass Prairie habitat section.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Brewer's Sparrow (BRSP) *Spizella breweri* Level I CA, M, R Score = 23 AI = 5 PT = 5	~Sagebrush dominated habitats	~Average nesting-shrub height = 20 inches, range 12 to 26 inches in WY (average 27 inches, range 16.5 to 41 inches in ID; average 16.5 inches in MT)	~Elevation is not a factor in WY; presence of sagebrush is a factor	~Open shrubland habitat, especially sagebrush cover types ~Nests in shrubs that are entirely or mostly alive ~Nests are placed <4 feet above ground ~Average territory size is 1.3 acres (ID)	~Sagebrush obligate ~Nest concealment by sagebrush is very important ~Sensitive to fragmentation of shrub-steppe habitat and spraying or removal of sagebrush ~Common cowbird host ~Winters in Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Sage Sparrow (SAGS) *Amphispiza belli* Level I CA, M, R Score = 22 AI = 5 PT = 2	~Big sagebrush ~Shadscale saltbush ~Antelope bitterbrush ~Rabbitbrush	~Nests in shrubs up to 3.3 feet high ~High shrub cover (≥30%) and sagebrush height >20 inches	~Elevation ≤6,500 feet where sagebrush is present	~Tall shrubs, low grass cover, clumped/ patchy shrub landscape ~Large patch size, low disturbance, little fragmentation ~Average territory size ranges from 1.7 to 2 acres (ID)	~Sagebrush obligate and area-sensitive ~Sensitive to fragmentation of shrub-steppe habitat and removal of sagebrush ~5 to 10 acre territory depending on habitat configuration (southern ID) ~Males return to the same territory ~Occasional cowbird host ~Winters in Mexico

Note: Lark Bunting (*Calamospiza melanocorys*), Level II, M, Score = 22, AI = 4, PT = 4, would appear here based on priority, but this species was already addressed in the Shortgrass Prairie habitat section.

Note: Black-chinned Hummingbird (*Archilochus alexandri*), Level II, M, P, Score = 20, AI = 2, PT = 3, would appear here based on priority, but this species is currently documented as a peripheral breeder in Wyoming and will not be addressed in the Wyoming Bird Conservation Plan at this time.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Sage Thrasher (SATH) *Oreoscoptes montanus* Level II M, R Score = 19 AI = 5 PT = 2	~Sagebrush ~Greasewood ~Rabbitbrush ~Saltbush	~Maximum height of nest = 5 feet in shrubs, average (ID) is 35 inches ~Dense stands of shrubs for nesting	~Elevation is not important; presence of sagebrush is ~Nest shade is important ~More abundant in drier sites	~Some bare ground between shrubs may be important for foraging ~Fairly adaptable to patchy habitats as long as sagebrush remains the dominant species ~Average territory size ranges from 2.4 to 4.6 acres (ID) ~Nesting populations need habitat patches of at least 250 acres (MT)	~Sagebrush obligate ~Nests in or under preferred shrub (usually sagebrush) in dense stands ~Nest protection from heat/cold may be important ~Males sing and display from tops of shrubs ~Sensitive to fragmentation of shrub-steppe habitat and removal of sagebrush ~Loss of large shrubs by habitat manipulation is detrimental ~Known ejector of cowbird eggs ~Consumes large number of grasshoppers and Mormon crickets ~May have large home ranges ~Winters in Mexico

Note: Grasshopper Sparrow (*Ammodramus savannarum*), Level II, M, Score = 19, AI = 3, PT = 5, would appear here based on priority, but this species was already addressed in the Shortgrass Prairie habitat section.

Note: Bobolink (*Dolichonyx oryzivorus*), Level II, M, Score = 19, AI = 2, PT = 3, would appear here based on priority, but this species was already addressed in the Shortgrass Prairie habitat section.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Loggerhead Shrike (LOSH) *Lanius ludovicianus* Level II M Score = 18 AI = 3 PT = 3	~Shrub-steppe ~Pinyon-juniper ~Greasewood ~Shadscale saltbush ~Shelterbelts	~Stable branches and dense cover needed for nest sites ~Nests placed at 13 to 63 inches above ground (regardless of shrub height)		~Relatively open habitat with scattered trees and shrubs for nesting and perch sites and low vegetation and bare ground for foraging	~Lookout perches needed ~Maintain prey base by conservative burning and limited pesticide use ~Barbed wire fences used for perching and prey impalement ~Urbanization, strip mining, hedgerow destruction, and agricultural conversions are habitat concerns ~Winters in Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Vesper Sparrow (VESP) *Pooecetes gramineus* Level II M, R Score = 18 AI = 5 PT = 4	~Shrub-steppe with mixed grass	~Scattered shrubs and thin grass cover		~Open habitat with scattered shrubs for conspicuous song perches and good bunchgrass cover for nest concealment	~Males frequently use sagebrush as song perches ~Widespread use of pesticides and grasshopper control may be detrimental to prey base ~Fires are detrimental if structure is removed ~Ground nester; more susceptible to predation ~Nests are often placed in croplands and destroyed by agricultural operations ~Common cowbird host ~Winters in Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Lark Sparrow (LASP) *Chondestes grammacus* Level II M Score = 18 AI = 3 PT = 4		~Usually nests on the ground, or up to 10 feet in a shrub		~Open habitat with scattered shrubs and trees	~Uses shrubs as song perches and lookouts ~Ground nester; more susceptible to predation ~Nests placed in croplands are destroyed by agricultural operations ~Occasional cowbird host ~Winters in Mexico

5) Biological objectives and recommendations:

Mountain Plover

The Mountain Plover is also a priority species in Shortgrass Prairie habitat, and was addressed in that section.

McCown's Longspur

The McCown's Longspur is also a priority species in Shortgrass Prairie habitat, and was addressed in that section.

Ferruginous Hawk

The Ferruginous Hawk is also a priority species in Shortgrass Prairie habitat, and was addressed in that section.

Brewer's Sparrow

Found across Wyoming in prairie and foothills shrubland habitat where sagebrush is present. Is a sagebrush obligate species, so is restricted to sagebrush habitats during the breeding season or year-round. Builds a cup nest of grass, rootlets, and forbs, lined with fine materials, low in a live sagebrush shrub or on the ground at the base of a live sagebrush shrub. Eggs [3 to 4, 0.7 inch (17 mm)] are bluish-green and marked with dark browns. Is a common cowbird host; parasitized nests are occasionally deserted. Feeds on insects and seeds gleaned from the ground. Winters south to central Mexico. Population declines are due to fragmentation and removal of sagebrush habitat. Other species that may benefit from habitat management for this species include the Sage Grouse, Sage Sparrow, Sage Thrasher, Loggerhead Shrike, Vesper Sparrow, and Lark Sparrow.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Brewer's Sparrows have been detected on 110 BBS routes in Wyoming, including 65 routes on which they were observed a minimum of 3 years.

a) Maintain Brewer's Sparrows on the 65 BBS routes on which they were observed (Figure 23).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 34).

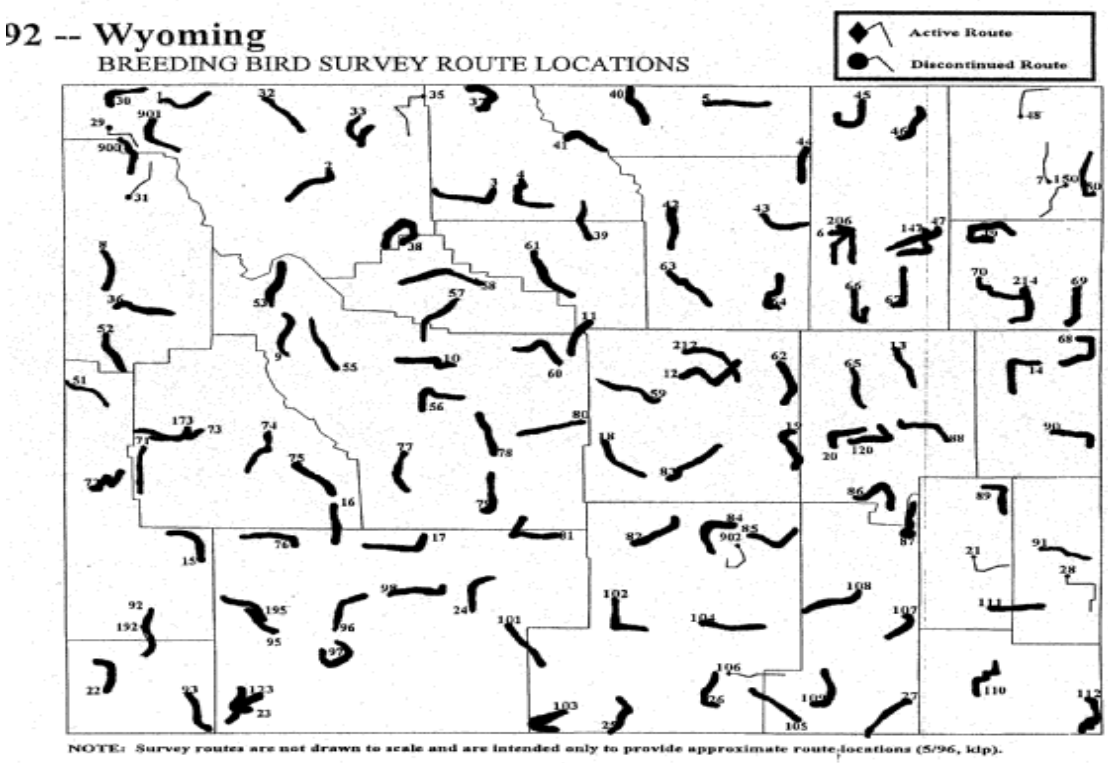

Figure 23. Bold lines indicate Breeding Bird Survey routes on which Brewer's Sparrows have been observed from 1968 through 1998.

Table 34. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Brewer's Sparrows were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
001 NE Entrance, YNP	9	9.90
002 Cody	14	4.36
003 Otto	2	0.82
004 Basin	8	1.00
005 Wyarno	24	12.52
006 CHANGED TO 206	1	8.73
008 Colter Bay	10	12.23
009 Dubois	21	11.48
010 Midvale	12	4.00
011 Nowood	32	46.38
012 CHANGED TO 212	16	17.16
013 Bill	5	18.50
014 CHANGED TO 214	2	9.57
015 Fontenelle	22	18.93
016 Elk Horn	39	32.25
017 Bear Creek	21	19.56
018 Ervay	21	18.44
019 Brookhurst	5	9.50
020 CHANGED TO 120	(2)	12.00
022 Cumberland	30	38.71
023 CHANGED TO 123	43	60.14
024 Patrick Draw	32	44.85
025 Savery	9	3.80
026 Riverside	15	4.17
027 Buford	1	1.91
030 Mammoth, YNP	13	7.38
032 Hunter Peak	5	4.31
033 Clark	4	2.25
036 Moose	23	22.65
037 Lovell	1	0.10
038 Meeteetse	19	11.00
039 Ten Sleep	14	11.00
040 Dayton	1	0.88
041 Bald Mountain	2	0.67
042 Crazy Woman	4	1.17
043 Schoonover	25	12.42
044 Arvada	4	1.08
045 Recluse	6	3.67
046 Soda Well	23	29.29
047 CHANGED TO 147	14	11.00
049 Upton	24	17.09
050 Moskee	1	0.07

Table 34. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
051 Alpine	4	3.80
052 Wilson	5	2.84
053 Horse Creek	17	12.78
055 Crowheart	14	8.50
056 Ethete	19	13.33
057 Anchor	11	19.00
058 Gebo	15	6.50
059 Arminto	16	13.10
060 Lysite	16	15.67
061 Worland	9	4.29
062 Teapot Dome	12	27.14
063 Mayoworth	13	6.00
064 Sussex	8	8.00
065 Harland Flats	11	3.80
066 Pine Tree	12	11.56
067 Highlight	24	25.50
068 Riverview	2	0.20
069 Newcastle	18	6.00
070 Raven	6	1.57
071 Soda Lake	16	9.29
072 Buckskin Mountain	6	5.20
073 CHANGED TO 173	25	64.14
074 Boulder	26	29.00
075 Big Sandy	38	35.90
076 Farson	(2)	36.00
077 Fiddler Lake	3	0.71
078 Sand Draw	8	5.33
079 Sweetwater	32	45.47
080 Gas Hills	16	28.33
081 Bairoil	41	41.50
082 Lamont	45	49.83
083 Pathfinder	23	13.00
084 Leo	22	29.33
085 Shirley	17	14.45
086 Warbonnet	1	0.14
087 Fletcher Peak	4	2.88
088 Shawnee	5	1.78
089 Meadowdale	6	4.11
090 Lusk	5	0.54
091 Lingle	1	0.28
092 CHANGED TO 192	(4)	47.83
093 Mountain View	18	25.56
095 CHANGED TO 195	(2)	40.88
096 Reliance	(5)	48.00

Table 34. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
097 Rock Springs	35	48.40
098 Black Rock	2	0.75
101 Wamsutter	25	13.00
102 Rawlins	33	44.78
103 Baggs	31	25.13
104 Walcott	(3)	2.75
105 Fox Park	1	0.14
107 Sybille Canyon	13	8.29
108 Rock River	5	2.43
109 Harmony	5	7.75
110 Cheyenne	3	0.35
111 Chugwater	14	6.08
112 Pine Bluff	2	0.31
120 Welch	16	12.30
123 Flaming Gorge	36	40.38
147 Rozet	16	11.50
173 Ryegrass	41	58.20
195 Seedskadee	33	47.63
206 Caballa Creek	1	0.43
212 Bucknum	14	16.17
214 Hampshire	2	1.00
900 NO LONGER RUN	5	6.33
901 Yellowstone, YNP	4	0.82

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the number of stops out of 50 on which individuals were observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Maintain dense stands of sagebrush habitat with tall live shrubs, patchy distribution, openings in the canopy for grass seed production, some grass cover for a seed food source, and some bare ground for an insect food source where Brewer's Sparrows occur.

2) Within extensive areas of sagebrush habitat, manage for a patchwork or mosaic of native plant communities across the local landscape.

3) Abundance of Brewer's Sparrows and other sagebrush obligates is correlated with vegetation structure (sagebrush density, canopy cover, and vertical structure) in unfragmented sagebrush shrub-steppe habitat. Manage for no-net loss of sagebrush habitat on a landscape scale.

Recommendations

1) Prevent large-scale fires that will eradicate large, continuous areas of sagebrush or result in cheatgrass invasion, and limit prescribed burns to small-scale fires during the non-breeding season. Brewer's Sparrows favor unburned sagebrush stands over burned stands.

2) Minimize sagebrush conversion to non-native grasslands or croplands.

3) Maintain sagebrush in large, continuous stands composed of a mosaic of open (5%) to moderate (25%) shrub cover and a variety of ages and heights. For the Brewer's Sparrow, average live shrub height for nesting is 27 inches (69 cm).

4) 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.

5) Discourage road construction and other developments where it would reduce sagebrush habitat patch size to less than 50 acres (130 ha).

6) Limit the number of roads in sagebrush habitat and consider rehabilitating old roads. Even roads and other developments with low traffic densities affect sagebrush obligate passerines.

7) Minimize or eliminate insect control in areas where Brewer's Sparrows nest.

<u>Sage Sparrow</u>

Found across most of Wyoming in prairie and foothills shrubland habitat where sagebrush is present. Is a sagebrush obligate species (restricted to sagebrush habitats during the breeding season or year-round) and area-sensitive (requires a large block of unfragmented habitat to successfully breed and survive). Builds a cup nest of twigs, grass, forbs, bark, and lined with fine materials, low in a sagebrush shrub near the main stem. Males return to the same territory each year, even if habitat changes have occurred. Eggs [2 to 4, 0.8 inch (19 mm)] are bluish-white and marked with dark browns. Is an uncommon cowbird host. Feeds on insects and seeds gleaned from the ground and low vegetation. Winters south to northern Mexico. Population declines are due to fragmentation and removal of sagebrush habitat. Other species that may benefit from habitat management for this species include the Sage Grouse, Brewer's Sparrow, Sage Thrasher, Loggerhead Shrike, Vesper Sparrow, and Lark Sparrow.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Sage Sparrows have been detected on 54 BBS routes in Wyoming, including 21 routes on which they were observed a minimum of 3 years.

a) Maintain Sage Sparrows on the 54 BBS routes on which they were observed (Figure 24).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 35).

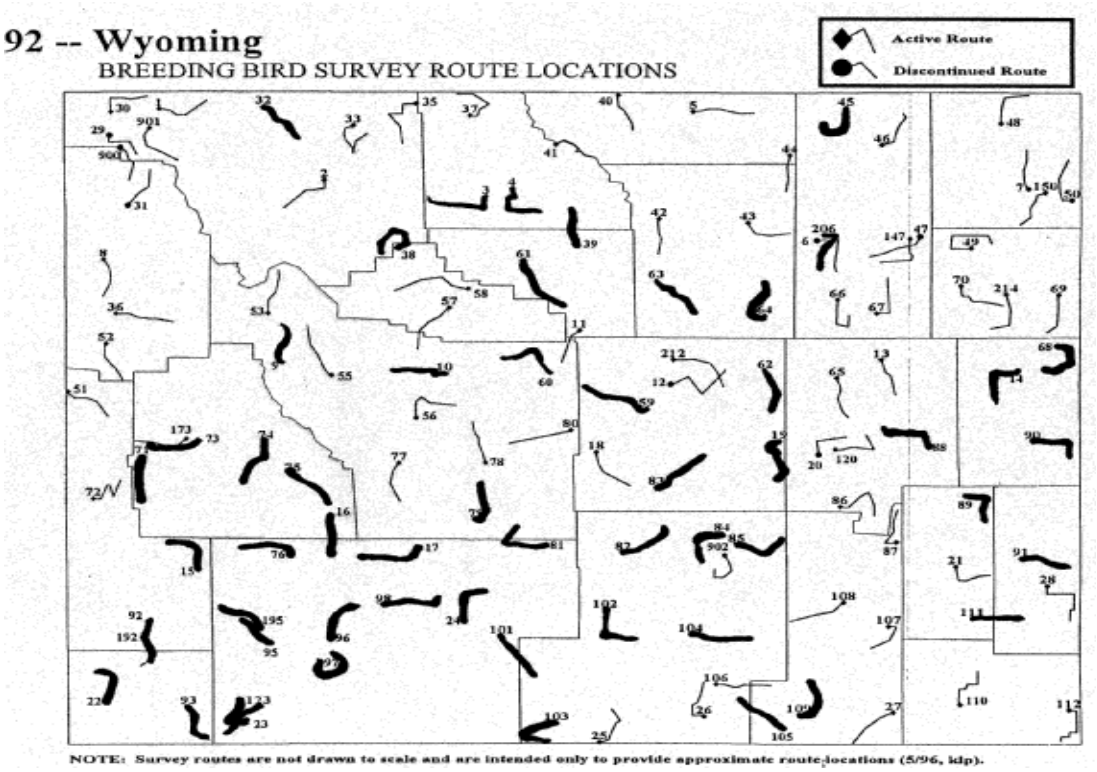

Figure 24. Bold lines indicate Breeding Bird Survey routes on which Sage Sparrows have been observed from 1968 through 1998.

Table 35. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Sage Sparrows were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
003 Otto	(1)	0.05
004 Basin	(1)	0.10
009 Dubois	1	0.33
010 Midvale	2	0.64
014 CHANGED TO 214	(2)	0.13
015 Fontenelle	9	6.07
016 Elk Horn	25	10.75
017 Bear Creek	35	13.76
019 Brookhurst	1	0.11
022 Cumberland	6	24.29
023 CHANGED TO 123	42	58.71
024 Patrick Draw	39	52.75
032 Hunter Peak	2	0.15
038 Meeteetse	1	0.29
039 Ten Sleep	4	2.25
045 Recluse	6	0.67
059 Arminto	5	2.70
060 Lysite	1	0.11
061 Worland	10	3.14
062 Teapot Dome	6	2.57
063 Mayoworth	(7)	0.50
064 Sussex	2	0.29
068 Riverview	5	0.47
071 Soda Lake	(1)	0.14
073 CHANGED TO 173	1	4.14
074 Boulder	34	27.00
075 Big Sandy	4	0.60
076 Farson	35	66.50
079 Sweetwater	1	0.26
081 Bairoil	26	15.50
082 Lamont	6	4.47
083 Pathfinder	2	2.40
084 Leo	(2)	7.17
085 Shirley	2	3.82
088 Shawnee	6	0.67
089 Meadowdale	1	0.11
090 Lusk	1	0.08
091 Lingle	5	0.28
092 CHANGED TO 192	(4)	46.00
093 Mountain View	6	20.78
095 CHANGED TO 195	(2)	45.50
096 Reliance	(2)	70.75

Table 35. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
097 Rock Springs	22	43.33
098 Black Rock	2	1.00
101 Wamsutter	12	5.50
102 Rawlins	11	3.44
103 Baggs	32	17.13
104 Walcott	9	1.58
105 Fox Park	2	0.43
109 Harmony	(1)	1.25
111 Chugwater	2	0.33
123 Flaming Gorge	40	35.38
195 Seedskadee	32	67.00
206 Caballa Creek	7	1.43

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the number of stops out of 50 on which individuals were observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Maintain large blocks of unfragmented tall, older, dense stands of sagebrush habitat in areas where Sage Sparrows breed. Sage Sparrows are sensitive to shrub-steppe habitat fragmentation and sagebrush removal, and males return to the same territories, so continuous areas should be greater than 50 acres (130 ha).

2) Within the shrub-steppe landscape, provide areas of short vegetation surrounded by sagebrush as important ground foraging and nesting areas for Sage Sparrows.

3) Maintain sagebrush in large, continuous stands composed of a mosaic of open (5%) to moderate (25%) shrub cover and a variety of ages and heights.

4) Abundance of Sage Sparrows and other sagebrush obligates is correlated with vegetation structure (sagebrush density, canopy cover, and vertical structure) in unfragmented sagebrush shrub-steppe habitat. Manage for no-net loss of sagebrush habitat on a landscape scale.

Recommendations

1) Prevent large-scale fires that will eradicate large, continuous areas of sagebrush or result in cheatgrass invasion, and limit prescribed burns to small-scale fires during the non-breeding season.

2) Minimize sagebrush conversion to non-native grasslands or croplands.

3) 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.

4) 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 4 miles (6.5 km)] breeding opportunity without high parasitism pressure.

5) Discourage road construction and other developments where it would reduce sagebrush habitat patch size to less than 50 acres (130 ha).

6) Limit the number of roads in sagebrush habitat and consider rehabilitating old roads. Even roads and other developments with low traffic densities affect sagebrush obligate passerines.

7) Minimize or eliminate insect control in areas where Sage Sparrows nest.

<u>Lark Bunting</u>

The Lark Bunting is also a priority species in Shortgrass Prairie habitat, and was addressed in that section.

<u>Black-chinned Hummingbird</u>

The Black-chinned Hummingbird would appear here based on priority, but this species is currently documented as a peripheral breeder in Wyoming and will not be addressed in the Wyoming Bird Conservation Plan at this time.

Sage Thrasher

Found across Wyoming in prairie and foothills shrubland habitat where sagebrush is present. Is a sagebrush obligate species, so is restricted to sagebrush habitats during the breeding season or year-round. Builds a bulky cup nest of coarse twigs, forbs, and grass, lined with fine materials in a dense stand of sagebrush low in a sagebrush shrub near the plant's main axis, or occasionally underneath. Eggs [3 to 5, 1 inch (25 mm)] are deep blue or greenish-blue, heavily spotted with brown. Is known to eject cowbird eggs from its nest. Gleans insects and fruit from the ground, and consumes large numbers of grasshoppers and Mormon crickets. Winters south to northern Mexico. Population declines are due to fragmentation and removal of sagebrush habitat. Other species that may benefit from habitat management for this species include the Sage Grouse, Brewer's Sparrow, Sage Sparrow, Loggerhead Shrike, Vesper Sparrow, and Lark Sparrow.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Sage Thrashers have been detected on 83 BBS routes in Wyoming, including 57 routes on which they were observed a minimum of 3 years.

a) Maintain Sage Thrashers on the 83 BBS routes on which they were observed (Figure 25).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 36).

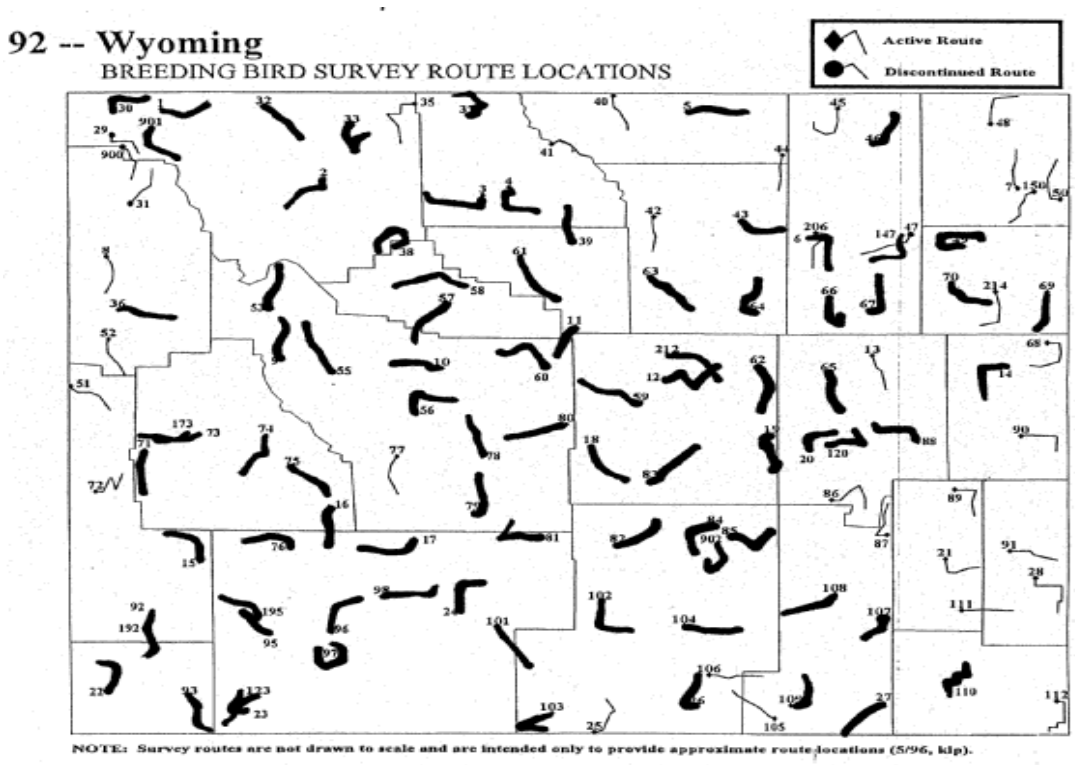

Figure 25. Bold lines indicate Breeding Bird Survey routes on which Sage Thrashers have been observed from 1968 through 1998.

Table 36. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Sage Thrashers were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
001 NE Entrance, YNP	2	1.00
002 Cody	11	3.36
003 Otto	17	6.32
004 Basin	9	3.76
005 Wyarno	6	0.80
006 CHANGED TO 206	(2)	1.27
009 Dubois	17	10.82
010 Midvale	12	7.43
011 Nowood	21	18.38
012 CHANGED TO 212	8	9.24
014 CHANGED TO 214	6	2.48
015 Fontenelle	22	24.00
016 Elk Horn	38	27.25
017 Bear Creek	30	21.52
018 Ervay	25	38.56
019 Brookhurst	9	2.11
020 CHANGED TO 120	(8)	9.40
022 Cumberland	32	45.21
023 CHANGED TO 123	40	73.14
024 Patrick Draw	38	52.20
026 Riverside	4	0.92
027 Buford	1	0.09
030 Mammoth, YNP	4	1.19
032 Hunter Peak	1	0.15
033 Clark	3	1.25
036 Moose	2	4.04
037 Lovell	1	0.30
038 Meeteetse	2	0.71
039 Ten Sleep	13	8.50
043 Schoonover	6	2.58
046 Soda Well	1	0.47
049 Upton	4	1.00
053 Horse Creek	7	3.39
055 Crowheart	18	11.00
056 Ethete	13	10.33
057 Anchor	13	13.00
058 Gebo	16	9.70
059 Arminto	14	12.30
060 Lysite	30	34.89
061 Worland	4	1.43
062 Teapot Dome	17	8.43
063 Mayoworth	5	1.81

Table 36. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
064 Sussex	2	0.43
065 Harland Flats	5	3.00
066 Pine Tree	2	0.33
067 Highlight	10	4.10
069 Newcastle	1	0.10
070 Raven	3	0.71
071 Soda Lake	(1)	0.57
073 CHANGED TO 173	37	56.43
074 Boulder	(22)	8.38
075 Big Sandy	33	28.90
076 Farson	27	67.50
078 Sand Draw	39	49.67
079 Sweetwater	46	52.00
080 Gas Hills	22	30.33
081 Bairoil	43	42.70
082 Lamont	35	47.33
083 Pathfinder	20	15.02
084 Leo	22	17.17
085 Shirley	18	9.46
088 Shawnee	7	3.44
092 CHANGED TO 192	(58)	89.00
093 Mountain View	13	41.00
095 CHANGED TO 195	(29)	52.50
096 Reliance	(40)	90.50
097 Rock Springs	20	47.53
098 Black Rock	9	5.50
101 Wamsutter	38	36.17
102 Rawlins	46	78.78
103 Baggs	28	17.50
104 Walcott	8	4.92
107 Sybille Canyon	5	1.43
108 Rock River	2	0.71
109 Harmony	4	1.38
110 Cheyenne	1	0.06
120 Welch	9	14.65
123 Flaming Gorge	47	38.63
147 Rozet	1	0.50
173 Ryegrass	37	56.80
195 Seedskadee	32	21.25
212 Bucknum	5	4.17
901 Yellowstone, YNP	2	0.64
902 Pryor Flats	2	2.00

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the number of stops out of 50 on which individuals were observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Maintain large blocks of unfragmented tall, older, dense stands of sagebrush habitat in areas where Sage Thrashers breed. Continuous areas should be greater than 50 acres (130 ha) in size.

2) Within the shrub-steppe landscape, provide areas of short vegetation surrounded by sagebrush as important ground foraging, nesting, and perching sites for Sage Thrashers.

3) Maintain sagebrush in large, continuous stands composed of a mosaic of open (5%) to moderate (25%) shrub cover and a variety of ages and heights.

4) Abundance of Sage Thrashers and other sagebrush obligates is correlated with vegetation structure (sagebrush density, canopy cover, and vertical structure) in unfragmented sagebrush shrub-steppe habitat. Manage for no-net loss of sagebrush habitat on a landscape scale.

Recommendations

1) Prevent large-scale fires that will eradicate large, continuous areas of sagebrush or result in cheatgrass invasion, and limit prescribed burns to small-scale fires during the non-breeding season.

2) Minimize conversion of shrublands and woodlands to non-native grasslands or croplands.

3) 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.

4) 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 4 miles (6.5 km)] breeding opportunity without high parasitism pressure.

5) Discourage road construction and other developments where it would reduce sagebrush habitat patch size to less than 50 acres (130 ha).

6) Limit the number of roads in sagebrush habitat and consider rehabilitating old roads. Even roads and other developments with low traffic densities affect sagebrush obligate passerines.

7) Minimize or eliminate insect control in areas where Brewer's Sparrows nest.

Grasshopper Sparrow

The Grasshopper Sparrow is also a priority species in Shortgrass Prairie habitat, and was addressed in that section.

Bobolink

The Bobolink is also a priority species in Shortgrass Prairie habitat, and was addressed in that section.

Loggerhead Shrike

Found across Wyoming in shrub-steppe, shrubland, and woodland habitats. Breeds in basin-prairie shrublands, sagebrush grasslands, mountain-foothills shrublands, pine-juniper woodlands, and woodland-chaparral. Builds a bulky cup nest of twigs, forbs, and woven bark strips, lined with fine materials in a tree or shrub, usually hidden below the crown in the crotch or on a large branch, from 3 to 30 feet above ground. Eggs [5 to 6, 1 inch (24 mm)] are grayish-buff and marked with gray, brown, and black. Swoops down on grasshoppers and other large insects from a lookout perch; also takes some small mammals and birds. Winters south to central Mexico. Population declines are due to habitat loss and conversion from cultivation and urbanization, loss of insect prey due to pesticide use, and pesticide contamination (especially on wintering grounds). Other species that may benefit from habitat management for this species include the American Kestrel, Sage Grouse, Northern Mockingbird, Sage Thrasher, Sage Sparrow, Brewer's Sparrow, Vesper Sparrow, and Lark Sparrow.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Loggerhead Shrikes have been detected on 80 BBS routes in Wyoming, including 40 routes on which they were observed a minimum of 3 years.

a) Maintain Loggerhead Shrikes on the 80 BBS routes on which they were observed (Figure 26).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 37).

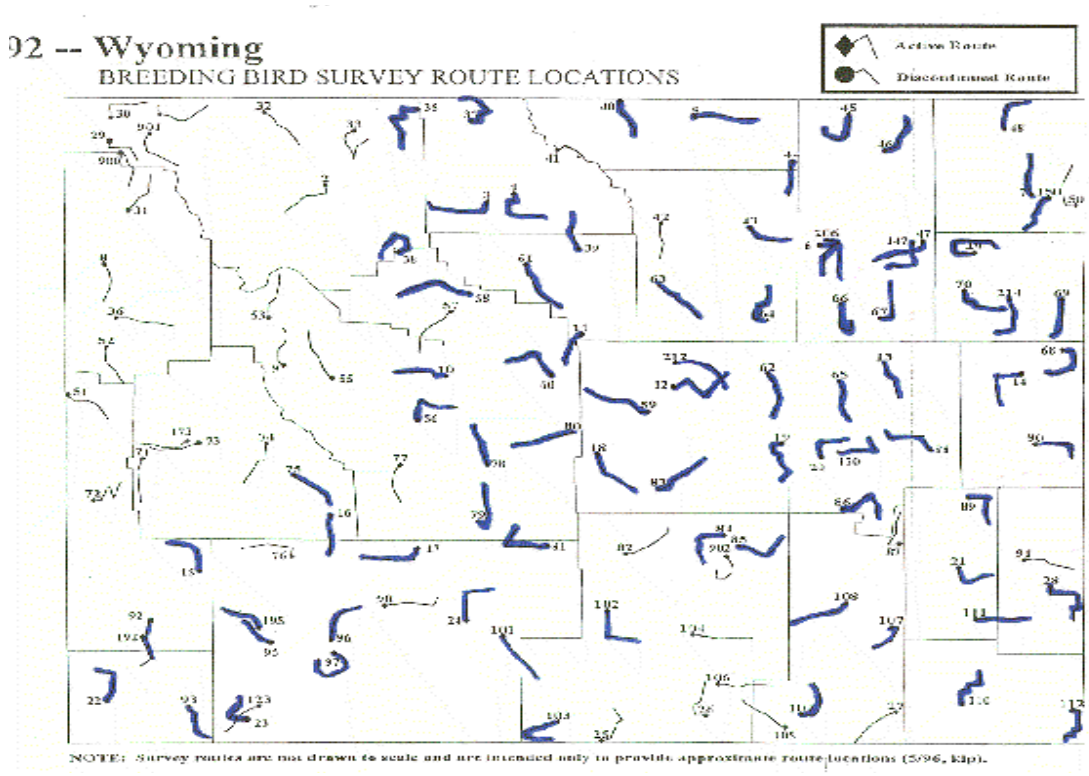

Figure 26. Bold lines indicate Breeding Bird Survey routes on which Loggerhead Shrikes have been observed from 1968 through 1998.

Table 37. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Loggerhead Shrikes were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
003 Otto	1	0.41
004 Basin	2	0.81
005 Wyarno	10	3.60
006 CHANGED TO 206	(1)	1.64
007 Sundance	1	0.04
010 Midvale	2	0.57
011 Nowood	1	0.63
012 CHANGED TO 212	6	4.32
013 Bill	2	2.67
014 CHANGED TO 214	6	4.65
015 Fontenelle	1	0.07
016 Elk Horn	1	0.25
017 Bear Creek	1	0.32
018 Ervay	2	0.69
019 Brookhurst	1	0.50

Table 37. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
020 CHANGED TO 120	(1)	0.30
021 Dwyer	3	1.50
022 Cumberland	(1)	0.71
023 CHANGED TO 123	(1)	1.64
024 Patrick Draw	5	2.35
028 Yoder	2	0.38
035 Frannie	3	1.00
037 Lovell	3	0.40
038 Meeteetse	1	0.14
039 Ten Sleep	1	0.25
040 Dayton	1	0.12
043 Schoonover	6	4.67
044 Arvada	4	2.69
045 Recluse	3	0.60
046 Soda Well	1	0.53
047 CHANGED TO 147	2	0.43
048 Seely	1	0.33
049 Upton	5	1.36
056 Ethete	1	0.17
058 Gebo	1	0.80
059 Arminto	4	2.10
060 Lysite	11	6.78
061 Worland	2	1.14
062 Teapot Dome	4	1.43
063 Mayoworth	5	2.00
064 Sussex	8	5.14
065 Harland Flats	3	0.60
066 Pine Tree	3	2.11
067 Highlight	6	4.20
068 Riverview	4	2.33
069 Newcastle	8	4.50
070 Raven	2	2.00
075 Big Sandy	(1)	0.20
078 Sand Draw	2	1.67
079 Sweetwater	7	0.68
080 Gas Hills	1	0.67
081 Bairoil	1	0.30
083 Pathfinder	3	1.07
084 Leo	1	0.17
085 Shirley	2	1.00
086 Warbonnet	1	0.71
088 Shawnee	3	1.78
089 Meadowdale	2	0.78
090 Lusk	3	1.23

Table 37. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
092 CHANGED TO 192	(2)	2.83
093 Mountain View	(1)	0.89
095 CHANGED TO 195	(2)	3.50
096 Reliance	(2)	2.75
097 Rock Springs	(2)	1.07
101 Wamsutter	2	0.67
102 Rawlins	2	0.44
103 Baggs	11	2.88
107 Sybille Canyon	2	0.43
108 Rock River	1	0.57
109 Harmony	1	0.13
110 Cheyenne	1	0.59
111 Chugwater	3	1.42
112 Pine Bluff	10	5.23
120 Welch	4	0.95
147 Rozet	4	5.00
150 Government Valley	2	0.86
195 Seedskadee	1	0.13
206 Caballa Creek	4	2.86
212 Bucknum	5	3.17
214 Hampshire	2	1.00

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the number of stops out of 50 on which individuals were observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Within the shrub-steppe landscape, provide areas of short vegetation (4 inches or less) surrounded by sagebrush, greasewood, and/or saltbush and areas of taller vegetation (higher than 8 inches) as important ground foraging and nesting areas for Loggerhead Shrikes.

2) Protect known Loggerhead Shrike nest trees from damage, such as browsing or rubbing by livestock and loss due to prescribed burning, when using grazing or fire as land management tools.

Recommendations

1) Prevent large-scale fires that will eradicate large, continuous areas of sagebrush or other shrublands and woodlands, or result in cheatgrass invasion. Limit prescribed burns to small-scale fires during the non-breeding season.

2) Minimize conversion of sagebrush and other shrublands and woodlands to non-native grasslands or croplands.

3) Maintain sagebrush in large, continuous stands composed of a mosaic of open (5%) to moderate (25%) shrub cover and a variety of ages and heights.

4) 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.

5) Minimize or eliminate insect control in areas where Loggerhead Shrikes nest.

Vesper Sparrow

Fsound across Wyoming in basin-prairie shrublands, mountain-foothills shrublands, grasslands, and agricultural areas. Excavates a depression in the ground and builds a bulky cup nest in it of grass, forbs, and rootlets, lined with fine materials. Nest is often placed in cropland and destroyed by agricultural operations. Eggs [3 to 4, 0.8 inch (21 mm)] are creamy-white or pale greenish-white and have various markings in shades of brown or gray. Is a common cowbird host. Feeds on the ground, eating insects and grass and forb seeds. Winters south to central Mexico. Concerns include loss of nests to agricultural operations and widespread pesticide use that eliminates insect prey base. Other species that may benefit from habitat management for this species include the Sage Grouse, Brewer's Sparrow, Sage Sparrow, Sage Thrasher, Loggerhead Shrike, and Lark Sparrow.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Vesper Sparrows have been detected on 116 BBS routes in Wyoming, including 90 routes on which they were observed a minimum of 3 years.

a) Maintain Vesper Sparrows on the 116 BBS routes on which they were observed (Figure 27).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 38).

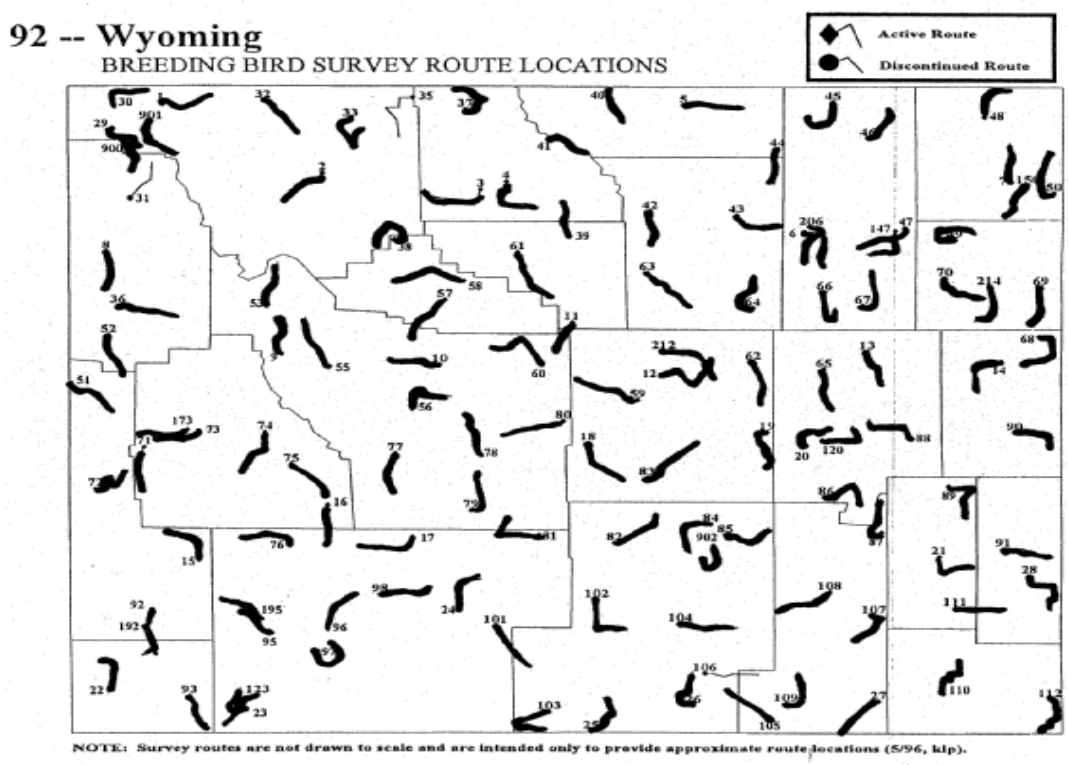

Figure 27. Bold lines indicate Breeding Bird Survey routes on which Vesper Sparrows have been observed from 1968 through 1998.

Table 38. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Vesper Sparrows were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
001 NE Entrance, YNP	27	23.60
002 Cody	8	4.91
003 Otto	6	2.55
004 Basin	1	0.19
005 Wyarno	26	32.00
006 CHANGED TO 206	(8)	28.10
007 Sundance	4	2.65
008 Colter Bay	15	19.69
009 Dubois	13	7.15
010 Midvale	14	10.93
011 Nowood	34	39.38
012 CHANGED TO 212	13	9.36
013 Bill	11	11.33
014 CHANGED TO 214	1	0.13
015 Fontenelle	14	9.43

Table 38. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
016 Elk Horn	10	9.50
017 Bear Creek	12	4.00
018 Ervay	19	32.75
019 Brookhurst	26	35.71
020 CHANGED TO 120	(29)	7.60
021 Dwyer	2	2.25
022 Cumberland	30	22.50
023 CHANGED TO 123	4	9.71
024 Patrick Draw	28	9.90
025 Savery	11	9.40
026 Riverside	14	8.75
027 Buford	20	14.73
028 Yoder	1	0.24
029 NO LONGER RUN	(1)	3.00
030 Mammoth, YNP	19	30.19
032 Hunter Peak	14	13.15
033 Clark	26	23.00
036 Moose	15	30.48
037 Lovell	1	0.40
038 Meeteetse	18	4.57
039 Ten Sleep	19	18.50
040 Dayton	15	20.12
041 Bald Mountain	9	11.67
042 Crazy Woman	12	10.56
043 Schoonover	26	37.50
044 Arvada	5	2.31
045 Recluse	27	16.80
046 Soda Well	16	26.47
047 CHANGED TO 147	11	11.71
048 Seely	30	27.51
049 Upton	22	19.36
050 Moskee	4	2.93
051 Alpine	5	6.00
052 Wilson	3	0.26
053 Horse Creek	14	9.67
055 Crowheart	23	19.00
056 Ethete	19	20.33
057 Anchor	7	10.00
058 Gebo	18	10.70
059 Arminto	23	19.10
060 Lysite	25	23.56
061 Worland	7	2.43
062 Teapot Dome	33	25.00
063 Mayoworth	19	12.69

Table 38. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
064 Sussex	12	6.00
065 Harland Flats	20	11.80
066 Pine Tree	31	10.56
067 Highlight	23	18.10
068 Riverview	16	7.47
069 Newcastle	18	9.70
070 Raven	27	17.00
071 Soda Lake	14	4.21
072 Buckskin Mountain	4	2.40
073 CHANGED TO 173	14	12.00
074 Boulder	(25)	4.63
075 Big Sandy	28	12.90
076 Farson	(13)	6.50
077 Fiddler Lake	2	0.36
078 Sand Draw	24	20.67
079 Sweetwater	46	45.58
080 Gas Hills	42	95.67
081 Bairoil	40	49.90
082 Lamont	43	61.25
083 Pathfinder	16	10.53
084 Leo	43	63.00
085 Shirley	16	14.55
086 Warbonnet	21	13.57
087 Fletcher Peak	14	25.47
088 Shawnee	18	16.56
089 Meadowdale	9	10.56
090 Lusk	16	9.85
091 Lingle	3	0.83
092 CHANGED TO 192	(41)	20.50
093 Mountainview	5	6.78
095 CHANGED TO 195	(18)	9.75
096 Reliance	(28)	8.86
097 Rock Springs	5	8.20
098 Black Rock	7	2.25
101 Wamsutter	15	7.17
102 Rawlins	29	32.22
103 Baggs	20	18.36
104 Walcott	38	43.92
105 Fox Park	11	3.29
107 Sybille Canyon	31	17.86
108 Rock River	17	15.86
109 Harmony	20	11.63
110 Cheyenne	7	3.07
111 Chugwater	(5)	0.83

Table 38. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
112 Pine Bluff	14	3.15
120 Welch	23	15.45
123 Flaming Gorge	4	1.38
147 Rozet	17	26.00
150 Government Valley	40	33.29
173 Ryegrass	24	16.20
195 Seedskadee	26	22.25
206 Caballa Creek	47	36.57
212 Bucknum	16	19.17
214 Hampshire	11	6.80
900 NO LONGER RUN	1	2.33
901 Yellowstone, YNP	9	11.00
902 Pryor Flats	6	69.00

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the number of stops out of 50 on which individuals were observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Maintain a mosaic of sagebrush heights, densities, and ages within the sagebrush shrub-steppe landscape so young, sparse sagebrush stands are available for nesting Vesper Sparrows.

2) Within shrublands where Vesper Sparrows nest, maintain grass height of 6 to 12 inches (15 to 30 cm), 6 to 24% bare ground, 10 to 20% shrub canopy cover, and territory size of about 5 acres (2 ha) per pair.

Recommendations

1) Prevent large-scale fires that will eradicate large, continuous areas of sagebrush or other shrubland habitat, or result in cheatgrass invasion. Limit prescribed burns to small-scale fires during the non-breeding season.

2) Minimize conversion of sagebrush and other shrublands to non-native grasslands or croplands.

3) Maintain sagebrush in large, continuous stands composed of a mosaic of open (5%) to moderate (25%) shrub cover and a variety of ages and heights.

4) 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.

5) 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 4 miles (6.5 km)] breeding opportunity without high parasitism pressure.

6) Minimize or eliminate insect control in areas where Brewer's Sparrows nest.

Lark Sparrow

Found across most of Wyoming in pine-juniper, woodland-chaparral, basin-prairie shrublands, mountain-foothills shrublands, grasslands, and agricultural areas. Builds a bulky cup nest of grass, forbs, and twigs, lined with fine materials in a hollow depression on the ground; occasionally nests low in a shrub. Eggs [4 to 5, 0.8 inch (20 mm)] are creamy to grayish-white and marked with dark brown and black. Is an occasional cowbird host. Feeds on insects and grass and forb seeds gleaned from the ground. Winters south to central Mexico. Concerns include habitat loss and conversion due to cultivation and urbanization, and loss of nests to agricultural operations. Other species that may benefit from habitat management for this species include the Sage Grouse, Brewer's Sparrow, Sage Sparrow, Sage Thrasher, Loggerhead Shrike, and Vesper Sparrow.

Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Lark Sparrows have been detected on 97 BBS routes in Wyoming, including 50 routes on which they were observed a minimum of 3 years.

a) Maintain Lark Sparrows on the 97 BBS routes on which they were observed (Figure 28).
b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all years the route was run (as established in 1999 in Table 39).

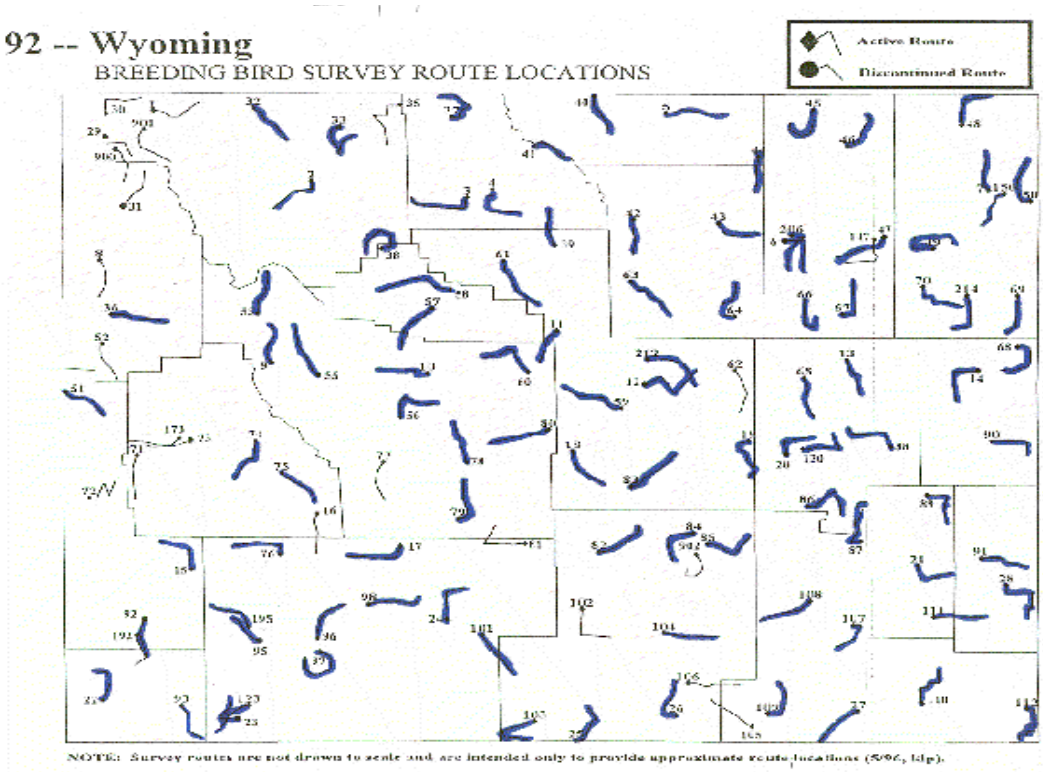

Figure 28. Bold lines indicate Breeding Bird Survey routes on which Lark Sparrows have been observed from 1968 through 1998.

Table 39. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Lark Sparrows were observed from 1968 through 1998. [a]

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
002 Cody	7	1.46
003 Otto	15	4.68
004 Basin	11	7.14
005 Wyarno	26	19.52
006 CHANGED TO 206	(2)	2.27
007 Sundance	2	0.48
009 Dubois	3	0.44
010 Midvale	4	2.29
011 Nowood	8	5.75
012 CHANGED TO 212	1	0.12
013 Bill	5	1.83
014 CHANGED TO 214	18	16.09
015 Fontenelle	1	0.07
017 Bear Creek	2	0.12
018 Ervay	1	0.06
019 Brookhurst	6	3.46
020 CHANGED TO 120	(2)	2.20
021 Dwyer	33	59.00
022 Cumberland	(2)	1.07
023 CHANGED TO 123	(2)	1.29
024 Patrick Draw	24	5.35
025 Savery	1	0.60
026 Riverside	(2)	0.67
027 Buford	(2)	1.09
028 Yoder	10	7.48
032 Hunter Peak	1	0.23
033 Clark	17	10.75
036 Moose	2	0.39
037 Lovell	4	2.90
038 Meeteetse	26	39.43
039 Ten Sleep	23	25.75
040 Dayton	4	2.18
041 Bald Mountain	1	0.17
042 Crazy Woman	3	0.28
043 Schoonover	14	8.00
044 Arvada	21	9.85
045 Recluse	5	1.53
046 Soda Well	2	1.65
047 CHANGED TO 147	5	0.86
048 Seely	16	15.79
049 Upton	1	0.18
050 Moskee	4	0.79

Table 39. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
051 Alpine	1	2.00
053 Horse Creek	2	0.11
055 Crowheart	2	1.50
056 Ethete	10	6.00
057 Anchor	3	4.00
058 Gebo	26	14.90
059 Arminto	3	0.80
060 Lysite	7	3.44
061 Worland	10	5.71
063 Mayoworth	24	15.63
064 Sussex	12	7.43
065 Harland Flats	24	16.40
066 Pine Tree	2	0.33
067 Highlight	13	8.40
068 Riverview	14	5.13
069 Newcastle	5	3.30
070 Raven	24	9.43
074 Boulder	1	0.25
075 Big Sandy	1	0.10
076 Farson	1	5.00
078 Sand Draw	7	9.00
079 Sweetwater	5	0.63
080 Gas Hills	7	4.67
082 Lamont	2	0.50
083 Pathfinder	17	3.20
084 Leo	29	12.50
085 Shirley	2	2.36
086 Warbonnet	8	4.29
087 Fletcher Peak	6	3.82
088 Shawnee	10	3.00
089 Meadowdale	13	11.44
090 Lusk	2	0.31
091 Lingle	17	17.83
092 CHANGED TO 192	(2)	3.33
093 Mountain View	3	1.78
095 CHANGED TO 195	(2)	2.36
096 Reliance	(2)	0.75
097 Rock Springs	2	1.20
098 Black Rock	1	1.50
101 Wamsutter	6	1.67
103 Baggs	1	0.13
104 Walcott	3	0.33
107 Sybille Canyon	5	2.29
108 Rock River	2	1.00

Table 39. Continued.

Breeding Bird Survey Number and Name	Maximum Number of Stops (Out of 50) On Which Species Was Observed	Average Number of Individuals Observed During All Years Route Was Run
109 Harmony	1	0.13
110 Cheyenne	4	2.00
111 Chugwater	7	9.00
112 Pine Bluff	12	2.77
120 Welch	4	3.00
123 Flaming Gorge	1	0.13
150 Government Valley	11	6.57
195 Seedskadee	1	0.13
206 Caballa Creek	3	1.00
212 Bucknum	2	0.33
214 Hampshire	6	4.00

[a] Numbers in parentheses are the total number of individuals observed on a route (rather than the number of stops out of 50 on which individuals were observed) because stop data are not available from 1968 through 1985.

Habitat Objectives

1) Maintain large blocks of unfragmented, tall, older, dense stands of sagebrush habitat in areas where Lark Sparrows breed.

Recommendations

1) Prevent large-scale fires that will eradicate large, continuous areas of sagebrush or other shrublands and woodlands, or result in cheatgrass invasion. Limit prescribed burns to small-scale fires during the non-breeding season.

2) Minimize conversion of sagebrush and other shrublands and woodlands to non-native grasslands or croplands.

3) Maintain sagebrush in large, continuous stands composed of a mosaic of open (5%) to moderate (25%) shrub cover and a variety of ages and heights.

4) 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.

5) 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 4 miles (6.5 km)] breeding opportunity without high parasitism pressure.

6) Inventory, monitoring, and research needs:

Inventory and Monitoring Needs

"Monitoring Wyoming's Birds: The Plan for Count-based Monitoring" would appear here, but was previously presented under Inventory and Monitoring Needs in the Plains/Basin Riparian habitat section.

Research Needs

Research needs will become more apparent once the inventory and monitoring needs have been met. Therefore, research needs will be addressed in a later version of the Wyoming Bird Conservation Plan.

Other Priority Habitat Types or Groups in Wyoming

Of the 18 Wyoming Partners In Flight habitat types or groups that were presented in Table 10, only the five highest priority habitats were addressed in Version 1.0 of the Wyoming Bird Conservation Plan. The remaining 13 types or groups were prioritized in the order given below, and will be addressed in later versions of the Wyoming Bird Conservation Plan.

1) Aspen
2) Juniper Woodland
3) Mountain-foothills Shrub
4) Low Elevation Conifer
5) High Elevation Conifer
6) Wetlands
7) Aquatic
8) Alpine Tundra/Grassland
9) Meadows
10) Specialized Habitats, Generalist, and Agricultural Croplands (these will be addressed using a different approach due to the nature of these groups)

OTHER ISSUES AND THREATS

The Bird Conservation Area (BCA) Program

The Bird Conservation Area program will be included in a later version of the Wyoming Bird Conservation Plan as time and funding allow.

The Important Bird Area (IBA) Program

What is an IBA?

Important Bird Areas (IBAs) are sites that provide essential habitat to one or more species of birds during some portion of the year (breeding areas, crucial migration stopover sites, or wintering grounds). IBAs may be a few or even thousands of acres, but usually are discrete sites that stand out from the surrounding landscape. IBAs may include public or private lands, or both, and they may be already protected or not.

Goals of the IBA Program

- **Identify** the most essential areas for birds.
- **Monitor** those sites for changes to birds and habitat.
- **Conserve** these areas for long-term protection of biodiversity.

A Brief History of the IBA Program

The IBA Program began as an initiative of BirdLife International. In 1989, *Important Bird Areas in Europe* was published, cataloguing over 2,000 sites in 32 countries. These IBAs have become long-term conservation priorities, and steps have been taken to protect many of them.

In the United States, the IBA Program began as a partnership between National Audubon and the American Bird Conservancy. Audubon has focused on establishing state IBA Programs; the first was launched in Pennsylvania in 1995, and subsequent programs have been started in 23 states, with planning in more than 12 others. IBA Programs are expected to be in progress for all 50 states in the year 2000.

By involving birders and other volunteers in the process of identifying IBAs, the program aims to create grassroots support for conservation initiatives. This has paid off in such victories as the passage of a law in New York State in 1997 to designate IBAs on state lands and manage those areas for birds and their habitats, potentially safeguarding nearly a million acres of state-owned lands. Specific sites have also received funding

and other support thanks to their designation as Important Bird Areas. In Pennsylvania, IBAs are given priority (10 points) for open space funding.

Technical Committee

The Technical Committee has the responsibility of setting state criteria for IBA status, recommending sites that are strong candidates and matching them with potential nominators, and reviewing nomination of sites for designation as IBAs. The main purpose of the committee is to review nominations and vote on acceptance of these sites as IBAs. Nominations for a particular area will be sent to the committee member that lives in that part of the state or that has special knowledge of the nominated site.

IBAs in Wyoming

The IBA program in Wyoming began in December of 1995, when potential sites were identified at a Wyoming Partners In Flight meeting. The Rocky Mountain Bird Observatory continued the Wyoming IBA program in 1999, and began the nomination process, from which came 16 approved IBAs in Wyoming. Unfortunately the IBA process was not taken any further due to a lack of personnel. Beginning in May of 2001, Audubon Wyoming initiated the IBA program in Wyoming once again, while retaining the 16 original IBAs in the state.

The IBA Coordinator will visit with local Audubon chapters, state and federal agencies, private landowners, and various nongovernmental organizations to promote the program and continue the IBA site nomination process. A technical committee will also be formed to evaluate and prioritize the nominated areas. Once the nomination process slows down in the winter months, the approved sites will be complied and conservation planning will begin.

Status of Nominations for the Wyoming IBA Program (as of 31 March 2000)

Accepted Sites, Permission Granted

- Breteche Creek Ranch
- Jackson Canyon Ranch
- Edness Kimball Wilkins State Park
- Red Canyon Ranch
- Sweetwater River Project
- Heart Mountain
- Wolf Creek Ranch
- Chapman Bench
- Loch Katrine

Accepted Sites, Contacted but Permission Pending

- Powder Rim - contact: Kurt Kotter (BLM)
- Canyon Creek - contact: Jim Dunder (BLM)
- Pathfinder NWR - contact: Mark Lanier (USFWS), John Lawson (BOR)
- Beck Lake/Alkali Lake – contact: Dennis Saville (Meadowlark Audubon IBA coordinator)
- Grand Teton NP - contact: Jack Neckels (NPS)

Accepted Sites, No Contact

- Natural Corral - landowner lives in New York
- Dry Lake - no contact info
- Little Popo Agie

Tabled Sites (Lack of Information)

- Hams Fork River Bottom
- Lake Viva Naughton
- Skull Point Reservoir
- Shirley Basin
- Little Firehole

Nominations Pending (Forms Not Yet Sent In)

- Bear River Marshes - Andrea Cerovski
- Thunder Basin National Grassland - Bruce Walgren
- Grays Reef Reservoir - Murie Audubon
- Hutton Lake NWR - Murie Audubon
- Union Pass Area - Murie Audubon
- Van Tassel Area - Murie Audubon

Shade-grown Coffee

The Conservation Coffee Campaign. (Excerpted from "The Conservation Coffee Campaign Organizers Kit", available from the Rainforest Alliance, 212-677-1900.)

Introduction

Coffee is a naturally shade-loving species, and it can grow in relative harmony with natural ecosystems. Coffee originated in the rainforests of eastern Africa (modern day Ethiopia), growing under the shade of the rainforest canopy. Today, some of the highest quality coffee in the world is grown throughout the middle altitudes of northern Latin America, from Colombia to Mexico. Forests in these altitudes are home to many people who make their living in the coffee industry, and also to a diversity of wildlife, including hundreds of species of resident birds and the Neotropical migrants that spend the non-breeding season in these areas.

The shade-grown coffee available today is grown under the canopy of the forest. Shaded coffee farms range from "rustic", with coffee bushes as part of the understory, to highly managed plantations with exotic species (usually crop trees) serving as shade cover that simulates a natural forest.

The Problem

Migratory bird diversity is abundant in the tropics at elevations between 1,600 and 6,500 feet (500 and 2,000 m). These are also the elevations where coffee is grown and development occurs. Considerable changes have occurred in coffee farming over the last 25 years. In many parts of Latin America, some farmers who once grew coffee under the shade of native forests have converted to full-sun, higher yield but chemically intensive coffee varieties, which have adverse impacts on wildlife and the environment. While the higher yields tempt farmers to convert to full-sun coffee plantations, this farming method removes centuries-old forests, which destroys habitat for birds and other wildlife, reduces the land's biological diversity, and increases soil erosion. Once the forest canopy is removed, crops are more susceptible to pests and disease and, therefore, require constant doses of fertilizers and pesticides.

Coffee plantations constitute 44% of permanent cropland in northern Latin America, accounting for about 7 million acres (2.5 million ha). Unfortunately, the majority of coffee plantations in Brazil, Colombia, and Costa Rica have already been cleared of trees. For example, the central Andes of Colombia are entirely deforested within the mid-elevations, and development is spreading rapidly to eastern and western areas of the Andes. Ironically, even though full-sun coffee plantations are more expensive to maintain and cause environmental degradation, government agencies often subsidize the transition because they fail to make the "coffee connection".

The Solution

Observations from the 1930s and studies since the 1970s have shown a clear connection between coffee and songbirds. For example, in Chiapas, Mexico, biologists found that shade-grown coffee farms have considerably more birds (more than 150 species) than other agricultural systems and compare favorably with native forest habitat. Also, the Smithsonian Migratory Bird Center found 94 to 97% fewer bird species in full-sun coffee farms than on shaded coffee farms. Scientists have also surveyed other wildlife in shade-grown coffee farms and coffee farms managed other ways and concluded that traditional shade-grown coffee farms host high levels of biodiversity, while the new, full-sun coffee farms are virtual "biological deserts".

There are about 250 species of birds that breed primarily in the temperate region of North America and winter mainly in the tropics. The coffee/songbird connection is about species like warblers, orioles, tanagers, flycatchers, vireos and their forest dependant cohorts, sparrows, and thrushes. Some of these species are clearly in decline, while the status of others is being studied and debated.

Buying shade-grown coffee is perhaps one of the simplest things a North American citizen can do to protect wildlife habitat. The collective power of consumers paying slightly more for certified shade-grown coffee will help provide Latin American coffee growers incentive to maintain their traditional, more environmentally compatible coffee farming. The sample of resources listed below will help you get started.

- The Conservation Coffee Campaign-Organizers Kit (e-mail: eco-ok@ra.org)
- Café Canopy www.shade-coffee.com
- CaPulin www.capulincoffee.com
- Counter Culture Coffee www.counterculturecoffee.com
- Kalani Organica www.kalanicoffee.com
- Royal Blue Organics www.cafemam.com
- Ruta Maya Coffee Company www.rutamaya.net/story.html
- Thanksgiving Coffee Company www.thanksgivingcoffee.com
- The Green Culture www.greenculture.com/ps/pp_coffee.html

Pesticides

When it Comes to Pesticides, Birds are Sitting Ducks. (Fact sheet No. 8, written by Mary Deinlein, Smithsonian Migratory Bird Center, and reprinted with permission.)

The word pesticide is a catch-all term for chemicals that kill or control anything that humans have deemed to be a pest. Such chemicals can be grouped according to the kind of organism targeted, such as insecticide (insect), herbicide (weed), fungicide (fungus), or rodenticide (rodent). Most pesticide compounds in use today are synthetic; that is, they are man-made concoctions produced in a laboratory. A danger inherent to the use of synthetic poisons is that once the chemicals are released into the environment, they may harm unintended victims and have unanticipated effects.

On a global scale, over five billion pounds of conventional pesticides are used annually for agricultural purposes, forest and rangeland management, and disease control, as well as in homes, and on lawns, gardens, golf courses, and other private properties. Twenty percent of this total volume, or 1.2 billion pounds, is used in the United States alone. What does this massive chemical dousing of the earth mean for the health of the environment? Birds provide some of the answers.

Population declines and extensive mortality of birds strongly indicate that the health of the environment, and thus the health of organisms that depend on it, suffers due to the prevalence of pesticides. From songbird declines beginning in the 1940s, to population crashes of Peregrine Falcons, Ospreys, and other predatory birds first detected in the 1960s, to the more recent deaths of over 5% of the world's population of Swainson's Hawks during the winter of 1995, birds have been unwitting victims of pesticide contamination.

In 1962, Rachel Carson's eloquent and best-selling book, "Silent Spring", drew international attention to the environmental contamination wrought by pesticides, particularly the insecticide DDT. Carson cited declines in the number of songbirds due to poisoning as a key piece of evidence.

Six years later came documentation of a more insidious effect of pesticide use. Accumulations of DDE, a compound produced when DDT degrades, were causing reproductive failure in several species of predatory birds, including Peregrine Falcons, Brown Pelicans, Osprey, and Bald Eagles. Not only was DDE toxic to developing embryos, it also caused eggs to be laid with abnormally thin shells. So fragile were the shells that the eggs would easily break under the weight of the adult bird during incubation.

DDT belongs to a class of insecticides known as organochlorines, which also includes dicofol, dieldrin, endrin, heptachlor, chlordane, lindane, and methoxychlor, among others. Some of these pesticide ingredients, such as dieldrin and heptachlor, are poisonous in very small amounts. However, the most dangerous traits of the organochlorines are their persistence – that is, their tendency to remain chemically active for a long time – and their solubility in fat, which means they become stored in fatty tissues within organisms and can accumulate over time. Because of these two traits, contaminant levels become more concentrated with each step up in a food chain – a process known as biomagnification. For example, when Ospreys repeatedly feed on fish contaminated with DDT, increasing amounts of the pesticide are stored within their bodies. Biomagnification accounts for why predatory birds, being at the top of the food chain, are most severely affected by organochlorine pesticides.

Thanks partly to the fervor generated by Carson's book and partly to a study done by the National Institutes of Health which found DDT or its by-products in 100% of the human tissues it examined, DDT and most other organochlorines were banned for use in the United States in the early 1970s. Since the ban, numbers of the more severely affected bird species have slowly recovered. However, the fate of some populations of Peregrine Falcons remains uncertain because DDT, its breakdown products, and other organochlorines are still prevalent in the environment.

If DDT was banned in the United States in the early 1970s, why is there still a problem today? One reason is that the United States continues to export DDT, along with other pesticides known to be hazardous to the environment and to human health. The countries of Latin America, the wintertime destination for many of the migratory birds that breed in the United States and Canada (including many Peregrine Falcons), are also the destination for many of these exported pesticides.

Because of the ban on DDT and the tight restrictions placed on other organochlorines, a new arsenal of pesticides predominates today. Organophosphates and carbamates are now two of the most common classes of active ingredients found in pesticide products. Although organophosphate and carbamate compounds are not as persistent as the organochlorines, they are much more acutely toxic, which means that even very small amounts can cause severe poisoning.

It is estimated that of the roughly 672 million birds exposed annually to pesticides on U.S. agricultural lands, 10% – or 67 million – are killed. This staggering number is a conservative estimate that takes into account only birds that inhabit farmlands, and only birds killed outright by ingestion of pesticides. The full extent of bird fatalities due to pesticides is extremely difficult to determine because most deaths go undetected.

Nevertheless, sobering numbers of dead birds have been documented. For example, in 1995, the pesticide monocrotophos, sprayed to kill grasshoppers, was responsible for the deaths of at least 20,000 Swainson's Hawks in Argentina. Thanks to the efforts of the American Bird Conservancy and other organizations, Novartis (formerly Ciba-Geigy), a major manufacturer of monocrotophos, has recently agreed to phase out the production and sale of this pesticide.

Over 150 bird "die-offs", involving as many as 700 birds in a single incident, have been attributed to diazinon, an organophosphate insecticide commonly used for lawn care. In 1990, diazinon was classified as a restricted ingredient, and banned for use on golf courses and turf farms, marking the first time regulatory action has been taken specifically on behalf of birds. However, in most states diazinon is still available over the counter for use on home lawns and parks. So, despite the restricted-use status, as much as 10 million pounds of diazinon are still used yearly in the United States, primarily by homeowners. Continued reports of bird fatalities, and additional evidence concerning the extreme toxicity of diazinon and its metabolites to aquatic invertebrates and mammals have prompted the U.S. Fish and Wildlife Service and a consortium of environmental organizations headed by the Rachel Carson Council to petition the Environmental Protection Agency to further restrict uses of diazinon.

In 1989, the Environmental Protection Agency reported that carbofuran was estimated to kill at least 1 to 2 million birds in the United States each year. This carbamate pesticide was introduced in the mid-1960s, but it wasn't until 1994 that any regulations were imposed on the manufacturer, FMC Corporation. Granular forms are now banned for most uses because of widespread bird kills, although about 2 million pounds in liquid form are still used in the U.S. each year.

So far, about 40 active ingredients in pesticides have been found to be lethal to birds, even when used according to the instructions on the label. Only about a quarter of these ingredients have been banned in the United States, and most are still used elsewhere. The active ingredients that have proven to be deadliest to birds include diazinon, phorate, carbofuran, monocrotophos, isofenphos, chlorpyrifos, aldicarb, azinphos-methyl, and parathion.

Ingestion is probably the most common way that birds are exposed to pesticides. Birds can swallow the pesticide directly, such as when a bird mistakes a pesticide granule for a seed, or indirectly, by consuming contaminated prey. They may also ingest pesticide residues off feathers while preening, or they may drink or bathe in tainted water. Pesticides can also be absorbed through the skin, or inhaled when pesticides are applied aerially.

Whether or not a bird is harmed as a result of pesticide exposure depends on a number of factors, including the toxicity of the chemical(s), the magnitude and duration of exposure, and whether the exposure is recurrent. Potential harmful effects range from imminent death due to acute poisoning to a variety of so-called "sub-lethal" effects, including the following: eggshell thinning, deformed embryos, slower nestling growth rates, decreased parental attentiveness, reduced territorial defense, lack of appetite and weight loss, lethargic behavior (expressed in terms of less time spent foraging, flying, and singing), suppressed immune system response, greater vulnerability to predation, interference with body temperature regulation, disruption of normal hormonal functioning, and inability to orient in the proper direction for migration. Each of these sub-lethal effects can ultimately reduce populations as effectively as immediate death, since they lower birds' chances of surviving or reproducing successfully, or both.

Pesticides can also affect birds indirectly by either reducing the amount of available food or altering habitat. Birds that eat insects are literally at a loss when insecticides cause a drop in the number of insect prey available, especially when they have young to feed. The breeding season of many birds has evolved to coincide with peaks of insect abundance. Unfortunately for them, peaks in insect abundance also mean peaks in insecticide use.

Herbicides, too, can lead to decreases in insect availability by eliminating weeds on which insects live – a chain of events responsible for sharp declines of Gray Partridges in the United Kingdom. The food supply of birds that eat the seeds of weeds can also be reduced by herbicides. In Britain, Linnets, a type of seed-eating finch, have gone from being a rather common bird on agricultural lands to an extremely rare one due to this type of indirect herbicide effect.

Another way that herbicides can harm birds is by reducing the amount of plant cover available for predator avoidance and nest concealment. For example, herbicides have been used extensively in the western United States to convert sagebrush habitat into cattle pastures. This loss of sagebrush has caused declines in Brewer's Sparrows, which require the cover provided by the plant for nesting.

Birds that breed in the United States and Canada and winter in Latin America and the Caribbean are potentially exposed to more pesticides than are resident birds, given the great distances over which they travel. Whereas the regulatory process for protecting the environment and human health in the United States may not be exemplary, conditions are generally worse in most Latin American countries where there are few regulations banning or governing the sale and use of pesticides. Therefore, resident birds and birds that over-winter in these countries, not to mention the people who live there, have a greater likelihood of exposure to harmful pesticides.

Pesticide contamination is often cited as one of the factors responsible for declining numbers of some Neotropical migratory birds, and yet so far there is very little hard evidence to support this claim. This lack of evidence does not necessarily mean that pesticides are not contributing to the declines; more likely it is testimony to the difficulty of detecting the role of pesticides in causing death or reproductive failure.

It has been shown that exposure to acephate, an organophosphate, can interfere with an adult bird's ability to orient itself in the proper direction for migration. Who knows how many vagrants (birds that are seen far from the range which is normal for their species) sighted off course each year have been disoriented by pesticides? Or, how many migrants don't make it to their right destination for this same reason?

When fat reserves are rapidly used up, as can occur during migration, enough accumulated organochlorine pesticides can be "liberated" within the body to cause death. Who knows what proportion of the birds that die during migration are victims of pesticide poisoning?

The same sorts of questions can be posed regarding the numbers of young birds that do not survive each year. How many were in nests that were inadvertently sprayed with pesticides, or were fed contaminated food, or did not receive enough food because pesticides reduced the number of available insects?

It is often difficult, if not impossible, to tease apart the many factors making life more and more difficult for migratory birds and to determine the relative contribution of each factor to population declines. Accordingly, the role that pesticides play remains unexplained. It stands to reason, however, that as the amount of wildlife habitat continues to dwindle and the quality of what remains takes on an even greater significance, anything that compromises that quality could be the proverbial straw that breaks the camel's back.

As evidence mounts regarding links between pesticide exposure and rates of sterility, cancers, hormonal disruption, and immune system disorders in humans, should we heed the warning signs provided by birds, or continue to pay the high environmental and social costs of rampant pesticide use? Here are a few thoughts and figures to consider. The benefits of pesticides are often cited in terms of their contribution to world food production, and yet it is estimated that crop losses to pests would increase only 10% if no pesticides were used. Between 1945 and 1989, pesticide use in the U.S. increased tenfold and yet crop losses doubled from 7 to 14%. Consider also that all of us, everywhere, are exposed to some pesticide residues in food, water, and the atmosphere. Residents of the United States eat an estimated 2 billion pounds of imported produce tainted with banned pesticides each year.

Scientist Paul Ehrlich has compared pesticides to heroin in that "they promise paradise and deliver addiction". Pesticide use leads to dependency by killing not only the targeted pests but also the natural predators and parasites of those pests and through the development of resistance in the pests. The destruction of natural enemies and increased resistance are countered by heavier and more frequent pesticide applications, thus maintaining the "pesticide habit" and increasing the costs of supporting it.

Honey bees and wild bees are among the victims of pesticide poisoning and their numbers are on the wane, a fact that is gaining increasing attention because of their economic, ecological, and agricultural importance as pollinators. With something as fundamental as the birds and the bees at stake, shouldn't we all be concerned?

If you want to help reduce global contamination and its costs, here are some things you can do:

- Educate yourself and others about the effects of pesticides and alternative pest control methods.
- Buy organically grown products.
- Support organizations working to reduce society's dependence on pesticides.

Here's where to go for more information:

- Northwest Coalition for Alternatives to Pesticides, P.O. Box 1393, Eugene, OR 97440; 541-344-5044; www.efn.org/~ncap.
- Pesticide Action Network, 116 New Montgomery, Suite #810, San Francisco, CA 94105; 415-541-9140; www.panna.org/panna.
- Rachel Carson Council, 8940 Jones Mill Road, Chevy Chase, MD 20815; 301-652-1877; www.members.aol.com/rccouncil/ourpage/rcc_page.htm.

Suggested reading:

- Gard, N., and M. Hooper. 1995. An assessment of potential hazards of pesticides and environmental contaminants. Pages 294-310, *in* T. Martin and D. Finch, editors. Ecology and Management of Neotropical Migratory Birds, Oxford University Press.
- Pimentel, D. et al. 1992. Environmental and economic costs of pesticide use. Bioscience Vol. 42, No. 10, November 1992.
- Stinson, E., and P. Bromely. 1991. Pesticides and Wildlife: A Guide to Reducing Impacts on Animals and Their Habitat. Virginia Department of Game and Inland Fisheries, Publication No. 420-004.
- Williams, T. 1997. Silent Scourge. Pages 28-35, Audubon, January - February 1997.

Effects of Pesticides and Contaminants on Neotropical Migrants. (Excerpted from Gard et al. 1993.)

Introduction

Substantial quantities of pesticides and industrial contaminants are released into the environment every year, both intentionally and accidentally. Migratory birds are potentially exposed to a wider range of pollutants than non-migratory species, as their annual movements can bring them into contact with pollutants in breeding and wintering regions and on migration routes. However, our understanding of the contribution of pesticides and pollutants to population declines of Neotropical migrants is hindered by a lack of knowledge on the extent to which migrants are exposed to these chemicals and the importance of pollutant-induced changes in mortality and reproductive success relative to other natural or human-caused factors which may also affect population size.

Modes of Expression of Toxic Effects

Pesticides and contaminants exert their toxic effects on birds in varying manners depending upon their chemical nature, environmental persistence, mode of action, and methods by which they are metabolized in birds. Toxic effects are either expressed acutely (brief exposure usually resulting in direct mortality), chronically (a long period of uptake of small amounts of a toxicant usually resulting in reproductive or behavioral changes, immunological impairment, carcinogenesis, and teratogenesis), directly (changes induced in a bird following exposure, such as increased mortality, decreased reproduction, increased susceptibility to predation, and behavioral impairment), or indirectly (responses to pesticide-induced changed in food resources, habitat structure, and predator or competitor abundance).

Contaminants of Concern

There are 5 major classes of environmental contaminants which may be most likely to affect Neotropical migrants: 1) Organochlorine pesticides and related industrial contaminants. These compounds typically have low acute toxicity, and the greatest risk to wildlife is due to their chemical stability, which confers prolonged environmental persistence. 2) Organophosphorus and carbamate insecticides. These compounds are widely used in North America for insect pest control in agricultural, rangeland, and forestry applications, and use in Latin American countries is increasing. These compounds generally have low environmental persistence, but their acute toxicity has resulted in numerous avian die-offs. 3) Herbicides. These are generally non-toxic to birds, but can have a severe impact on avian populations since they produce extensive habitat modification. Furthermore, it may take years for habitat alterations to have their greatest effect on bird populations. 4) Acidic precipitation. Acid-stressed ecosystems

are likely to impact birds indirectly through changes in habitat structure or prey availability, and directly through the bioavailability of toxic metals such as mercury, aluminum, cadmium, and lead. 5) Metals. These have the ability to bioaccumulate through food chains, especially in aquatic systems. Of greatest concern are mercury, cadmium, aluminum, lead, and selenium. Dietary exposure can lead to reproductive dysfunction, increased susceptibility to disease, or mortality.

Monitoring Techniques

We currently lack sufficient information to satisfactorily evaluate the effects of toxicants on population dynamics of songbirds. Several non-lethal monitoring techniques can provide useful information. Blood samples can be obtained from birds captured in mist nets and analyzed for organochlorine residues. Plasma can be assayed for the presence of metals such as lead, and metal residues in feathers can also indicate contamination.

Incident monitoring involving collection of mortalities following pesticide applications or pollution events enables carcasses to be tested for the presence of pesticides or residues.

Since monitoring programs cannot be created for all songbirds, several focal species can be selected to serve as indicators of exposure to, and toxicity of, contaminants for other songbirds. A suitable focal species must be sufficiently abundant, easily manipulated, must possess ecological and behavioral characteristics similar to those of other songbirds, and must display representative sensitivity to contaminants.

Conclusion

Despite our current lack of knowledge on contaminant loads of pollutants and pesticides in songbirds, it is very likely that birds are being exposed to at least some of these chemicals, and it is reasonable to expect that some adverse effects are occurring. To improve our understanding of the effects of environmental pollutants, the following research and management needs must be addressed: 1) expansion and standardization of monitoring programs, 2) selection of appropriate Neotropical migrants as indicator species, 3) improvement of hazard identification procedures in wintering regions and on breeding habitats, 4) assessment of sublethal impacts of contaminant exposure, and 5) development of quantitative population models which incorporate appropriate ecological and toxicological data to predict the effects of environmental contaminants on population dynamics of Neotropical migratory and resident songbirds.

Predation

Human-assisted Predators

Human perception of the role of predators in the natural world has changed greatly over time. Once, all wild predators were considered evil and destructive, and were persecuted relentlessly. Today, public perceptions of predators are more diverse, and many people recognize predators as a natural part of a healthy biological community. However, even in apparently natural settings, predators can cause problems for populations of native prey species, especially bird nests, eggs, and young.

Once species become rare, even natural levels of predation may lead to endangered status, and drastic protective measures are required. Today, control of predators and nest parasites has become a necessary management tool for several rare or endangered birds like the Least Tern, Kirtland's Warbler, and Southwest Willow Flycatcher.

A more complex problem involves the adverse effects of native predators on native birds in relatively natural environments. In many cases, these habitats are not as natural as they appear. Human alterations to the landscape can affect the natural balance of predator and prey. Small mammalian predators, including the raccoon, striped skunk, red fox, and opossum, benefit from human sources of food and shelter. On the shortgrass prairie, shrub-steppe grasslands, and forested mountains and foothills of Wyoming, suitable food and shelter for these species was historically scarce in winter. The introduction of row crops, garbage cans, town dumps, road-killed carrion, and winter-killed livestock have made large portions of Wyoming habitable to these small predators. Also, shelter under houses and sheds, in junkyards, brush piles, shelterbelts, and road culverts now protect them from severe weather and natural enemies. For example, the raccoon has greatly expanded its range into the west and throughout Wyoming, increasing its population to as much as six times the levels of 60 to 70 years ago. Likewise, human development on the high plains has permitted westward range expansion of the red fox in the 20th Century.

Avian predators of adult birds and eggs also benefit from alternative food sources and shelter provided by human development. Avian predators include corvids like the American Crow, Common Raven, Black-billed Magpie, and Blue Jay; and raptors like the Great Horned Owl. Many of these species were uncommon, rare, or absent from Wyoming prior to development in the 20th Century. For example, the Blue Jay first appeared on Cheyenne Christmas Bird Counts in the 1960s.

Where they are too abundant, predators can have significant impacts on both game and nongame bird populations. Fragmented habitat can also increase the hunting efficiency of both nest predators and nest parasites, like the Brown-headed Cowbird, reducing reproductive success and leading to population declines in some songbirds.

Domestic Cat Predation on Birds and Other Wildlife. (Cats Indoors! The Campaign for Safer Birds and Cats, American Bird Conservancy.)

How many birds and other wildlife do domestic cats kill each year in the United States? No one knows, although reasonable extrapolations from scientific data can be made. Nationwide, cats are estimated to kill hundreds of millions of birds and more than a billion small mammals (such as rabbits, chipmunks, squirrels, and shrews) each year. Cats kill not only plentiful animals, but rare and endangered species for which the loss of even one animal is significant. The scientific community is increasingly concerned about cat predation.

There are over 66 million pet cats in the United States. A recent poll shows approximately 35% are kept exclusively indoors, leaving more than 40 million owned cats free to kill birds and other wildlife, all or part of the time. In addition, millions of stray and feral cats roam our cities, suburbs, farmlands, and natural areas. Abandoned by their owners or lost (stray), or descendants of strays and shunning all human contact (feral), these cats are victims of human irresponsibility through owner abandonment and the failure to spay or neuter pets. No one knows how many homeless cats there are in the U.S., but estimates range form 40 to 60 million. These creatures lead short, miserable lives.

Cats Are *Not* a Natural Part of Ecosystems

The domestic cat, *Felis catus*, is a descendant of the wild cat of Africa and extreme southwestern Asia, *Felis silvestris libyca*. Domesticated in Egypt approximately 4,000 years ago, cats were introduced to Europe around 2,000 years ago. Cats were introduced to North America when Europeans arrived on this continent, but were brought in large numbers during the latter part of the nineteenth century in an attempt to control burgeoning rodent populations associated with the spread of agriculture. Some people presume that a cat killing certain animals, such as field mice, is beneficial, but native small mammals are important to maintaining biologically diverse ecosystems. For example, mice and shrews are an important food source for birds such as the Great Horned Owl, Red-tailed Hawk, and American Kestrel.

Cats Compete with Native Predators

Owned cats have huge advantages over native predators. They may be afforded some protection from disease, predation, competition, and starvation; factors which control native predators such as owls, bobcats, and foxes. Cats with dependable food supplies are not as vulnerable to changes in prey populations. Unlike many native predators, cats are not strictly territorial, keeping members of their own species out of a given area. As a result, cats can exist at much higher densities and may out-compete

native predators for food. In addition, unaltered cats are prolific breeders. A female cat can have up to three litters per year, with four to six kittens per litter.

Cats Transmit Disease to Wildlife

Unvaccinated cats can transmit rabies, and cats are the domestic animal most frequently reported rabid to the Centers for Disease Control and Prevention. Cats are also suspected of spreading feline leukemia virus to a mountain lion in California and may have infected the endangered Florida panther with feline distemper. Feline infectious peritonitis has been diagnosed in mountain lion and lynx, and feline immunodeficiency virus has been found in Florida panther and bobcat.

Studies of Cat Predation

Extensive studies of the feeding habits of domestic, free-roaming cats have been conducted over the last 50 years in Europe, North America, Australia, Africa, and on at least 22 islands. These studies show that approximately 60 to 70% of the wildlife cats kill are small mammals, 20 to 30% are birds, and up to 10% are amphibians, reptiles, and insects.

Scientists have found that the number and types of animals killed by cats vary greatly, depending on the individual cat, time of year, and availability of prey. Some free-roaming domestic cats kill more than 100 animals each year. Some cats specialize in killing birds while others take mainly small mammals. One regularly fed cat that roamed a wildlife experiment station was recorded to have killed more that 1,600 animals (mostly small mammals) over 18 months. Rural cats take more prey than suburban or urban cats. Birds that nest or feed on the ground are the most susceptible to cat predation, as are nestlings and fledglings of many other bird species. Following are summaries of specific studies:

<u>Wisconsin Study</u>: Researchers at the University of Wisconsin coupled their four-year cat predation study with data from other studies, and predicted a range of values for the number of birds killed each year in the state. By estimating the number of free-ranging cats in rural areas, the number of kills per cat, and the proportion of birds killed, the researchers calculated that *rural* free-roaming cats kill at least 7.8 million, and perhaps as many as 217 million, birds a year in Wisconsin. They estimated that in some parts of the state, free-roaming cat densities reach 114 cats per square mile, outnumbering all natural predators. (Coleman, J. S., and S. A. Temple. 1995. How many birds do cats kill? Wildlife Control Technology:44.)

Virginia Study: Virginia researchers compared free-roaming domestic pet cats in a rural setting and a more urban one. A total of 27 native species (eight bird, two amphibian, nine reptile, and eight mammal, including the star-nosed mole, a species of special state concern) were captured by a single rural cat. Four urban cats captured 21 native species (six bird, seven reptile, eight mammal). Between January and November 1990, each cat caught, on average, 26 native individuals in the urban area, and 83 in the rural area. The study did not count prey killed and completely consumed, prey killed and left elsewhere, or non-native prey. (Mitchell, J., and R. A. Beck. 1992. Free-ranging domestic cat predation on native vertebrates in rural and urban Virginia. Virginia Journal of Science 43:197-206.)

Cats at Bird Feeders Study: A continent-wide survey of 5,500 homes with bird feeders during the winter of 1989-1990 showed that the domestic cat was a significant predator of birds at feeders. Species killed by cats at bird feeders included Dark-eyed Junco, Pine Siskin, Northern Cardinal, and American Goldfinch. (Dunn, E. H., and D. L. Tessaglia. 1994. Predation of birds at feeders in winter. Journal of Field Ornithology 65(1):8-16.)

Cats on Islands

Because some island bird populations evolved in the absence of mammalian predators, they have no defense mechanisms against them. When an efficient predator such as the domestic cat is introduced or abandoned on an island, elimination of entire bird populations can result. Domestic cats are considered primarily responsible for the extinction of eight island bird species and the eradication of over 40 bird species from New Zealand islands alone. Island bird species that are now extinct primarily due to cat predation include the following: Stephen's Island Wren, South Island Thrush, Chatham Island Rail, Stewart Island Snipe, and the Auckland Island Merganser. On Marion Island in the Sub-Antarctic Island Ocean, cats were estimated to kill about 450,000 seabirds annually prior to cat eradication efforts.

Cat Predation of Wildlife in Habitat Reduced to Islands

Cats can have highly significant impacts on local wildlife populations, especially in habitat "islands" such as suburban and urban parks, wildlife refuges, and other habitats that are surrounded by human development. For birds, the loss of species from habitat islands is well documented, and nest predation is an important cause of the decline of Neotropical migrants. The Point Arena mountain beaver, Stephen's kangaroo rat, and Pacific pocket mouse, protected under the Federal Endangered Species Act, now live on habitat islands created by destruction and fragmentation of their habitat in California. Domestic cat predation by pet and feral cats on these species is a serious threat to their future existence on the habitat that is left.

Cat Predation of Federally-Protected Wildlife

The Migratory Bird Treaty Act (MBTA) prohibits the hunting, taking, capturing, or killing of any migratory bird. However, owners of free-roaming domestic cats permit their pets to kill birds protected by the MBTA in seeming violation of this landmark law. Domestic cats are also killing birds and other wildlife protected under the Endangered Species Act.

Through the Endangered Species Act, the federal government protects and restores wildlife at risk of extinction. Habitat loss is the most significant cause of species declines, and predation, including killing by cats, ranks second. Although cats may not be responsible for the perilous status of endangered wildlife, the loss of even a single animal can be a setback to the survival of the species. It is not possible to document fully the predation of protected species by cats, but the following is a list of protected species for which there is at least one documented case of cat predation in the U.S.

Documented Cat Predation of Birds Protected by the Endangered Species Act

- Light-footed Clapper Rail, *Rallus longirostris levipes*
- California Clapper Rail, *Rallus longirostris obsoletus*
- California Least Tern, *Sterma antillarum browni*
- Western snowy Plover, *Charadrius alexandrinus nivosus*
- California Brown Pelican, *Pelecanus occidentalis californicus*
- California Gnatcatcher, *Poliptila californica*
- Piping Plover, *Charadrius melodus*
- San Clemente Loggerhead Shrike, *Lanius ludovicianus mearnsi*

Documented Cat Predation of Mammals Protected by the Endangered Species Act

- Pacific Pocket Mouse, *Perognathus longimembris pacificus*
- Stephens' Kangaroo Rat, *Dipodomys stephensi*
- Morro Bay Kangaroo Rat, *Dipdomys heermanni morroensis*
- Point Arena Mountain Beaver, *Aplodontia rufa nigra*
- Florida Beach Mouse, *Peromyscus polionotus leucocephalus*
- Key Largo Woodrat, *Neotoma floridana smalli*
- Key Largo Cotton Mouse, *Peromyscus gossypinus allopaticola*

Documented Cat Predation of Reptiles Protected by the Endangered Species Act

- Island Night Lizard, *Xantusia riversiana*
- Alameda Whipsnake, *Masticophis lateralis euryxanthus*

Correcting Four Myths About Cat Predation of Birds and Other Wildlife

Some people mistakenly believe:

1. Well-fed cats are not a danger to wildlife.
2. Putting a bell on a cat is an effective way to deter predation.
3. Interrupting an attack by a cat allows the prey to escape and live.
4. Stray cat colonies present no danger to wildlife.

Well-Fed Cats *Do* Kill Birds: Well-fed cats kill birds and other wildlife because the hunting instinct is independent of the urge to eat. In one study, six cats were presented with a live small rat while eating their preferred food. All six cats stopped eating the food, killed the rat, and then resumed eating the food.

Cats with Bells on Their Collars *Do* Kill Birds: Studies have shown that bells on collars are not effective in preventing cats from killing birds or other wildlife. Birds do not necessarily associate the sound of a bell with danger, and cats with bells can learn to silently stalk their prey. Even if the bell on the collar rings, it may ring too late, and bells offer no protection for helpless nestlings and fledglings.

Birds that Seem to Escape *Don't* Get Away Unscathed: Contrary to popular belief that birds and other small animals can be rescued from a cat attack and get away unharmed, wildlife rehabilitation centers report that most small animals injured by cats die. Cats carry many types of bacteria and viruses in their mouths, some of which can be transmitted to their victims. Even if treatment is administered immediately, only about 20% of these patients survive the ordeal. A victim that looks perfectly healthy may die from internal hemorrhaging or injury to vital organs. Wildlife rehabilitation centers also report that a large percentage of their patients are cat attack victims and animals orphaned by cats. Victims of cat attacks may be more easily found that victims of other wildlife hazards such as cars and disease. At wildlife Rescue, Inc. in Palo Alto, California, approximately 25% of their patients during May and June 1994 were native cat-caught birds and almost half were fledglings. Thirty percent of birds and 20% of mammals in the care of the Lindsay Wildlife Museum in California were caught by cats. Cat predation of wildlife is especially frustrating to wildlife rehabilitators. These losses are totally unnecessary because, unlike other predators, pet cats don't need these animals to survive.

Cat Colonies *Are* a Problem for Birds and Other Wildlife: Domestic cats are solitary animals, but clusters often form around an artificial feeding source, such as garbage dumps or food left out for them. These populations can grow very quickly, can have significant impacts on wildlife populations, and can cause significant health risks to other cats, wildlife, and humans. Feeding these cats does not prevent the predation of birds and other wildlife. For example, a famous heron and egret rookery of several thousand birds reportedly has been decimated, and songbird populations have

plummeted, in Greynolds Park in Dade County, Florida, where the numbers of cats and raccoons fed by humans have exploded.

Conclusion

Cats are not ultimately responsible for killing our native wildlife - people are. *The only way to prevent domestic cat predation on wildlife is for owners to keep their cats indoors!*

For More Information

Contact the American Bird Conservancy; Cats Indoors! The Campaign for Safer Birds and Cats; 1250 24th Street, NW #400; Washington, DC 20037; phone: 202-778-9666; fax: 202-778-9778; e-mail: abc@abcbirds.org; website: www.abcbirds.org.

Nest Parasitism

Overview

Although Brown-headed Cowbirds are native to North America and traditionally followed the large buffalo herds across the plains, certain livestock grazing and management practices have enabled cowbirds to expand their range and detrimentally increase the effects of nest parasitism. Cowbirds build no nest of their own, but lay their eggs in a host species nest, often removing a host's egg in the process. Cowbird young hatch earlier than the host young and are larger and more aggressive; therefore, they receive the majority of food brought to the nest, at the expense and often demise of the host's young.

Cowbird Ecology and Management (Ortega 1998)

Cowbird Ecology

Studies from Washington, California, and Illinois have found cowbird abundance to be highest within 2 miles (3 km) of agricultural areas, but parasitism rates were not associated with cowbird abundance. The highest parasitism rates were found in riparian areas and in habitats associated with human disturbance. Parasitism rates decreased with increasingly open habitat, suggesting that cowbirds prefer forest habitat; thus, managing for large trees within riparian areas may reduce parasitism rates. Parasitism rates were lower in large native pastures than in small native pastures, but did not differ between grazed and ungrazed pastures. Conversely, in Montana, parasitism rates were greatest in disturbed and residential habitats and were lowest in mature forest. In Colorado, the most heavily parasitized species were Plumbeous and Warbling Vireos, and parasitism rates of Lazuli Buntings may reach 80 to 100%.

Cowbird-Host Interactions

Nest desertion rates are higher among old hosts (species co-evolved with cowbirds) than among new hosts (species recently exposed to cowbirds), but desertion may not be due to cowbird parasitism in all cases. Cowbird parasitism decreases the number of hosts fledged in 11 species of birds ranging in size from vireos to blackbirds. However, as host size increased, the number of host young fledged also increased, reducing the impact of parasitism. In one island study, removing cowbirds reduced nest predation rates, suggesting that cowbirds may have more of an effect on their hosts than is apparent from parasitism rates alone. Female cowbirds tend to be site faithful, and fecundity may not be as high as once thought, from 3 to 13 parasitized nests within a female's home range.

Cowbird Management

The endangered Least Bell's Vireo suffered parasitism rates of 80 to 90%, with parasitized nests averaging much lower success than unparasitized nests. After a cowbird control program was begun in 1996, parasitism rates dropped to 35%. However, even with cowbird trapping, some vireos continued to be parasitized, and removal of cowbird eggs from parasitized nests did not always prevent subsequent abandonment. In a heavily parasitized population of Lazuli Buntings, unparasitized nests only produced enough young to replace themselves and, thus, were population sinks. Point counts in areas with cowbird control programs have found higher abundance of host species than in areas without cowbird control programs. However, several studies have shown no correlation between cowbird abundance and parasitism rates. Studies have also shown that predation reduces host productivity more than parasitism and, in many parasitism studies, the effect of predation is difficult to account for. Removal of livestock from a Black-capped Vireo study area reduced cowbird parasitism rates. A study in California found parasitism to be the major source of Willow Flycatcher nest failure. A cowbird trapping program reduced cowbird abundance by 50%, parasitism rates declined, and flycatcher productivity increased. However, the flycatcher population remained unchanged, thus suggesting that factors other than parasitism are preventing population recovery.

Cowbird Control Programs

In cases where cowbird control programs have not resulted in increases in host populations, there is a danger that continued cowbird control may prevent attention from being focused on other, possibly more important, causes of host population decline. Conference participants called for standardization of cowbird control programs, methods for determining whether a control program is needed, and better methods for evaluating control program efficacy. Before a control program is established, it should be documented that host reproductive rates are less than that needed to sustain the population, that parasitism is responsible for low reproductive rates, and that predation is not responsible. It should also be recognized that cowbirds are native to western landscapes; declining habitat quality and increased predator populations are more likely responsible for host population declines than cowbird parasitism; and, because control is expensive and labor-intensive, it is best viewed as a temporary solution to localized problems. Winter trapping of cowbirds at large concentrations is viewed by many as counter-productive for a variety of reasons. First, it can detract from other, more important, factors limiting host populations. Second, cowbirds are not a problem across their entire range and winter trapping likely removes individuals from other non-target breeding populations. And finally, sacrifices of non-target species have resulted in adverse program publicity.

Colorado Cowbird Research

Dr. Ortega has studied cowbird parasitism in grazed and ungrazed Gambel's oak and riparian habitats in southwestern Colorado since 1992. Her results show that parasitism increased with grazing in oak habitats, but not in riparian habitats. She also found that grazing had little effect on nest predation, which was a major cause of host reproductive failure. Chipping Sparrow parasitism rates increased and productivity decreased in association with grazing. However, Chipping Sparrows were successful in spite of parasitism. Predation had a much larger effect on the local Chipping Sparrow population than did cowbird parasitism. Dr. Ortega suggests that cowbirds may prefer riparian pastures over oak pastures and may opportunistically find host nests as they forage with cattle. Because cowbird egg-laying declines after mid-June, later nesting host species were parasitized less than earlier nesting species.

Conference Conclusions

Cowbird abundance is often not correlated with host parasitism rates. Cowbirds are not a problem throughout their range. In many habitats, predation is a far more important source of nest failure than is parasitism. Cowbird habitat preferences are variable, but disturbed habitats are preferred. Very little is known about the effects of livestock grazing on parasitism rates, and is the top research priority. The North American Breeding Bird Survey has shown an overall decline in cowbird abundance since 1966. Cowbird trapping programs can be effective in reducing parasitism in local host breeding populations. However, it is a temporary solution at best, and assessment of program efficacy should be built into project design and funding.

Cowbird Scientific Advisory Council

The American Bird Conservancy governing council approved on 14 December 1997 a proposal to create a National Cowbird Advisory Council, which grew out of the Partners In Flight Cowbird Conference in Sacramento. The Council is composed of a broad range of representatives who are resource managers, federal scientists, and academic scientists. The Council will serve as a logistic center for information on cowbird impacts on hosts and appropriate management procedures. A central database will be established at Patuxent Wildlife Research Center (U.S. Geologic Service - Biological Resources Division), Laurel, MD, where all cowbird management programs will be registered. For more information, visit the Patuxent Wildlife Research Center's home page at www.pwrc.usgs.gov.

Habitat Conversion

The landscape of North America has undergone significant changes from descriptions provided in early accounts. The impacts have been varied, with some having primarily local effects on the native avifauna and others having more universal impacts across the landscape. In this section we review three major problems of habitat conversion to the avian community: development, land use changes, and conversion of native habitat to cropland.

Habitat Fragmentation

What exactly does the phrase "habitat fragmentation" mean? Habitat fragmentation refers to the breaking-up of large, contiguous areas of similar vegetation. This 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 microhabitat level, and poor dispersal skills.

Habitat fragmentation can occur on different levels, for different lengths of time, and have varying detrimental effects. For example, converting patches of native grassland to cropland usually causes permanent and large-scale habitat fragmentation, whereas certain timber harvesting practices cause temporary fragmentation by creating patches of young forest within an overall mature forest.

Fragmenting habitats also creates 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 because predator abundance is greater along the edge than in the interior, increased rates of nest parasitism by cowbirds because this native species is also more abundant along edges, more competition between species for limited nesting and foraging sites, and diminished pairing and nesting success.

Fragmented habitats can also result in breeding areas that support "source" populations (enough young birds are produced to replace breeding adults, and perhaps enough to disperse and populate other areas) into marginal breeding habitat that supports only "sink" populations (not enough young birds are produced to compensate for adult mortality; they only exist due to continued colonization from other areas).

Landowners and land managers can use a number of tools to lessen the impacts of habitat fragmentation on birds. When planning and managing reserves and habitat restoration projects, one single large reserve is more beneficial to birds than several small reserves. This provides habitat for area-sensitive species that only breed in non-edge habitat. Reserves and habitat restoration sites should have a compact, roughly circular or square shape to maximize the size of the core area. Reserves and restoration sites should be clustered together, where possible, rather than spaced widely apart. Where fragmentation has already occurred, make sure the existing fragments retain their habitat qualities, as these sites may still be important for post-breeding dispersal habitat and as migration stopover spots for birds.

Development (Sierra Club 1998)

One of the most pressing problems facing us in the Unites States today is that of uncontrolled development, or suburban sprawl. Technically defined, sprawl is "low-density, automobile-dependent development beyond the edge of service and employment areas". The classic picture of uncontrolled sprawl is the strip malls and large-lot subdivisions spreading out over previously open or undeveloped spaces. More than just an eyesore, the consequences of decades of unplanned, rapid growth and poor land-use management are evident all across America: lost open space; destroyed wildlife habitat, farm and ranch lands, wetlands, forests, shrublands, grasslands, and riparian areas; increased dependence on fossil fuels; increased traffic congestion; longer commutes; worsening air and water pollution; increased flooding; higher taxes; increased demand and costs for public services; and dying city centers.

Land consumption is far out-pacing population growth in urban areas across the U.S. It is estimated that each person uses 4 to 5 times more land for roads, homes, and shopping now than 40 years ago. Indeed, between 1970 and 1990, more than 19 million acres of rural land were developed. Every year, 400,000 acres are being bulldozed under, and the rate of development is accelerating. The American Farmland Trust reports that an astounding 70% of prime or unique farmland is now in the path of rapid development. And residential sprawl development costs more tax money to provide for public infrastructure such as schools, roads, and sewers, than it creates in revenues.

At the same time that sprawl is making increased demands on the cleansing and restorative properties of ecosystems, it is consuming them. The forests, wetlands, and grasslands that we are losing are vital for nutrient uptake, flood control, filtering sediment, and providing wildlife habitat. In addition, sprawl is consuming our highest quality agricultural lands, especially those closest to metropolitan areas, where 79% of our fruits, 69% of our vegetables, and 52% of our milk is produced.

Smart, compact growth makes sense. Compact growth consumes 45% less land and costs 25% less for roads, 15% less for utilities, and 5% less for housing than sprawl

development does. Growth management is an issue that many states are making a top priority; over 25 states now have regional or statewide growth management advocacy groups.

For more information on this topic, visit the environmental quality section of the Sierra Club's web site at www.sierraclub.org.

Land Use Changes (Askins 2000, Knopf 1994)

As human influence continues to spread, both directly and indirectly, across even the most remote natural areas, many species are unable to adapt to environmental changes we incur. For example, some birds can use young, regenerating forests, but they are intolerant of small patches of forest surrounded by open habitats that result when forests are fragmented. Similarly, many grassland specialist birds disappear from small patches of grassland that have unsuitable surroundings. Some species disappear from small areas because they have a large home range and are unable to find enough food in a small habitat patch. Some disappear because they are intolerant of the increased rates of nest predation and cowbird nest parasitism that frequently occur in small patches. Whatever the reason, small habitat size and isolation of habitat patches are more likely to affect bird populations in landscapes where 70% or more of the native habitat has been destroyed.

Conversely, some species depend on periodic destruction and simplification of the dominant vegetation. Humans have changed the landscape by interfering with natural causes of environmental disturbance, such as frequent fires, grazing by prairie dogs and bison, seasonal floods, windstorms, and beavers. When these disturbances are removed or when their frequency or intensity are reduced, then the habitat will slowly change until it is unsuitable for those species that depend on an earlier stage of plant succession. Introduced plants can also spread rapidly, and replace or eradicate the vegetation needed by habitat specialists.

Native Habitat to Cropland (Knopf 1994)

One major change across the Great Plains landscape has been extensive agricultural cultivation, where native grasses have been plowed under, mainly for cereal grain production. The eastern Great Plains have been virtually obliterated for grain (primarily corn) production, while the proportion of native grasslands on the western Great Plains in Montana, Wyoming, and Colorado that have remained in a grassland landscape is comparatively high at nearly 72%. (In 1987, native grasslands in Wyoming were comprised of 4,000 miles^2 in cropland, 1,200 miles^2 in introduced pastureland, and 42,100 miles^2 in native grassland.) In addition, 6,000 miles^2 remain in 19 National Grasslands, with 17 of those on the Great Plains, mainly in the shortgrass prairie. Compared to the eastern grassland landscape, the western is merely fragmented rather than obliterated.

Draining wetlands for cultivation purposes has also dramatically altered the local locations of plants on grasslands. Values for Montana, Wyoming, and Colorado show a 40% loss of 8,000 miles^2 of wetlands.

Habitat Rehabilitation and Restoration (Askins 2000)

Altered habitats can be rehabilitated and restored. Incorporating successful bird conservation depends on a thorough understanding of species' habitat requirements and how their habitats are sustained. This entails comprehension along an escalating scale, from the territory of a single breeding pair to the local and regional landscape levels, while considering how the landscape naturally shifts over time. This type of analysis is termed "landscape ecology", and is important in understanding, maintaining, and restoring natural ecosystems. Finding a balance between maintaining ecological processes and the species that depend on them across landscapes that are used by people for economic purposes is, therefore, crucial.

Part of the solution is to establish preserves that are close to other protected areas. Cluster preserves, link them with corridors, and coordinate their management. When natural areas are restricted to relatively small, scattered areas, it is important to manage different areas in different ways across the landscape. Managers of different natural areas should coordinate their efforts, with some providing habitat for species associated with mature or other relatively undisturbed habitats, while others create early successional habitats that require frequent natural or artificial disturbances.

Across North America, most of the land is privately owned, and successful conservation will depend on the efforts of landowners in partnership with land managers and nongovernmental organizations. Fortunately, most farmers, ranchers, and other landowners are interested in preserving the natural quality of their land. Although they need to derive income from the land, this is often compatible with maintaining regional biological diversity. Partners should recognize the habitat needs of different species and the economic needs of the people who own and use most of the land to earn a living.

Combine core preserves and buffer areas. When possible, manage core preserves strictly for biological diversity. Surround core preserves with buffer areas, like ranches, where some areas of natural vegetation can be sustained. Although the buffer areas are used for cattle-grazing and other land uses, they still protect large areas of habitat. The natural landscape on ranches can be protected with conservation easements. In some cases, ranchers can derive income from hunters and, increasingly, from birders and other naturalists who visit the region. Thus, many ranchers have an economic incentive (as well as a personal commitment) to saving the natural landscapes. A conservation plan for the protection of a system of preserves would protect the largest expanses of habitat while permitting development in more fragmented habitat. The emphasis is on protecting sustainable populations of all species in the region rather than attempting to protect every relict population, regardless of its long-term prospects.

Structures

Communication Towers

Migratory bird mortality from striking television and communications towers and guy wires is a serious problem. Bird kills at tall communication towers in North America were first documented during the late 1940s, when towers were being constructed to broadcast the emerging television medium. Although bird kills at lighthouses had been noted for centuries, it is unlikely that anyone anticipated the staggering number of songbirds that would be killed at tall communication towers which were lighted at night for aviation safety. A decline in the number of towerkill studies and attention to the issue occurred during the 1980s and 1990s. Indeed, there are only a few studies on the continent that have been on-going for more than 20 years, and there are only a handful of studies which have attempted to understand the mechanism of the towerkills. All studies indicate that sizable kills occur on a regular basis, with occurrences depending on specific weather conditions. Consequently, all show a considerable range of numbers killed from year to year; thousands may be killed in one season while only a few dozen the next. Hundreds of short-term studies have been conducted consisting of data gathered from just a single night or over several years. Due to weather variables these studies are less reliable for gauging continental mortality, although they do confirm that kills regularly occur over a wide area of North America.

The American Bird Conservancy reports that 230 species of birds have been documented as being killed at towers; this is over one quarter of all avian species found in the U.S. Night-migrating songbirds are most prone to collide with tall structures, especially warblers, vireos, thrushes, and young birds migrating in the fall for the first time. When cloudy, birds may be attracted to tower lights as an escape response. They fly toward the brightest part of the night sky, which would represent the moon under natural conditions, to get above the fog or low clouds and out of any potential problems. Unfortunately, they swarm and circle around the tower instead, crashing into each other, the guy wires, and the tower itself. Up to 10,000 birds have been killed this way on a single night.

Two aspects of tower lighting that can attract birds are the color (white, ultraviolet, or specific wavelengths) and duration (strobe, flashing, or steady). White lights seem less attractive to birds than red lights, and strobe lights are less attractive than flashing or steady lights. Also, long wavelengths of light in the red and orange part of the spectrum can disorient migratory birds by interfering with their innate magnetic compass.

There are approximately 45,000 towers tall enough to warrant warning lights nationwide, killing an estimated 4 to 5 million songbirds each year. The Federal

Aviation Administration (FAA) estimates that from the mid-1970s through the early 1990s, new tower construction (200 feet tall or higher) had been proceeding at a rate of about 1,000 per year. At least 5,000 towers measuring 200 feet or higher were planned for 2000. This number is estimated to grow at a rate of 6 to 8% a year, adding quickly to the 45,000 tall towers and over 75,000 total towers that already exist. The problem is not just the impact on the species involved, but on the ecological processes these birds are involved in - insect control, pollination, seed dispersal, etc. - that are likely being affected by declines in bird numbers.

It is widely agreed that the taller a communication tower is, the more deadly it is for night-migrating songbirds, but much seems to rely on the tower's location. Evidence suggests that a relatively short tower constructed on a hilltop may have the same impact as higher towers on flat ground. There are no long-term studies at communications towers below 500 feet high.

The data used to chart towers were derived from the FAA's Digital Obstacle File. This information lists locations and heights of communication towers and tower farms that affect aviation safety; typically when a tower stands 200 feet above average ground level. As of 2 November 1998, Wyoming's tower status includes 80 towers from 200 to 299 feet tall, 40 towers between 300 and 499 feet, three towers from 500 to 799 feet, and no towers currently over 800 feet tall; this data is outdated, however, as many new towers have been constructed over the past three years.

On 14 September 2000, the U.S. Fish and Wildlife Service developed "Interim Guidelines for Recommendations on Communications Tower Siting, Construction, Operation, and Decommissioning" to help with this problem. These guidelines are listed below.

1) Any company/applicant/licensee proposing to construct a new communications tower should be strongly encouraged to co-locate the communications equipment on an existing communication tower or other structure (e.g. billboard, water tower, or building mount). Depending on tower load factors, from 6 to 10 providers may co-locate on an existing tower.

2) If co-location is not feasible and a new tower or towers are to be constructed, communications service providers should be strongly encouraged to construct towers no more than 199 feet above ground level (AGL), using construction techniques which do not require guy wires (e.g. use a lattice structure, monopole, etc.). Such towers should be unlighted if Federal Aviation Administration (FAA) regulations permit.

3) If constructing multiple towers, providers should consider the cumulative impacts of all of those towers to migratory birds and threatened and endangered species as well as the impacts of each individual tower.

4) If at all possible, new towers should be sited within existing "antenna farms" (clusters of towers). Towers should not be sited in or near wetlands, other known bird concentration areas (e.g. state or Federal refuges, staging areas, rookeries), in known migratory or daily movement flyways, or in habitat of threatened or endangered species. Towers should not be sited in areas with a high incidence of fog, mist, and low ceilings.

5) If taller (>199 feet AGL) towers requiring lights for aviation safety must be constructed, the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA should be used. Unless otherwise required by the FAA, only white (preferable) or red strobe lights should be used at night, and these should be the minimum number, minimum intensity, and minimum number of flashes per minute (longest duration between flashes) allowable by the FAA. The use of solid red or pulsating red warning lights at night should be avoided. Current research indicates that solid or pulsating (beacon) red lights attract night-migrating birds at a much higher rate than white strobe lights. Red strobe lights have not yet been studied.

6) Tower designs using guy wires for support that are proposed to be located in known raptor or waterbird concentration areas or daily movement routes, or in major diurnal migratory bird movement routes or stopover sites, should have daytime visual markers on the wires to prevent collisions by these diurnally moving species. (For guidance on markers, see Avian Power Line Interaction Committee (APLIC). 1994. Mitigating Bird Collisions with Power Lines: The State of the Art in 1994. Edison Electric Institute, Washington, D.C. 78pp; and Avian Power Line Interaction Committee (APLIC). 1996. Suggested Practices for Raptor Protection on Power Lines. Edison Electric Institute/Raptor Research Foundation, Washington, D.C. 128pp. Copies can be obtained at www.eei.org/resources/pubcat/enviro/ or by calling 1-800-334-5453.)

7) Towers and appendant facilities should be sited, designed, and constructed so as to avoid or minimize habitat loss within and adjacent to the tower "footprint". However, a larger tower footprint is preferable to the use of guy wires in construction. Road access and fencing should be minimized to reduce or prevent habitat fragmentation and disturbance, and to reduce above ground obstacles to birds in flight.

8) If significant numbers of breeding, feeding, or roosting birds are known to habitually use the proposed tower construction area, relocation to an alternate site should be recommended. If this is not an option, seasonal restrictions on construction may be advisable in order to avoid disturbance during periods of high bird activity.

9) In order to reduce the number of towers needed in the future, providers should be encouraged to design new towers structurally and electrically to accommodate the applicant/licensee's antennas and comparable antennas for at least two additional users (minimum of three users for each tower structure), unless this design would require the addition of lights or guy wires to an otherwise unlighted and/or unguyed tower.

10) Security lighting for on-ground facilities and equipment should be down-shielded to keep light within the boundaries of the site.

11) If a tower is constructed or proposed for construction, Service personnel or researchers from the Communication Tower Working Group should be allowed access to the site to evaluate bird use, conduct dead-bird searches, to place net catchments below the towers but above the ground, and to place radar, Global Positioning System, infrared, thermal imagery, and acoustical monitoring equipment as necessary to assess and verify bird movements and to gain information on the impacts of various tower sizes, configurations, and lighting systems.

12) Towers no longer in use or determined to be obsolete should be removed within 12 months of cessation of use.

For more information on this issue, refer to the following web sites and related links:

- ABC's "Communication Towers: A Deadly Hazard to Birds" www.abcbirds.org
- Baldwin, Maine Activists www.clickandgo.com/towerstop
- Fatal Light Awareness Program, Toronto www.flap.org
- NPR's "Of Birds and Towers" www.loe.org/html/headlines/birds.html
- Towerkill information www.towerkill.com
- Towerkill links www.towerkill.com/links.html

PUBLIC AWARENESS, OUTREACH, AND EDUCATION

Resources

Awareness, outreach, and education are key components of successful conservation programs. Listed below is a very small sample of the many resources available for learning more about Partners In Flight, Neotropical migratory birds, conservation issues, and ways you can help wildlife. Visit local offices of the Wyoming Game and Fish Department, Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service, Conservation District, or Extension services, or visit your local Audubon chapter for more information.

Publications

- Wyoming Game and Fish Department Stewardship Packet for Birds in Wyoming (contact: Andrea Cerovski, WGFD, 260 Buena Vista, Lander, WY 82520)
- International Migratory Bird Day Organizer's Packet (contact: Partners In Flight, www.PartnersInFlight.org)
- International Migratory Bird Day Educator's Packet (contact: Partners In Flight, www.PartnersInFlight.org)

Educational Tools

- Songbird Blues Boxes (all regional WGFD offices and Cheyenne headquarters, and the USFWS in Cheyenne have these trunks to lend, free of charge)
- Sod Box (contact: Tim Byer, USFS, 2250 East Richards Street, Douglas, WY 82633)
- Tree Trunks (contact your local U.S. Forest Service office for availability)

Web Sites

- PIF home page: www.PartnersInFlight.org
- WY-PIF home page: www.sdvc.uwyo.edu/pif

Education Centers

- Audubon Center at Garden Creek (contact: Vicki Spencer, Audubon Wyoming Executive Director, 101 Garden Creek Road, Casper, WY 82604)
- Teton Science School (contact: Teton Science School Director, P.O. Box 68, Kelly, WY 83011)
- The Nature Conservancy (contact: Dave Neary, TNC Director, 258 Main Street, Lander, WY 82520)
- Wyoming Game and Fish Department Whiskey Mountain Conservation Camps (contact: WGFD Education Coordinator, 5400 Bishop Blvd., Cheyenne, WY 82006)

BIRD CONSERVATION PLAN IMPLEMENTATION

Implementation of the Wyoming Bird Conservation Plan will require a broad range of partnerships, an extensive amount of cooperation, and sizeable financial resources. Participation will be necessary from federal and state natural resources agencies, agricultural organizations, private conservation organizations, academia, and private landowners. The biological objectives and recommendations presented here will benefit on-the-ground bird conservation through increased public awareness, education, commitment, and political support.

The step-wise process for implementing the Wyoming Bird Conservation Plan, Version 1.0 is to distribute this document to land managers and natural resources personnel in federal and state agencies and conservation and agricultural organizations, to landowners in the private sector, to those in academia, and to any other interested parties. The Plan will also be converted to a working web-based document, which will help ensure that it will continue to evolve and contain the latest available science, species natural history information, biological objectives and recommendations, species monitoring data, and additional habitat types and bird species. Finally, the Plan will continue to evolve as Partners In Flight, and WY-PIF, transitions from physiographic areas and plans to bird conservation regions that cross state boundaries, agency politics, and traditional political territories. When this transition occurs, bird conservation is likely to realize even greater effectiveness and public awareness.

The Wyoming Bird Conservation Plan, Version 1.0 can and should be applied to other conservation planning efforts taking place in Wyoming and regionally. Information presented in this Plan should be integrated into existing habitat restoration programs and used in the development of site-specific conservation plans such as state and private Habitat Conservation Plans, agency and interagency Management Plans, and local land-use planning strategies.

Federal, state, and private sources of funding, tax incentives, technical support, and other forms of assistance are available to landowners wishing to establish or improve wildlife habitat. Brief descriptions of these programs are presented below.

Federal Funding Programs

There are numerous voluntary programs available under the 1996 Farm Bill that provide financial and technical assistance to landowners for habitat improvement. The U.S. Department of Agriculture (USDA) administers these programs through the Farm Services Agency (FSA), and they are implemented by the Natural Resources Conservation Service (NRCS).

Conservation Reserve Program (CRP)

This program provides technical assistance, cost-share, and rental payments to create and maintain habitat. It is available to producers whose land has been in production for two of the most recent five crop years and is capable of commodity production. Contract agreements range from 10 to 30 years. The goals of this program are to prevent soil erosion, improve water quality, and enhance wildlife habitat through planting grass, trees, and other long-term cover.

Wetland Reserve Program (WRP)

This program offers technical support and cost-share to producers who are interested in retiring agricultural land. The purpose of this program is to enhance, restore, protect, and expand wetland areas. Qualifying acres have to be composed of hydric soils; however, 50% of the total sign-up can be non-hydric upland soils. There are three options for enrolling in WRP: 1) the restoration component includes a one-time 75% cost-share for wetland acres only with no rental payments, 2) the 30 year easement provides a one-time payment of 75% for the land's appraised market value plus a 75% cost-share for restoration, and 3) the permanent easement offers a one-time payment of 100% cost-share for restoration and maintenance. However, sign-up for this later component is very competitive.

Wildlife Habitat Incentive Program (WHIP)

This program provides technical assistance and pays up to 75% of the cost for wildlife habitat development. Cost-share agreements are for a minimum of 10 years. The program objectives are to connect upper and lower watershed habitats, enhance native plant communities, increase biodiversity, and improve habitat for threatened and endangered species.

Conservation Reserve Enhancement Program (CREP)

This program offers financial incentives and technical support. Enrollment is based on the CRP model. Land must be owned or leased for at least a year and must be capable of being cropped. This program focuses on long-term, voluntary protection of

environmentally sensitive cropland through filter strips, forested riparian areas, establishment or restoration of wetlands, and ground cover for threatened wildlife species.

Environmental Quality Incentive Program (EQIP)

This program offers technical support, cost-share payments, and incentive payments to producers. Contracts are for five to ten years and are based on a conservation plan to improve environmental quality.

Conservation of Private Grazing Land

The grazing lands provision of the 1996 Farm Bill authorizes $60 million per year to ensure that technical, educational, and related assistance is provided to landowners on the nation's 642 million acres of private grazing lands.

Farmland Protection Program

This is a program under which the Secretary of the Interior will join with state or local governments to purchase conservation easements. Based on voluntary participation, it only applies to land that farmers want to preserve in agriculture.

State Funding Programs

Grant programs are available from the Wyoming Game and Fish Department. A total of $7,500 is available for water development projects and $10,000 for riparian and wetland projects; these also include terrestrial development. Larger grants are available from the Wyoming Game and Fish Department's Trust Fund.

Private Funding Programs

A number of private programs for conserving, restoring, and enhancing habitat on private lands are also available. Two of these programs are presented below.

Conservation Easements

These are voluntary, legal agreements between property owners and a land trust to protect significant property features. Terms of the agreement are registered on the title and apply to the donor and all future owners. Conservation easements can be made for the protection of wildlife habitat, open spaces, or agricultural lands. This "donation" creates a charitable income tax deduction on the landowner's federal and state tax returns.

Conservation Research and Education

The National Natural Resources Conservation Foundation is a charitable, not-for-profit corporation that funds research and educational activities relating to conservation on private lands. This foundation will offer grants for research, education, and demonstration projects. Grants will also assist conservation districts in building resources to carry out local conservation programs.

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APPENDICES

Appendix I - The Partners In Flight Bird Conservation Strategy, or *The Flight Plan*.

The Flight Plan

THE *PARTNERS IN FLIGHT* BIRD CONSERVATION STRATEGY

An abundance of wild birds contributes to ecosystem health and provides economic, recreational, scientific, and aesthetic values for society. Fostering cooperative, voluntary, and coordinated habitat management on private and public lands that will lead to the conservation of avian diversity throughout the Western Hemisphere is the subject of the *Partners In Flight* Bird Conservation Strategy, or simply, "The Flight Plan".

Partners In Flight and the Bird Conservation Strategy are common sense approaches to the conservation of birds and their habitats. This Strategy initially addresses only nongame land birds in the United States and depends upon conservation decisions and actions taken at local and state levels. However, it lays the groundwork for international cooperation on long-term conservation of all birds throughout this hemisphere.

Introduction

The *Partners In Flight* Bird Conservation Strategy summarizes the collective actions that are being taken and that are necessary for the conservation of birds. The Strategy provides the framework for Bird Conservation Plans that set conservation priorities and specific objectives for bird populations and habitat for every state and ecoregion in the country. Furthermore, the Strategy lays out the means by which these Plans can be implemented. This process involves an unprecedented level of voluntary cooperation and coordination among state and federal agencies, private organizations, industry, and the public. The power in the process lies in the synergy that builds when such diverse and committed groups work together for a common goal.

Basic Principles of The Flight Plan

- conservation when it should be done -- before species become endangered
- conservation based on sound science
- conservation that stresses both healthy ecosystems and wise management of natural resources
- local and timely conservation within the context of large-scale objectives and long-term plans
- conservation of habitats in breeding, migration, and wintering areas
- an informed constituency of people concerned about bird conservation
- groundbreaking partnerships that foster voluntary cooperation among public and private landowners

Development of Bird Conservation Plans will be a simultaneous and iterative "bottom-up" and "top-down" process in which actions are decided upon and taken at grassroots and local levels in the context of priorities set at larger geographic scales. Coverage will be geographically comprehensive, with plans developed for each ecoregion and state. Although variability among plans reflecting local conditions and interests will be expected and encouraged, regional and national level plans will be developed to assure comprehensive attention to priority issues.

Focused, cooperative, and voluntary habitat conservation on a landscape level is the key to bird conservation. A concentration on habitat will improve conditions for all birds, whether migratory or resident, endangered or common, game or nongame, and will contribute to the protection of other animals, plants, and communities. Success will not be possible without recognition of landowner objectives and encouragement of compatible uses of the land.

Ultimately, the Strategy can be applicable to the conservation of the over 800 species of birds in the continental United States and close to 4,000 in the Western Hemisphere. Many of these birds bind our nations together through annual migrations and their dependence on the conservation of habitats across international boundaries. As plans become more international and taxonomically comprehensive, they will build on the success of international treaties; *Partners In Flight;* the North America Waterfowl Management Plan; the Western Hemisphere Shorebird Reserve Network; and the many conservation efforts of the federal government, state wildlife agencies, private conservation organizations, and industry. Each of these programs will retain its own special identity and constituency, yet each will become more effective through greater collaboration and cooperation.

The Conservation Process

The *Partners In Flight* Bird Conservation Strategy consists of four steps that result in the development and implementation of Bird Conservation Plans.

Step I. Identify species and habitats most in need of conservation (or, "what we have")

The first step is to identify birds most in need of conservation action. Priorities are set within biologically appropriate conservation planning units, such as physiographic areas (e.g. Mississippi Alluvial Plain), watersheds, or ecoregions (e.g. shortgrass prairie). The nature of planning units will vary geographically, depending upon the distribution of birds and their habitats and locally achieved consensus decisions.

Within a planning unit, each species is prioritized according to a set of criteria including population trends, size of geographic range, and threats on the breeding and nonbreeding grounds. The values assigned to each species provide an index of conservation need. High priority species can be grouped into species suites that tend to occur together and presumably respond similarly to habitat conditions and management practices.

Step II. Establish population and habitat conservation objectives (or, "what we need")

There are two parts to this step:

- Describe the habitat conditions and management practices favorable to priority species or species suites

- Set objectives for the nature, extent, and distribution of favorable habitat conditions or populations of priority birds

In the first part, current principles of conservation biology and knowledge of the natural history of birds and the ecosystems they inhabit are used to describe conditions that will foster long-term maintenance of healthy populations. This process can result in recommendations that may include the number of birds necessary to sustain a population, the amount and configuration of habitat that a population needs, habitat characteristics that should be maintained within habitat blocks, and the temporal and spatial stability of habitat conditions.

Turning an understanding of the needs of birds into specific landscape-level conservation objectives is perhaps the most important, and often conceptually the most difficult, component of the planning process. Objectives must be set relative to a baseline understanding of the current status of bird populations and habitat conditions. The nature of objectives will vary among planning units on the basis of geography, land use history, and conservation opportunities, and may be phrased in terms of numbers of populations or habitat patches, densities of birds, or population trends. Although *Partners In Flight* attention has been largely focused on breeding terrestrial birds in the United States, these objectives must include a broader consideration of potentially important migration or wintering conservation issues. Each conservation planning unit must be evaluated as a landscape rather than as a collection of independent sites, and each unit must meet its bird conservation responsibilities within the context of regional and international needs.

Conservation objectives must be set within the context of the economic and sociological factors that influence conservation potential, particularly landowner objectives. This strategy cannot succeed without the voluntary and eager participation of private landowners. Objectives must also ultimately be integrated with other conservation issues. Birds are a necessary but not sufficient component of planning for the conservation of biological diversity.

Step III. The Bird Conservation Plans: Actions to meet objectives (or, "how to do it")

Three overlapping concepts capture the entire range of actions that have been or can be taken to enhance the conservation of birds. There have been and continue to be successes in on-the-ground application of these concepts; Bird Conservation Plans will specifically and efficiently target them for the accomplishment of defined landscape-level objectives.

1. Landscape Prescriptions and Best Management Practices -- Many birds can benefit more from the application of Prescriptions across landscapes than from activities limited to designated sites. An example could be maintenance of certain quantities of land in various successional stages across a region. The exact sites for particular conditions will vary over time. Best Management Practices can be modifications of standard management practices, developed within landowners' varied operational and economic constraints, that improve conditions for birds in small but important ways. Examples include grazing and burning programs that benefit prairie birds, timber management programs that benefit forest birds, and maintenance of woodlots for in-transit migrants.

2. Bird Conservation Areas -- These are large areas that sustain or are capable of sustaining healthy populations of birds. Bird Conservation Areas may be single land holdings specifically designated for conservation purposes (such as a Wilderness Area of a National Forest). More typically they include multiple cooperating landowners who voluntarily coordinate their management practices to provide a constant base of habitat needed by birds. The nature of bird conservation efforts in these areas must be compatible with other social and economic priorities.

3. Important Bird Areas -- Sites that are critical to rare species or large concentrations of a species should be designated and managed as Important Bird Areas. Examples include waterfowl (Laguna Atascosa National Wildlife Refuge, Texas) and shorebird (Delaware Bay) concentration areas; seabird nesting cliffs (Pribilof Islands); islands inhabited by threatened, endemic species and subspecies (Santa Cruz Island, California); endangered species areas (Kirtland's Warbler breeding habitat); and key landbird stopover sites (High Island, Texas).

Step IV. Implement Bird Conservation Plans and monitor progress (or, "do it!")

Completion of the first three steps in this Strategy will result in a Bird Conservation Plan. Implementation is the final and most challenging step. Although the biological objectives in the Plans should be set within conservation planning units, implementation may be more effectively accomplished within politically-defined units through the efforts of state or provincial working groups. A large array of conservation tools must be included within these Plans. These include:

Partnerships -- This most obvious and fundamental factor in conservation is embodied in *Partners In Flight* Working Groups, but requires continual expansion and improvement.

Funding -- Accomplishment of these ambitious objectives will require innovative funding mechanisms, including dedicated sources of federal, state, and private funding.

Research -- Development and implementation of these Plans will stimulate new research efforts focused on key conservation questions,

including issues of natural history, population health, and accommodation of birds in managed landscapes.

Education and Outreach -- Achieving Plan objectives will require an effective and comprehensive information and education campaign directed toward policy makers, landowners, community leaders, and the general public.

Policy -- National, state, and local governments must be active and constructive partners in the conservation of birds and habitat. A policy strategy should be developed in order to encourage the effective application of existing incentives, policies, treaties, and laws and the development of new initiatives for improved governmental participation in conservation efforts.

The entire process must be "adaptive" in nature, with the flexibility for adjustments in Bird Conservation Plans and their implementation in response to observed results of actions. There will be two sources of information that may indicate that changes are necessary:

Regional, National, and International Plans -- The sum of the efforts in conservation planning unit and state Bird Conservation Plans must add up to adequate levels of protections throughout the ranges of priority bird species. Simultaneous application of this Strategy at these different geographic scales will help assure achievement of this goal.

Monitoring -- Finally, there must be a means of evaluating the results of all of these efforts through a long-term commitment to monitoring the status of bird populations. Beginning with the Breeding Bird Survey and other existing efforts, a comprehensive monitoring program is needed to measure results and influence further conservation and management actions.

Partners In Flight and the Future of Birds

Bird conservation is a complex challenge. Birds use virtually every habitat on the surface of the earth and recognize no political boundaries. A single migrating bird may pass through a dozen countries that each has its own conservation priorities and challenges. Conserving birds and their habitats is beyond the capacity of any one organization, agency, or country. But when many groups work together, and their efforts are fueled by the enthusiasm of millions of birdwatchers and wildlife supporters, tremendous synergy is possible. This Strategy and development and implementation of Bird Conservation Plans will capture this synergy and ensure the future of North America's birds.

Appendix II - Steps taken to complete the Wyoming Bird Conservation Plan.

Wyoming Bird Conservation Plan (BCP) - Step I

Wyoming Priority Landbirds and Their Conservation Status

Level I (Conservation Action) - species clearly needs conservation action (CA). This designation includes monitoring (M), and the need for additional knowledge (K) through research into basic natural history, distribution, etc. (we know so little about the species that it cannot be given another designation, although monitoring is not precluded).

Level II (Monitoring) - the action and focus for the species is monitoring (M). The stability of the species is often unknown. Or the species is peripheral (P) for breeding in the habitat, geographic area, and state.

Level III (Local Interest or Concern) - species that the group wants to recommend specifically for conservation action (CA) that are not otherwise a high priority species but are of local interest (LI). For example, a species that is widespread that wouldn't occur very high in the species prioritization database, but that may have a narrow habitat requirement, such as the Black Swift, Peregrine Falcon, Bald Eagle, etc.

Level IV (Not Considered a Priority Species) - species is known or thought to be stable (S) or increasing; no action is needed; monitoring is not precluded but is not the focus for the species. Or the species is extirpated (E) from the state and usually no action is needed, but action is not precluded (such as species reintroduction). Or the species is not found breeding in the state (X) and no action is needed; however, looking for the species is not precluded (eventually PIF-WWG will extend to consider conservation of wintering and migratory birds).

Wyoming BCP - Step II

The first part of Step II involves identifying habitat requirements of high priority species and species suites, and setting biological objectives (habitat objectives and population objectives), or "what we want". Objectives should be measurable and have a geographic frame of reference.

An effective plan will combine the "why" (i.e. specific habitat needs for priority species) with the "where" (i.e. identifying specific types of habitat blocks that species need). There are two approaches to setting habitat and population objectives and both can be used in bird conservation planning: 1) A priori - set a knowledgeable objective, whether for some area of habitat or some number of breeding pairs, and then go to the maps and field and determine if we have it; or 2) A posteriori - go to the field to

determine who has what species and habitats and where, and then piece together what we think is viable (it is imperative that studies are done to ensure that what is pieced together *is* viable for birds).

For each priority habitat type within the gross habitat groups (riparian, grassland, forest, and shrubland), a description of those habitats for high priority birds should be recorded. This entails describing the biotic and abiotic conditions where the birds of interest occur (*not* how to manage them), including dominant vegetation types, horizontal and vertical structural characteristics, foliage density, the abiotic/physical situation, the moisture regime, conditions and threats, geographic extent, importance of phases or subtypes for each, context, etc.

When working in habitat groups, consider on a landscape level the following: 1) Describe the habitat: what are the historic conditions of the landscape and what are the present conditions of the landscape; 2) List the issues: use, access, problems, and what has acted on the habitat to change it; 3) Identify the specific features needed by the highest priority species [Level I (CA) and Level II (M) species]; and 4) What we want in order to maintain habitat, what is needed for birds, what is the habitat's potential, and how do we get there.

Wyoming BCP - Step III

This step involves developing Best Management Practices (BMPs) for each habitat group, identifying state Bird Conservation Areas (large areas that do or can sustain healthy populations of birds), and nominating Important Bird Areas (sites that are critical to rare species or large concentrations of a species) within the state.

To date, WY-PIF has been the lead for developing BMPs for riparian and grassland habitats. Idaho Partners In Flight has been the lead for developing BMPs for shrub-steppe habitat for the Western Working Group states; this publication was modified to suit Wyoming and included in Version 1.0 of our Plan.

A total of 28 sites in Wyoming were identified by WY-PIF participants as potential Important Bird Areas (IBAs). If a site is not eligible for national IBA status, it may still qualify as a state IBA or a Bird Conservation Area.

Wyoming BCP - Step IV

Implement the plan: develop partnerships; identify funding sources; conduct inventory and monitoring (landowner contacts are needed for bird and habitat monitoring on private lands in the state), research, education, and outreach programs; and monitor the plan's success with on-the-ground habitat and population conservation projects.

ADDENDUM I

WYOMING PARTNERS IN FLIGHT
WYOMING BIRD CONSERVATION PLAN
VERSION 1.0

25 June 2002

Note: This addendum should be inserted at the end of Version 1.0 of the Wyoming Bird Conservation Plan.

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L.1.1.1.1.1.1.1.1 Forest Habitat Group

Aspen

1) Describe the habitat (Bartos and Campbell 1998; DeByle 1990; DeByle and Winokur 1985; Dieni and Anderson 1997a; Knight 1994; Mueggler 1988, 1989; Schullery 1995; Winternitz 1980; Yellowstone National Park 1997):

a) Historic conditions: Prior to the influence of European American settlers, aspen was probably much more widely distributed than it is now. Aspen thrives on ecological perturbations, and historically was probably regenerated by natural fires caused by either lightning or Native Americans. Blowdowns, landslides, flooding, and even natural pathogens also perpetuated aspen communities, but fire was probably of paramount importance. Aspen reproduces vigorously by root suckers following a disturbance. It may occur as a climax species, or as a successional cover type which can become dominated by conifers over time. Thus, many of today's mixed stands that include decadent aspen and conifers in the overstory were at one point dominated by aspen. In addition, changes in the grazing pressure of wild and domestic ungulates since European settlement have altered the composition of the aspen community, both in the understory and in the aspen itself.

b) Present conditions: About 467,000 acres of aspen is found throughout Wyoming's major mountain ranges. The greatest concentrations of aspen stands are found on the Sierra Madre, Wyoming and associated ranges, Wind River Range, and the Gros Ventre Range. Sizable stands are also found in the Medicine Bow and Laramie Mountains of southeastern Wyoming. Relatively little contiguous aspen occurs in the Black Hills and Bear Lodge Mountains, Bighorn Mountains, Absaroka Range, Teton Range, or the Yellowstone Plateau. It is estimated that over half of the historic aspen acreage within Wyoming has converted to other community types through fire suppression and natural succession, or has been lost to urban expansion.

Aspen grows in a wide variety of environmental conditions from the foothills to the subalpine zone. It typically occurs in depressions, ravines, and valley bottoms, or on the lee sides of ridges, where snow accumulates, and where more moist and well developed soils occur. Required site conditions include long growing seasons, deep snows, and annual precipitation exceeding 16 to 20 inches (40 to 50 cm). Considerably less aspen is found in Wyoming than in other parts of the West, such as Utah, but it usually occurs as conspicuous, small, scattered groves that are a highly valued part of the landscape. In Wyoming, aspen is usually a seral constituent of Englemann spruce-subalpine fir, Douglas-fir, blue spruce, lodgepole pine, and ponderosa pine forests. At lower elevations, it is often found as stringers along riparian corridors, or in small mesic (moist) islands surrounded by drier pine uplands. At higher elevations, it functions primarily as a seral dominant species within the lodgepole pine-spruce-fir community. At intermediate elevations and on deep soils, aspen can occur as pure stands of successionally stable woodlands dispersed within a matrix of coniferous forest types.

A characteristic element among aspen communities is the luxuriant undergrowth that it supports compared to that in adjacent coniferous forests. This undergrowth frequently consists of three layers: tall shrubs, medium shrubs/tall herbs, and low herbs. Forbs generally dominate the herb component but, occasionally, grasses and sedges are equally abundant. However, changes in the grazing pressure of wild and domestic ungulates since European settlement have altered the nature and structure of the shrub/herbaceous component. Human influences have likely altered the understory community composition and associated use by avian species.

About 88 species of birds potentially use aspen habitats in Wyoming. Breeding bird densities and diversity in aspen are higher than in other montane vegetations. Because of the ecological amplitude of aspen, overstory and understory vegetation composition varies widely across its range, resulting in equally diverse breeding bird assemblages. Bird communities within aspen stands are often composites of aspen-associated species along with many species found in the surrounding habitats. It appears that breeding bird density in aspen is related to surface water and ground moisture levels, large and numerous insects in the aspen understory, edge effect, and nest cavity availability. Perhaps the most important contribution of aspen woodlands to avian nesting habitat is as a substrate for primary and secondary cavity nesters. Aspen trees have soft wood, and are prone to infection from decay fungi, such as the heart rot fungus, which makes them attractive to cavity excavators. In many instances, aspen forests provide the only available nesting habitat for some ground and shrub nesting species.

Most aspen regeneration occurs as root-suckering; establishment from seed is rare. Therefore, aspen stands consist of a mosaic of clones, within which individual trees are genetically identical and have strong structural uniformity. Despite uniformity within clones, multi-clone stands often exhibit wide structural variation due to genetic and site differences among adjacent clones. Clone size averages 0.5 acre (0.2 ha) across the species range. Most aspen stands have well-defined overstory layers of relatively uniform height produced by the rapid regeneration of suckers following stand-replacement events. The majority of stems are produced during the first 4 to 6 years after disturbance; thus, stands with an equal representation of multiple age and size classes are rare. Multiple age classes develop when older stands begin to disintegrate or when disease or insects open up the canopy and apical dominance declines, releasing understory suckers.

Following severe disturbance, such as stand-replacement fires or clear-cutting, aspen usually dominates sites for many decades. On some sites, conversion back to a conifer-dominated stand occurs very quickly (<100 years), while on other sites, conversion may take many aspen generations and extend 300 to 400 years. The rate of stand conversion is determined by disturbance factors, proximity to conifer seed sources, and rate of conifer seedling growth into the stand canopy. Modern fire suppression practices and drought conditions have contributed to the loss of seral aspen stands and the decline of aspen regeneration throughout the mountain West. Remaining stands are often decadent and approaching their maximum age.

As aspen sprouts become less common through succession and fire suppression, livestock and big game in need of browse concentrate on those that remain, which can lead to their further deterioration. Heavy utilization can prevent aspen sprouts from growing into adult height after a fire, as can heavy utilization in combination with a lack of fire. Grazing by cattle and sheep has been the primary consumptive use of the aspen forest type in Wyoming. Heavy browsing by livestock, particularly sheep, can adversely impact aspen growth and regeneration. Most livestock use aspen, browsing the leaves and twigs, but it is estimated that sheep consume about four times more aspen sprouts than cattle. In addition, wild ungulates graze the abundant and succulent forage under aspen, often selecting this forage source over several others available in the vicinity. Both deer and moose can impact aspen regeneration, but elk are usually the most damaging because elk typically winter in or near mid-elevational zones where aspen forests principally grow. Elk herds, particularly in western Wyoming, have dramatically impacted the ability of aspen stands to regenerate, even after extensive treatments. However, there is some controversy over whether today's heavy elk utilization is or is not representative of presettlement conditions.

2) Identify the issues:

a) Use: Aspen-dominated woodlands provide food, cover, and breeding sites for many wildlife species; produce forage for domestic livestock; produce wood fiber; provide fire protection by acting as living firebreaks for the more flammable conifers; provide watershed protection; provide high yields of water; and are valued for recreation and scenic beauty.

b) Access: Most aspen habitat is on National Forest land and is highly accessible to the public. The density of roads from logging and recreation has increased, allowing more access by vehicles.

c) Problems: Because of the decrease in severe fires resulting from modern forest fire prevention and suppression practices, natural succession is replacing aspen with conifers. Human development has brought a loss of habitat diversity, an increase in predators that are attracted to human habitation (e.g. raccoons, skunks, and red foxes), domestic dogs and cats, invasive plant species, and exotic wildlife like European Starlings and House Sparrows. Other problems include heavy grazing and trampling by wild and domestic ungulates; clearing for agriculture; heavy, high-intensity recreation; and climatic change, through lower moisture levels (which allow succession from aspen to sagebrush) and temperature extremes.

d) What has been the cause of change to the habitat: Fire suppression and over-grazing are the primary causes of change. Climate change to a more arid state, increased recreation, and the issues of human development have contributed to stress on aspen habitat.

3) Best Management Practices:

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

General

1) Regulate ungulate grazing levels. Ungulates can cause injuries to overstory trees by stripping the bark and increasing their susceptibility to disease (Dieni and Anderson 1997b); heavy barking may indicate overutilization in the stand. Ungulates may also affect establishment of seedlings and stand development.

2) Control noxious weeds to retain understory integrity.

3) Monitor understory conditions to ensure that grazing does not cause lower value species, such as mule's ear and tar weed, to become dominant. Species such as these lower the soil stability, value for wildlife, and the regeneration ability of the aspen stand.

Regeneration

In the prolonged absence of stand-altering disturbance, shade-tolerant conifers eventually begin to dominate aspen, and the shade-intolerant aspen becomes decadent and fails to produce suckers. At this point, it becomes necessary to regenerate the aspen stand artificially to prevent it from dying completely. Intuitively it may seem that the best way to rejuvenate the aspen stand would be to selectively remove the conifers. However, the parent stems in an aspen clone produce a hormone called auxin, which inhibits the production of suckers along its root system. Therefore, it is necessary to kill most of the parent stems in the clone in order to halt apical dominance and maximize suckering (Schier et al. 1985).

The other primary successional pathway occurs when there is no conifer seed source in the aspen stand. In these cases, the aspen grow to maturity and beyond, and eventually begin to die. At this point, the root system will respond to the death of the overstory with new sprouting, or an existing sapling understory will be released to continue the clone. In some cases, the root system may be incapable of sufficient suckering to overcome biotic factors that kill new suckers, such as overbrowsing, and the clone will die (Shepperd 1990). Decadent stands are also more susceptible to diseases that can kill the entire tree, including the root system (Knight 1994). If sucker reproduction is inadequate, small, and obviously not developing into saplings as openings occur, then management action is required. If browsing by livestock or big game is responsible for the lack of reproduction, then protection from this impact for several years should permit adequate sucker-to-sapling development (DeByle 1990). Some stable or climax aspen habitat types have been identified throughout Wyoming. Stands possessing uneven-aged overstories, indicative of aspen recruitment, and minimal conifer development should be managed as stable aspen communities (Dieni and Anderson 1997a).

Animals that depend upon the forage or cover produced in young aspen communities benefit from some treatment for regeneration. Other species—cavity-nesting birds, for example—do well in old, sometimes decadent, aspen stands. For these, treatment may not be necessary for habitat management if the aspen on the site is stable or climax. "Clear-cutting may improve some aspen subtypes by creating a mosaic of different structural stages, which will be differentially attractive across a suite of avian species. However, clear-cutting may degrade other aspen subtypes by removing or diminishing key habitat components required by obligate or near-obligate aspen-nesting birds" (Dobkin 1992). The key is to strike a balance. To provide a diversity of habitats and wildlife species, treatments are usually needed to maintain a mosaic of plant communities and age classes within aspen communities (DeByle 1985). Regardless of the short-term effects, the regeneration of aspen through treatments such as clearcutting and burning will, in the long run, benefit aspen-associated birds by ensuring clone perpetuation (Dieni and Anderson 1997b).

Bartos and Campbell (1998) developed a list of risk factors for evaluating aspen communities. Managers should use these factors for identification and prioritization of aspen stands prior to treatment. The five risk factors are:

1) Conifer cover (including understory conifers) >25%
2) Aspen canopy cover <40%

3) Dominant aspen trees >100 years of age
4) Aspen regeneration <500 stems/acre [5 to 15 feet (1.5 to 4.5 m) tall]
5) Sagebrush cover >10%

Any one of these risk factors places the aspen community in a high priority for treatment.

Prescribed burning and clearcutting are the two main management alternatives for halting succession to conifers and regenerating the aspen forest. Burning is a popular method, in part, because large areas can be effectively and inexpensively treated. However, although the tree itself is very sensitive to fire and is easily killed when exposed, aspen forests do not readily burn, requiring suitable fuel and flammability conditions which are generally available only during late summer and fall. Grazing of fine fuels pre-treatment can reduce fire behavior potential by 80 to 90% compared to ungrazed conditions. Burning works best in stands with coniferous or shrub understory fuels to carry the fire. When optimal conditions are present, suckering responses can be impressive, depending on the pre-treatment stand condition and the severity of the burn (Dieni and Anderson 1997a). Prescribed burning may be a better option than clearcutting, or can be used in combination with clearcutting, on sites where the soil has deteriorated and become more acidic and lower in nutrients, because burning increases soil pH and adds organic carbon and nutrients to the soil, which maximizes suckering (Howard 1996).

Clearcutting is an effective tool for regenerating aspen, and, unlike burning, has the advantage that the number of overstory trees immediately killed can be controlled, thus ensuring sufficient regeneration for stand replacement. Clearcutting greatly stimulates suckering, and the number of suckers that appear is directly proportional to the number of stems removed (Smith and Rogers 1990). Partial cuttings can seriously inhibit sprouting because apical dominance is retained in standing stems, and shade from standing stems reduces vigor of the few suckers that do appear (Howard 1996). However, when the goal is to retain some overstory trees for the benefit of wildlife, partial cutting or thinning may be feasible if enough trees are removed and overstory shade is not an impediment to initial sucker growth (Dieni and Anderson 1997a). Schier et al. (1985) reviewed other mechanical treatments used to regenerate aspen including bark-girdling, which is not particularly effective, and aerial herbicide spraying, which is effective but also kills other woody and broadleaf herbaceous plants and may have adverse effects on the insect and wildlife populations. Bulldozing appears to be a viable regeneration technique for smaller areas near roads, and may be more cost-effective than clearcutting, as a bulldozer is able to down stems about five times as fast as a six-person saw crew.

A successfully regenerated aspen stand should have several thousand stems per hectare at least 6.5 feet (2 m) tall at the end of the fifth growing season after treatment (Shepperd 1996). The following recommendations for the enhancement of aspen regeneration will benefit birds and other wildlife.

1) Maintain a diversity of structural changes across the landscape. Stands that include many age and size classes of aspen are richest in birds (Winternitz 1980), and various mixes of aspen and conifers appear to be most beneficial to the largest number of wildlife species (Scott and Crouch 1988).

2) Restore the natural fire process. A moderate intensity fire that kills most or all of the overstory will stimulate adequate suckering and have the least effect on subsequent sucker growth. If fire occurs at infrequent intervals (e.g. 50 years) and is moderately intense enough to kill most or all of the aspen and competing conifers, most aspen sites will retain viable stands of aspen. More frequent fires may adversely affect site quality for aspen (Jones and DeByle 1985).

3) Rest the aspen stand from grazing prior to prescribed burning to allow fine fuels to accumulate (Dieni and Anderson 1997a).

4) Clearcut between mid summer and late fall to avoid destroying songbird nests. Soil compaction and erosion hazards are greatest if logging is done with heavy equipment when soils are saturated in the spring. Logging in the spring is also most damaging to aspen roots, which can reduce suckering, and, because root carbohydrate reserves are lowest in spring, harvesting at this time can further reduce sprouting (Jones and Shepperd 1985).

5) Retain snags, some older trees, and/or some trees with heartrot. Prevent indiscriminate removal of standing aspen snags by firewood cutters. Withhold portions of the aspen forest from cutting until it is overmature to preserve natural cavity-nesting habitat.

6) Scattered aspen that are left for perching sites or for cavity nesters in clearcuts should be dead or killed so that they do not assert apical dominance over the developing aspen suckers. Small, irregularly shaped clearcuts, or clearcuts with islands of mature or overmature leave trees, are better than leaving scattered live parent stems within a clone.

7) Reduce overbrowsing of suckers and overstory plants by domestic and wild ungulates. Make clearcuts and prescribed burn mosaics large enough to overwhelm the resident browsers [at least 500 to 1000 acres (200 to 400 ha)] (Bartos and Campbell 1998), kill all or most parent stems in a clone to maximize suckering, and fence vulnerable areas to exclude ungulates. Where the treatment area is not burned, cut trees and slash may be left on the ground as a natural barrier to ungulates. Because of the expense of fencing, elk herd control by hunting may be the only answer if aspen is to be retained on heavily used ranges. Careful grazing management is necessary for at least 3 to 5 years after treatment to allow suckers to outgrow the reach of livestock. In many cases, rest rotation grazing, good herders, and proper placement of salt blocks and water can sufficiently control livestock use (DeByle 1990).

8) Avoid damaging the lateral root system of the parent clone or compacting the soil. Minimize skid trails and landings. During bulldozing operations, always keep the dozer blade clear of the ground. Gouging the blade into the soil surface, or disturbing or compacting the lateral roots may result in regeneration failure (Shepperd 1996).

9) Pile or remove slash after clearcutting or bulldozing heavily stocked stands, since large concentrations of slash on the ground can inhibit sprouting (Shepperd 1990).

4) Highest priority bird species and their habitat requirements (note: see Tables 6-9 for a description of status information for each species)**:**

Northern Goshawk (*Accipiter gentilis*), Level I, CA, M, Score = 19, AI = 4, PT = 3, would appear here based on priority, but this species was already addressed in the Mid Elevation Conifer habitat section.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Red-naped Sapsucker (RNSA) *Sphyrapicus nuchalis* Level II M Score = 20 AI = 3 PT = 2	~Occurs primarily in aspen forests or in coniferous forests where aspen is present ~Prefers aspen for nesting	~Mid to late seral stage ~Strongly associated with mature aspen ~Nest tree dbh ≥9 inches ~Nests 3-35 feet above ground	~Elevation 5000–9000 feet	~Territory size 5-12 acres ~Fire can be beneficial ~Late succession	~Excavates cavities for nesting in dead or live trees with heartrot ~Nest tree fidelity; excavates new nest each year, but often in same tree for several years ~Keystone species: creates nest cavities and sap wells that are used by other birds, mammals, and insects ~Winters south to Central America

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Dusky Flycatcher (DUFL) *Empidonax oberholseri* Level II M Score = 19 AI = 3 PT = 2	~Ponderosa pine-savannah, aspen, mountain foothills shrub, riparian shrub	~Open canopy ~Nests 2-15 feet above ground in low trees or shrubs ~High percentage cover of ground vegetation		~Presence of water not a nest site requirement ~Early succession ~Favors brushy, cutover slopes	~Feeds exclusively on insects ~Rare cowbird host ~Winters south to southern Mexico

5) Biological objectives and recommendations:

M Northern Goshawk

N The Northern Goshawk is also a priority species in Mid Elevation Conifer habitat, and was addressed in that section.

O Red-naped Sapsucker

Found in the mountainous areas of Wyoming where coniferous forests and stands of aspen dominate. Inhabits mixed conifer forests with aspen and montane riparian woodland, but is most strongly associated with mature aspen (especially riparian) woodland. Excavates a cavity nest in a snag or a living tree with a dead or rotten interior; shows a strong preference for aspen. Nests 3 to 35 feet above ground in a tree of ≥9 inches dbh. Shows strong fidelity to nest tree, but chisels a new hole each year. Eggs [4 to 5, 1 inch (24 mm)] are white. Feeds primarily on insects (particularly ants), captured by bark gleaning and by drilling into trees; also consumes sap and pitch, occasionally fruit, acorns, and berries. Relies heavily on sap from conifers as a food source upon arrival in spring; uses sap of aspen and birch only after buds open on the trees. Also sallies from perch to hawk insects in a flycatcher-like fashion. Winters south to Central America. May be declining due to loss of snags and live aspen with dead heartwood for nesting habitat. Sustaining populations requires maintaining, enhancing, and restoring snags, riparian woodlands, and stands of aspen adjacent to coniferous forest. Although decadent aspen may be beneficial in the short term, lack of regeneration will adversely affect the species in the long term. Will use forest edges and logged forests but extensive clear-cuts or the removal of snags and preferred tree species would be detrimental. Also will use burns, partially-cut forest and small clear-cuts where snags and live hardwood trees remain and adjacent forest is available for foraging. Other species that may benefit from habitat management for this species include the Downy Woodpecker, Hairy Woodpecker, Williamson's Sapsucker, Tree Swallow, Mountain Bluebird, Black-capped Chickadee, Mountain Chickadee, Western Wood-Pewee, Warbling Vireo, House Wren, and American Kestrel.

P Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Red-naped Sapsuckers have been detected on 32 BBS routes in Wyoming, including 22 on which they were observed a minimum of 3 years.

a) Maintain Red-naped Sapsuckers on the 32 BBS routes on which they were observed (Figure 29).

b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all the years the route was run (as established in 1999 in Table 40).

[Insert figure here]

Figure 29. Bold lines indicate Breeding Bird Survey routes on which Red-naped Sapsuckers have been observed from 1968 through 1998.

Table 40. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Red-naped Sapsuckers were observed from 1968 through 1998.

[Insert table here]

Q Habitat Objectives

1) Survey for nesting trees before habitat manipulation. Identify and maintain existing nest stands.

2) Reintroduce disturbance into forest stands to provide nesting/foraging habitat through long-term management for aspen regeneration and stands of mature aspen.

3) Maintain an average snag density of 150 snags ≥10 inches (25 cm) dbh per 100 acres (40 ha) in areas where Red-naped Sapsuckers occur (Paige 1999).

4) All understory and adjacent communities, especially riparian, should be managed to maintain diversity and variety.

R Recommendations

1) In areas where Red-naped Sapsuckers occur, implement aspen Best Management Practices that manage for diverse age classes at the landscape scale, with adequate representation of mature stands and old growth.

2) Maintain disturbance regimes, natural and mechanical, and the dynamic nature of aspen communities on a landscape scale. Where natural disturbance mechanisms cannot be reintroduced, mechanical disturbance events should mimic, as closely as possible, the disturbance history of the local area and surrounding habitats.

3) Implement aspen Best Management Practices that emphasize maintaining snags suitable for Red-naped Sapsuckers in aspen habitat.

4) Implement woodland practices that encourage oak survival where it occurs to enhance feeding and nesting for Red-naped Sapsuckers.

5) Retain downed logs and woody debris as sources of insect food for Red-naped Sapsuckers.

S Dusky Flycatcher

Scattered across most of Wyoming in a wide range of open woodland and shrub habitats, including ponderosa pine savannah, pine-juniper, aspen, cottonwood-riparian, woodland chaparral, and riparian shrub. Found in early successional forests that have a well-developed shrub layer and sunlight penetration; generally avoids forests with a high percentage of canopy cover. Prefers thinned coniferous forests and brushy, cutover slopes. Builds a cup nest of weed stems, grass, feathers, and hair in a crotch of juniper or sagebrush, or near the base of a thorny shrub, usually 3 to 7 feet above ground. Eggs [3 to 4, 0.7 inch (18 mm)] are white and unmarked. Is a rare cowbird host. Feeds exclusively on insects. Forages low over shrubby vegetation for flying insects. Winters south to southern Mexico. Other species that may benefit from habitat

management for this species include the Lincoln's Sparrow, MacGillivray's Warbler, Wilson's Warbler, Lazuli Bunting, Orange-crowned Warbler, Mountain Bluebird, Tree Swallow, Western Wood-Pewee, and American Kestrel.

T Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Dusky Flycatchers have been detected on 24 BBS routes in Wyoming, including 18 on which they were observed a minimum of 3 years.

a) Maintain Dusky Flycatchers on the 24 BBS routes on which they were observed (Figure 30).

b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all the years the route was run (as established in 1999 in Table 41).

[Insert figure here]

Figure 30. Bold lines indicate Breeding Bird Survey routes on which Dusky Flycatchers have been observed from 1968 through 1998.

Table 41. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Dusky Flycatchers were observed from 1968 through 1998.

[Insert table here]

U Habitat Objectives

1) Maintain open canopies in areas where Dusky Flycatchers nest.

2) Maintain plant species diversity in areas where Dusky Flycatchers nest.

V

W Recommendations

1) Manage for diverse shrub understories in open forest stands.

2) Implement aspen Best Management Practices that manage for diverse age classes and species in aspen stands.

3) Avoid or minimize insecticide use in aspen and shrubland habitats to maintain a food source for Dusky Flycatchers (and other insectivores). Postpone all insecticide use until Dusky Flycatchers and other insectivores have completed their breeding cycle.

6) Inventory, monitoring, and research needs:

W.1

W.2 Inventory and Monitoring Needs

W.2.1.1

habitat section.

W.3 Research Needs

Research needs will become more apparent once the inventory and monitoring needs have been met. Therefore, research needs will be addressed in a later version of the Wyoming Bird Conservation Plan.

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W.3.1.1.1.1.1.1.1 Shrubland Habitat Group

Juniper Woodland

1) Describe the habitat (Beidleman 2000, Ferry et al. 1995, Fitton 1989a, Gottfried and Severson 1993, Green and Conner 1989, Gruell 1999, Miller and Wigand 1994, Pavlacky 2000, Pavlacky and Anderson 2001, Tausch 1999, Tirmenstein 1986, Zlatnik 1999):

a) Historic conditions: Presettlement juniper woodlands were usually savannah-like or confined to rocky ridges and rocky low sagebrush flats where fine fuels were too low in abundance to carry a fire. Fire probably maintained both shrubs and trees at low densities and restricted the trees to rocky sites. It appears that fire burned in irregular patterns, producing a mosaic of burned and unburned landscape. Fire frequency varied from 15 to 25 years and usually killed juniper trees less than 40 to 50 years old. Native-caused fires augmented lightning fires in the more mesic (moist) communities. Competition from cool-season grasses helped to keep juniper from invading other communities by competing for soil resources during the critical time of juniper seedling establishment.

b) Present conditions: Today the pinyon-juniper woodland occupies somewhere between 43 and 100 million acres of land in the West, and is possibly as much as three times as common as it was 150 years ago. Extending over large areas of Arizona, Colorado, Nevada, New Mexico, and Utah, it could be labeled the characteristic habitat type of the Southwest. Moving north from Colorado and Utah into Wyoming, the pinyon-juniper woodland breaks up into small discontinuous patches of juniper woodland. The two major species of juniper in Wyoming are Utah juniper and Rocky Mountain juniper. In eastern Wyoming, Rocky Mountain juniper occurs in ravines or where summer precipitation is higher. Utah juniper occurs in escarpments in the more arid basins of western Wyoming. Pure juniper stands dominate in the state, with the two species forming mixed stands where their ranges overlap. Mature pinyon pine is very uncommon in the juniper woodlands of Wyoming, but seedlings and saplings are present in the understory in the extreme south. Common understory shrubs include big sagebrush, mountain mahogany, rubber rabbitbrush, and antelope bitterbrush. The elevation range of juniper in Wyoming is 4000 to 10,000 feet (1220 to 3050 m), but it generally occurs below 6000 feet (1830 m) on very dry, sandy, or rocky soils. Usually in association with mountain foothills, juniper woodlands are commonly found on moderate to steep surfaces of dipping sedimentary strata, often on rock outcrops and shallow breaks. Juniper woodland in Wyoming is configured in a naturally patchy distribution, not always a result of human-caused woodland fragmentation. It exists as a mosaic of woodland patches within a sagebrush-grassland matrix. Juniper communities today range from open savannah to closed canopies. Since juniper woodlands make up a mere 2.2% of land area in Wyoming [709,000 acres (287,000 ha)], this community is unique and has significant conservation value. Because this habitat is poorly represented in the state, several juniper specialist bird species have limited distributions in Wyoming. In addition, these woodlands mark the northernmost range for several juniper obligate bird species.

2) Identify the issues:

a) Use: Juniper woodlands are used by wildlife and livestock for cover, breeding sites, and food. Many bird species depend on juniper berries for fall and winter food. The unique, gnarled, spreading form of mature trees provides a substrate for many cavity-nesting species. Although juniper itself is not a favored foliage plant, one of the most important economic values of juniper woodlands is for livestock grazing. The wood is highly decay resistant, durable, and clean-burning, and is often harvested for fence posts, poles, and firewood. Other uses include recreation (such as hunting), off-road vehicles, oil and gas development, and cover for watershed protection.

b) Access: About 460,000 acres are in public ownership; the remaining 250,000 acres are privately owned. 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, and increased intensity of fires when they do occur; habitat fragmentation from recreational pursuits that include off-road vehicles, which can rapidly turn paths and trails into roads; oil and gas development and its associated roads and habitat fragmentation; exotic species (particularly cheatgrass, European Starlings, and House Sparrows); overuse by livestock, which can increase erosion and juniper expansion; climate change; and increased cowbird nest parasitism.

d) What has been the cause of change to the habitat: Juniper woodlands began increasing in density, crown cover, and distribution in the late 1800s because of climate changes, grazing, and lack of fire. Warm and wet climate conditions at that time were ideal for vigorous juniper growth. Fire frequency decreased because the grazing of high densities of domestic livestock greatly reduced the grasses and shrubs that provided fuel, and the relocation of Native Americans eliminated an important source of ignition. Livestock also encouraged juniper expansion by reducing competition from herbaceous forage species. Continued grazing and 50 years of fire suppression practices have allowed juniper expansion to continue. In general, expansion has occurred down slopes to lower elevations and from shallow to deeper soils. In more recent years, reductions in livestock grazing have resulted in a buildup of woody and fine fuels, and a shift from low intensity to high intensity fires. The introduction of cheatgrass has also contributed to making fires more intense and severe. Most juniper expansion in Wyoming has not been as extensive as it has been in other areas of the West, where dense, tree-dominated woodlands are perhaps as much as three times as common as they were 150 years ago. Throughout the West during the past 40 years, juniper woodlands have been burned, chained, cut, plowed, and poisoned in attempts to restore various ecosystem values (primarily forage improvement), with varying effects on the distribution and condition of the communities. As with many of today's issues relating to land use and management, considerable controversy over past and current juniper restoration projects has developed.

3) Best Management Practices:

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

Introduction

Throughout the West, juniper woodlands began increasing in density, crown cover, and distribution in the late 1800s because of climate changes, grazing, and lack of fire. Because of this widespread expansion, especially into rangelands, juniper woodlands have often been held in low esteem by land managers and owners. Removal of juniper trees through chaining or burning has often been prescribed to produce more forage for big game and livestock and to prevent expansion of juniper into adjacent habitats (Paulin et al. 1999). However, most juniper expansion in Wyoming has been on a small scale and of low intensity (Wight and Fisser 1968). In fact, juniper woodlands make up a mere 2.2% of land area in Wyoming, and can be considered a unique community with significant conservation value (Pavlacky 2000). Juniper woodlands support a rich and distinctive bird community, often outranking big sagebrush, ponderosa pine, and lodgepole pine communities in the abundance and variety of birds they support. High structural diversity; large numbers of sites for perching, singing, and nesting; high insect diversity; and plentiful berries all contribute to a large number of bird species in juniper woodlands (Belsky 1996). Large crops of juniper berries coupled with good thermal cover make these woodlands especially attractive to birds in the winter (Paulin et al. 1999). Over 100 species of birds have been documented in the juniper woodlands of southwestern Wyoming and approximately 40 species routinely nest there (Fitton 1989a). Because this habitat is poorly represented in Wyoming, several juniper specialist bird species have limited distributions in the state, and these woodlands mark the northernmost range for several juniper obligate bird species (Pavlacky 2000). Most of the juniper obligates require mature (older than 100 years) junipers for nesting coupled with a shrub understory and shrub/juniper habitat interspersion for foraging. Some species need trees old enough and large enough to have natural cavities. Many juniper bird species could be threatened by extensive tree removal, soil erosion, isolation from adjacent populations of conspecifics in neighboring states, or by cessation of natural juniper stand rejuvenation, primarily through fire suppression (Fitton 1989b).

The following Best Management Practices (BMPs) should provide some reasonable guidelines for managing juniper woodland habitats to benefit a wide variety of resident and Neotropical migratory birds in Wyoming. Most of the BMPs for juniper woodlands are general enough to be applicable in a variety of management situations. Other BMPs are broken out into categories, such as Grazing and Fire.

General

1) Identify and protect those habitats that still have a thriving community of native understory plants and juniper trees. Conserve unique representatives and large, ecologically functioning examples of juniper woodland. Conserve local breeding sites, migratory stopover sites, and wintering sites in juniper woodlands that are important for the conservation of priority species. These areas may be managed as conservation easements (which do not necessarily exclude economic land uses), refuges, protected areas, sanctuaries, or research areas. Management should focus on restoring natural disturbance processes, such as fire, and removing invasive non-native plants.

2) Take a conservative approach to management activities in juniper woodlands. Because junipers take over 100 years to mature, any miscalculations could have longlasting consequences. Consider both long- and short-term impacts and/or benefits of any activities within or adjacent to juniper woodlands. Recreation, development, fire suppression, and improper grazing in juniper woodlands can reduce the multi-aged, multi-layered structure, including snags (standing dead trees) and diseased trees, most beneficial to birds.

3) Maintain old growth stands where they exist, and ensure the presence of multiple stages of mature woodland on the landscape. Habitat alterations should be designed to promote habitat interspersion but not to the detriment of old growth stands. Old growth juniper woodlands provide snags for cavity nesting species and late successional conditions favored by many woodland-dwelling species (Pavlacky 2000). Single tree harvests may be conducted in old growth stands in order to increase interspersion and slow stand decadence (Fitton 1989a).

4) Within extensive areas of juniper woodland habitat, manage for a patchwork or mosaic of native plant communities and successional stages across the local landscape. This may include stands of young and old juniper, openings (ranging from bare ground to short vegetation to high grass density to sagebrush), seeps and riparian areas, and other interspersed shrub and woodland habitats. Mosaics support many bird species with different needs. Open, sparse stands support species like Scott's Orioles and Western Bluebirds. Mature and old-growth stands provide nesting areas for Juniper Titmice, Ash-throated Flycatchers, Black-throated Gray Warblers, Bewick's Wrens, and many others. Interspersed sagebrush and other shrub areas benefit Juniper Titmice, Western Scrub-Jays, Bushtits, and others.

5) Maintain existing larger stands of juniper. The removal of large patches or reductions in patch size to below 1.2 mile^2 (3 km^2) may negatively impact source populations of juniper specialists, and result in ecological traps for woodland-dwelling species in small, simple patches. Because very few large woodland patches >7.3 mile^2 (19 km^2) are present on the landscape, woodlands of this size have high conservation value (Pavlacky 2000).

6) Maintain continuity between stands wherever possible. Habitat fragmentation can result from land conversion to annual grassland, mining, and development. These activities break juniper communities into small, and sometimes isolated, stands. An increase in the number of juniper woodland patches with an average isolation of >1,000 feet (300 m) may have negative impacts on woodland-dwelling species. Nest predation and cowbird nest parasitism can reduce bird productivity in fragmented habitat, and most woodland patches >14 miles (22 km) from contiguous woodland in northern Utah exhibit high densities of cowbirds. The best way to avoid habitat fragmentation is to manage for no net loss of juniper woodland habitat and to maintain native vegetation communities in large and continuous stands wherever possible. Priority should be given to woodland communities <4.3 miles (7 km) from contiguous pinyon-juniper woodland in northeastern Utah. Woodland habitat <4.3 miles (7 km) from what is considered the mainland species pool appear to be relatively free from the negative impacts of open and edge habitats (Pavlacky 2000).

7) Avoid designs and practices that create or increase the amount of edge between juniper woodland 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.

8) Maintain woodlands that contain a pinyon pine component. Mature pinyon pine is very uncommon in Wyoming, but seedlings and saplings are present in the understory in the extreme south. A positive correlation may exist between the proportion of permanent avian residents in the community and the proportion of trees in the woodland that are pinyon pines (Balda and Masters 1980). The distribution of birds such as Gray Flycatchers, Juniper Titmice, Bewick's Wrens, and Black-throated Gray Warblers may be somewhat limited to areas where pinyon pine occurs in juniper woodlands (Pavlacky and Anderson 2001).

9) Extensive, overly dense, and crowded juniper stands that have lost much of the native herbaceous understory and plant diversity may require selective removal of trees to re-establish a balance between tree and shrub cover and perennial grass and forb cover. Woodlands with over 70% canopy cover will support little to no understory vegetation and the insects of the understory layer will no longer be available as food for birds (Fitton 1989a).

10) Provide small-scale openings in the habitat. A landscape mosaic that intersperses cover patches with small openings that provide foraging and browsing opportunities may be the best way to meet an array of management objectives (Paulin et al. 1999). Openings create a diverse landscape that favors many wildlife species. For example, small mammal populations increase within cleared areas, which would attract predatory birds. Birds that feed on insects associated with openings should also benefit from this landscape. However, openings should not be too large and the woodlands should not become fragmented. Clearing widths should be limited to 650 feet (200 m) to maximize use by species that nest in adjacent woodlands, yet can include cleared areas in their territories. These openings would still provide adequate space for species restricted to cleared areas (O'Meara et al. 1981). Openings should follow natural contours, have irregular edges (Fitton 1989b), be interrupted by areas with various ages of junipers, and be in close proximity to mature juniper stands (Fitton 1989a).

11) Provide multiple layers of plants, or "vertical vegetation structure", in juniper woodland habitats. Many bird species nest and forage within 10 feet (3 m) of the ground, so it is critical to have sufficient amounts of vegetation at

that level. Healthy juniper woodlands have young trees, shrubs, and herbaceous grasses/forbs that provide these layers.

12) Increase the quantity and quality of shrub cover near to or interspersed among mature juniper stands (Fitton 1989b). Select sites for shrub enhancement that have good potential for shrub growth, leave lots of woody slash, and use varying levels of treatment so that more trees are left standing toward the edges of units. All of these measures will add structural complexity to the treated unit, thus compensating, in part, for the loss of the juniper overstory. Such treatment units will be more versatile as wildlife habitat than units stripped clean of wood and seeded with grasses (Paulin et al. 1999). Also, shelterwood cuts (whereby several large trees are left temporarily as a source of shade for a new crop of seedlings) can result in increased shrub production, while providing a seed source for future junipers (Fitton 1989a). Shrub enhancement should not be conducted to the detriment of old growth stands of juniper.

13) Manage for a variety of locally native plants. Different plant species host different insect populations, which provide food for a variety of bird species.

14) Manage existing stands of juniper for a balance between tree, shrub, and grass/forb cover and for open to moderate tree cover and multiple height classes.

15) Regardless of the motivation for altering juniper habitat, snags should not be removed. The multi-stemmed juniper growth form produces a large number of natural cavities where the stems meet. The more tree-like, single-stemmed growth form is a common substrate for woodpeckers to excavate cavities. Both tree forms should be maintained in the same proportions post disturbance as pre-disturbance (Fitton 1989a).

16) Implement juniper woodland habitat monitoring programs to establish baseline data and identify changes in habitat quality (both positive and negative) through time. Monitoring ecosystem responses following treatment will aid in making proper land management decisions in the future.

Fire

Prior to human settlement and livestock grazing, fire was the most important natural disturbance in juniper woodland ecosystems. Grass fires often killed juniper trees less than 3 feet tall, and maintained juniper stands in a savannah-like condition with grassland inclusions. The absence of fire since European settlement has resulted in increased density and canopy cover in juniper woodlands, and in many cases a loss of diversity and density in the understory. Prescribed and natural fires may be used in juniper habitats to decrease density and canopy cover, increase herbaceous cover, and increase shrub productivity. Although fires can be detrimental to birds during the summer when eggs and nestlings might be destroyed, the understory growth in a recently burned area creates nesting habitat for birds that nest on or near the ground, and attracts insects, which leads to a better food supply for insectivorous birds.

1) Use prescribed fire with great care or not at all in areas threatened by cheatgrass or medusahead invasion. Cheatgrass, an alien annual grass, has invaded many juniper woodlands, and when the tree and shrub overstory is removed by fire, this aggressive grass may dominate the site. If the native understory vegetation is depleted by competition from a dense tree overstory or by overgrazing, its ability to compete with cheatgrass and other noxious weeds is further hindered. In severe cases, fire suppression may be the only way to avoid continued cheatgrass invasion. In other cases, prescribed fire may be combined with artificial reseeding of native bunchgrass and forb species to curb the invasion of non-native annuals. A hot fire may destroy enough of the seed reserve of cheatgrass, which is mostly located in the litter or on the soil surface, to provide a brief time window for successful seeding of native species (Evans 1988).

2) Burns should be relatively small so a portion of the area contains nesting cover and mature stands at all times. Historically, small, patchy fires were probably the norm in most juniper woodlands. Burns to create openings in continuous or dense juniper should be on a small scale and designed to allow gradual re-establishment of juniper from adjacent stands. This will provide multiple ages of juniper cover across the landscape and over time.

3) In areas known to support nesting birds, prescribed burns should not be conducted until fall to avoid loss of nesting cover. Burns should also be timed to consider the development and susceptibility of desired plants. Mid-summer burns can devastate native perennial grasses and forbs because they destroy plants before they have reached maturity. Mid-summer fires also favor cheatgrass, and can increase erosion when the soil is exposed to severe rainstorms.

4) Juniper stands are often difficult to ignite, and a reduced herbaceous ground cover may cause the fire to carry poorly. Burning has been most successful when the trees themselves were lit and managers did not depend on the understory to carry the fire into the canopy. Often the conditions necessary to get a fire to burn in juniper—hot, dry, windy weather—are too dangerous to allow burning. Temperatures above 70° F, relative humidity of less than about 25%, and winds of 10 to 30 mph provide the most favorable conditions for burning. A Haines index of 5 or 6, which indicates the lower atmosphere is dry and unstable, is helpful for large fire growth and successful burning. Cloud-free days are necessary for sustained fire spread, and ignition in drainage bottoms can help achieve crown fires (Erskine and Goodrich 1999, and Zlatnik 1999).

5) Natural fires less than 1,000 acres (400 ha) should not be suppressed except when significant stands are threatened or when fragmentation of old growth stands will become too severe. If a large increase in fire frequency and areas burned occurs then the policy should be reviewed by considering the amount of old growth left and its distribution over the landscape (Fitton 1989a).

6) Keep cattle off recovering sites for one to two growing seasons. Grazing after a burn can seriously damage soil and native perennials, delaying recovery.

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

a) Burn Area – Clearly define the boundaries of the burn area.
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.
d) Burn 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.

Grazing

Livestock production has long been the primary use for juniper woodlands, although livestock grazing in Wyoming, especially sheep operations, was more extensive during the early 1900s than it is currently. Even today, the juniper community is a low value, but nevertheless important, component of the range complex, as it provides forage and shelter for both domestic livestock and wildlife. In many areas, a year-round grazing scheme has traditionally been used to maximize profits. In areas where this occurs, overgrazing can influence woodland succession by decreasing native grass species and increasing shrubs, forbs, exotic grasses, and the density of juniper cover. In addition, big game wintering areas that exceed carrying capacity can greatly alter the structure of the community. Juniper woodlands require careful grazing management because of their susceptibility to changes in understory vegetation, invasion by exotic grasses, and erosion.

1) There are many possibilities for harmonizing grazing practices with habitat management for birds. No single grazing strategy is appropriate for all juniper habitats, and grazing management should be tailored to the condition and potential of each grazing unit. In general, juniper birds will benefit if grazing plans promote a mosaic of different amounts of tree and shrub cover, perennial grass and forb cover, and openings of bare ground and rock, short grass, or high grass/forb density. Proper seasonal grazing management can also ensure nesting cover and provide protection from trampling of nests or broods during the nesting season.

2) Grazing management plans should be developed and evaluated on a case-by-case basis by the managing agency or landowner because no single grazing strategy will fit all situations. Include juniper woodland management as an

integral part of each grazing management plan. Determine site-specific objectives and tailor the grazing management plan to help meet the objectives. Consider the site's specific factors of concern, such as erosion or loss of old growth juniper; the site's potential and capability; its suitability for grazing livestock and the type of stock best suited to the area; and the ideal grazing strategy, including the time, place, amount, duration, and intensity of grazing. Monitor the effects of each grazing strategy on the juniper woodland to check progress toward the objectives. Record how various size classes of juniper, the overall juniper ecosystem, and the understory plant species respond to grazing management (annual photographs taken from the same point are helpful).

3) 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 cover. To maintain native bunchgrasses on a given unit, defer grazing until after crucial growth periods, waiting until grasses have begun to cure so seed-set can happen. However, deferred grazing can favor cheatgrass unless perennial grasses are a significant component of the vegetation. In stands where cheatgrass and native perennial grasses are mixed, grazing during the dormant period may favor perennial species (Paige and Ritter 1999).

4) Maintain proper stocking rates and livestock distribution to protect juniper woodland ecosystems. Incompatible grazing can negatively influence the species, structure, and health of understory vegetation; can increase the density of juniper cover; and can increase soil erosion. Use stocking levels that stabilize or increase native perennial grass and forb cover and prevent juniper over-dominance or non-native plant invasion. Manage grazing intensity at a level that will maintain the composition, density, and vigor of desired plants and will not promote soil erosion.

5) Manage pastures in a rotation grazing system. Where feasible, use a deferred-rotation or rest-rotation system, whereby no pasture is grazed the same season (spring, summer, or fall) two years in a row.

6) Allow time for plants to rest and regrow between grazing periods to ensure they remain vigorous and productive. Plants that are continuously grazed during the growth period will lose their vigor and stop producing seeds, and their roots will die back, eventually causing a change in the plant community from more productive, palatable species to less productive and less palatable species.

7) Set aside pastures for intensive treatment, e.g. thinning, seeding, or permanent or long-term rest.

8) Be aware of the impacts that cowbird nest parasitism and predators have on nesting birds. In addition to existing in close proximity to cowbird feeding sites (i.e. where cattle graze), juniper woodlands also provide an abundance of available cowbird hosts. Increased nest parasitism results when forests are fragmented or livestock grazing occurs near woody habitats during the nesting season, and predators like raccoons, skunks, and crows often increase in number around human developments. Control cowbirds and predators in juniper woodlands if nest parasitism and predation become problems.

9) Keep cattle off burned sites for one to two growing seasons. Grazing after a burn can seriously damage soil and native perennials, delaying recovery.

10) In wet years, and near springs and seeps, closely monitor livestock activity to avoid overuse. Rocky Mountain juniper is susceptible to loss from erosion because it often grows on moist sites with highly erodible soils. Overuse by livestock can accelerate the erosion process. Damage by ungulates may be decreased by reducing animal numbers, fencing damaged areas, placing natural barriers such as logs and brush across pathways, and placing salt blocks and feed on uplands (Sieg 1991).

11) Improve livestock distribution and forage use by using salt and mineral blocks, but avoid placing them within wetland and riparian areas or in immediately adjacent uplands [keep them at least ½ mile (0.8 km) from wetlands or streams].

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

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

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

15) Avoid joining insect control projects. The use of pesticides for insect control can greatly reduce the food base of many bird species by killing far more than just the target species. Strictly limit insecticide and herbicide application to activities that improve or maintain the juniper woodland community (e.g. elimination of competitive noxious weeds). Where pesticides are needed, use them as part of an Integrated Pest Management (IPM) program. IPM involves closely monitoring pest populations of plants, animals, and insects, and using chemicals only when and where pests are likely to cause economically or ecologically important damage. This reduces exposure of wildlife to harmful chemicals and reduces the destruction of non-target insects and plants. If available, use biological control for specific noxious species rather than chemical control. When possible, apply pesticides and herbicides by hand to target weeds and other pests as specifically as possible. Include birds in IPM plans for insect control, along with natural pathogens, suitable crop and grazing practices, pest-resistant crop strains, minimal use of insecticides, and using less toxic or persistent forms of insecticides.

16) Management plans should consider other grazers, such as elk and deer, which can impact the vegetation in juniper woodlands. Managing for one species can sometimes have negative impacts on other species, such as birds. Consider juniper community conditions and big game impacts when setting herd objective levels. Do not exceed the carrying capacity of juniper habitats. When appropriate, fence livestock out of crucial big game winter range.

17) 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 (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 private land can be protected with conservation easements. In some cases, landowners can derive income from hunters, birders, and naturalists who visit the region.

Forestry

1) Tree harvesting, if properly planned, can have beneficial effects on juniper woodland habitat. Single tree selection (whereby individual trees are chosen for harvest on the basis of size, shape, growth potential, or competition with neighboring trees so that the result is an uneven-aged stand) and two-step shelterwood (whereby several large trees are left temporarily as a source of shade for a new crop of seedlings) methods are best for reducing tree densities and for productivity of juniper woodlands. These methods can result in increased shrub, grass, and forb production, while providing a seed source for future junipers. If harvest areas do not exceed 650 feet (200 m) in width and snags are left standing, this type of harvest can benefit the juniper community in the long-term. Keep the altered site small and irregular in shape, maintain nearby trees and tall shrubs, and avoid soil erosion. Slash should be left unburned, in small piles. Use single tree selection, rather than shelterwood, methods in old growth stands to increase interspersion and slow stand decadence. The seed-tree method (whereby several mature parent trees are left as seed sources for blocks of cutover woodland) generally results in unsatisfactory regeneration because of poor seed dispersal. Clearcutting of large areas is not appropriate in juniper woodlands because of poor seed dispersal and slow maturation of trees. However, in areas where substantial increases in forage production are required, patchcutting may be used. Patches should be no larger than 5 acres (2 ha), irregularly shaped, no closer

than 1,000 feet (300 m) to adjacent patchcuts, and should follow natural contours (Fitton 1989a, Gottfried and Severson 1993, and Meeuwig and Bassett 1983).

Rehabilitation

1) Recreate the historic, open stands of large size class juniper woodlands and savannahs. Because many juniper woodlands have increased in density in the last century, management through prescribed fire or thinning is probably important to maintain or restore various resource values. However, selection of sites to be treated, the pattern of treated and untreated juniper stands on the landscape, and proper management following treatment will probably determine the success or failure of juniper woodland management (Miller and Wigand 1994).

2) Where possible, restore or rehabilitate degraded and disturbed sites to native plant communities. 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 juniper stands, creating small openings, or other strategies.

3) Mining and oil/gas development should only be a short-term habitat conversion. Use land reclamation, initiated concurrently with mining operations, to restore juniper habitat for birds. Reclamation efforts should duplicate as closely as possible the original habitat interspersion and the original topography, including exposed rock. Reclamation may be accelerated by the use of locally derived cultivars and by mycorrhizal inoculations of shrubs and trees.

4) Reseed large disturbed areas to shorten recovery time and prevent dominance by non-native cheatgrass and other weedy species where stands of juniper are dense and lack a diverse understory. When 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. Aerial seeding followed by chaining to cover the seed may be the most effective way to establish perennial vegetation on areas with slopes, gullies, rocky outcrops, dead tree stumps, and debris. Drill seeding can result in a very high germination response, but can only be used on level areas free from obstacles; therefore, it is not possible in many juniper habitats. Aerial seeding without covering the seed may not result in adequate germination (MacDonald 1999).

Agriculture

1) Avoid practices that permanently convert juniper woodland to non-native grassland. Wherever perennial bunchgrasses and native forbs persist, choose practices that stabilize or increase native grass and forb cover in balance with open to moderate juniper cover. To reduce the likelihood of weed invasion, maintain the vigor of native species, control livestock stocking levels, avoid large-scale soil disturbances, and minimize habitat fragmentation. Remove exotic plants, like cheatgrass, that compete with native plant species and do not provide foraging or nesting opportunities for wildlife. While treatments in juniper habitat, such as tree removal and prescribed fire, may increase the productivity of native perennial forbs and grasses, they may also cause an increase in undesirable species such as cheatgrass or medusahead. The potential for these exotic weeds to form closed communities usually depends on the composition of the understory prior to treatment, seed pools, slope, aspect, size of treatment, soil condition, dispersion of slash, and management following treatment (Miller and Wigand 1994).

2) Avoid joining insect control projects. The use of pesticides for insect control can greatly reduce the food base of many bird species by killing far more than just the target species. Strictly limit insecticide and herbicide application to activities that improve or maintain the juniper woodland community (e.g. elimination of competitive noxious weeds). Where pesticides are needed, use them as part of an Integrated Pest Management (IPM) program. IPM involves closely monitoring pest populations of plants, animals, and insects, and using chemicals only when and where pests are likely to cause economically or ecologically important damage. This reduces exposure of wildlife to harmful chemicals and reduces the destruction of non-target insects and plants. If available, use biological control for specific noxious species rather than chemical control. When possible, apply pesticides and herbicides by hand to target weeds and other pests as specifically as possible. Include birds in IPM plans for insect control, along with natural pathogens, suitable crop and grazing practices, pest-resistant crop strains, minimal use of insecticides, and using less toxic or persistent forms of insecticides.

3) 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.

4) 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 (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 private land can be protected with conservation easements. In some cases, landowners can derive income from hunters, birders, and naturalists who visit the region.

Wildlife

1) Management plans should consider other grazers, such as elk and deer, which can impact the vegetation in juniper woodlands. Managing for one species can sometimes have negative impacts on other species, such as birds. Consider juniper community conditions and big game impacts when setting herd objective levels. Do not exceed the carrying capacity of juniper habitats. When appropriate, fence livestock out of crucial big game winter range.

2) Habitat alterations to increase browse for deer winter range should be made only where historical big game use is documented and where potential shrub productivity is high. Avoid converting old growth stands to shrub stages. Altered areas should be small, irregular in shape, and near thermal cover. Retain all snags in the altered area (Fitton 1989a).

Recreation

1) Driving vehicles off-road across juniper habitats destroys vegetation, 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 contribute to soil erosion. Reduce impacts by keeping these users to established trails. Limit the number of roads and trails, and reclaim unused roadbeds with native vegetation. This will reduce weed invasion, roadkills, and fragmentation.

4) Highest priority bird species and their habitat requirements (note: see Tables 6-9 for a description of status information for each species)**:**

Note: Cassin's Kingbird (*Tyrannus vociferans*), Level II, M, K, P, Score = 22, AI = 3, PT = 3, would appear here based on priority, but this species is currently documented as a peripheral breeder in Wyoming, and will not be addressed in the Wyoming Bird Conservation Plan at this time.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Gray Flycatcher (GRFL) *Empidonax wrightii* Level II M Score = 21 AI = 3 PT = 3	~Juniper woodlands; tall sagebrush; and arid, very open pine woods	~Mature woodlands with intermediate grass cover and tree height, and moderate amounts of juniper regeneration ~High canopy cover ~High density of senescent trees ~Dead limbs for sallying perches and song posts	~Low elevation ~Semi-arid	~Occurs in stands of less than 2.5 acres, but not in such stands isolated from larger stands by 0.6 mile or more	~Feeds exclusively on insects ~May be limited by the presence of pinyon pine in Wyoming ~Frequent cowbird host ~Winters south to central Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Juniper Titmouse (JUTI) *Baeolophus ridgwayi* Level II M Score = 21 AI = 3 PT = 3	~Pine-juniper woodland, juniper-sagebrush	~Late-successional juniper woodlands with high canopy cover ~High density of large, dead limbs and decadent trees ~Productive understory and high herbaceous ground cover		~Prefers south and west aspects of slopes ~Breeding territories 2 to 12 acres; minimum viable population size is 20 individuals, requiring 125 acres	~Requires cavities for nesting ~Nest site fidelity ~May form permanent pair bonds ~May defend territory throughout the year ~Will use nest boxes ~In Wyoming, is dependent on the southwestern juniper community ~Year-round resident of Wyoming

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Scott's Oriole (SCOR) *Icterus parisorum* Level II M Score = 21 AI = 3 PT = 3	~Juniper-sagebrush	~Mature woodlands with moderate to sparse canopy closure ~Also uses smaller junipers and deciduous shrubs for foraging		~Lower elevations where junipers create a savannah with herbaceous vegetation and desert shrubs ~Tree density less than 60 per acre	~Will come to sugar-water solutions at bird feeders ~Rare cowbird host ~Natural history and habitat requirements poorly known ~In Wyoming, is dependent on the southwestern juniper community ~Winters from northern and northwestern Mexico south to southern and southwestern Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Western Bluebird (WEBL) *Sialia mexicana* Level II M Score = 19 AI = 3 PT = 3	~Pine-juniper, juniper woodlands, open ponderosa pine forests ~Also frequents meadows, burns, and other open areas	~Open woodland or edge habitat with exposed perches and fairly sparse ground cover ~Attracted to post fire successional communities		~Open country with scattered trees ~Prescribed fire is usually beneficial, especially if it reduces shrubs and understory trees ~Benefits from moderate disturbance	~Requires cavities for nesting; secondary cavity nester ~Will use, and sometimes prefers, nest boxes ~House Sparrows and European Starlings compete for nest cavities ~Rare cowbird host ~Depends on mistletoe and juniper berries in winter ~Winters mostly within U.S., usually within breeding range at lower elevation

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Western Scrub-Jay (WESJ) *Aphelocoma californica* Level II M Score = 18 AI = 3 PT = 3	~Pine-juniper and juniper-sagebrush	~Large juniper trees for nesting and sentinel posts ~Sparse to medium juniper cover ~Open juniper-sagebrush savannah	~Moderate amount of exposed rock around the nest	~Rocky ridges and ravines	~Sensitive to human activity around the nest ~Long-term pair bond; pair of family group remain year-round on permanent territory ~In Wyoming, is dependent on the southwestern juniper community ~Is a year-round resident of Wyoming

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Ash-throated Flycatcher (ATFL) *Myiarchus cinerascens* Level II M Score = 16 AI = 2 PT = 3	~Pine-juniper and juniper	~Open canopy of old growth juniper ~Sparse understory ~High density of snags ~Trees <16 feet in height	~Rock outcrops	~Steep topography such as rocky mesas and canyon lands ~Is benefitted by habitat interspersion ~Lower elevation juniper woodlands	~Requires cavities for nesting ~Will use nest boxes ~In Wyoming, is dependent on the southwestern juniper community ~Winters south to northeast Costa Rica

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Bushtit (BUTI) *Psaltriparus minimus* Level II M Score = 16 AI = 3 PT = 3	~Pine-juniper and juniper-sagebrush	~Younger juniper, 35 to 100 years old ~Edges, openings, and shrubby areas		~Minimum viable population size is 30 individuals, requiring 34 acres of habitat	~Occurs in local concentrations ~Sensitive to disturbance during nesting ~Will come to bird feeders ~In Wyoming, is dependent on the southwestern juniper community ~Rare cowbird host ~Year-round resident of Wyoming

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Virginia's Warbler (VIWA) *Vermivora virginiae* Level III M Score = 24 AI = 3 PT = 3	~Arid montane woodland, pine-juniper, riparian willow and alder thickets, open spruce-fir forests near scrubby thickets	~Heavy understory ~Older age classes ~Some trees and taller shrubs for singing and foraging posts	~5500-9000 feet elevation	~Activities that reduce shrub habitats can be detrimental ~Declines immediately after fire, but benefits from eventual regeneration of shrubs and native understory grasses	~Requires shrubby vegetation for nesting ~Nests are concealed by ground vegetation ~Feeds exclusively on insects ~Rare cowbird host ~Winters in central and southern Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Black-throated Gray Warbler (BTGW) *Dendroica nigrescens* Level III M Score = 22 AI = 3 PT = 3	~Pine-juniper, woodland-chaparral	~Mature woodland with well-developed understory and high canopy cover ~Open conifer forests that are interspersed with shrubs or forest edges	~Prefers and is perhaps limited to dry slopes	~Northeast aspects of juniper woodland slopes ~May be limited by the distribution of pinyon pine in southwest Wyoming ~Small tracts isolated by more than 5 miles may have sparser populations than those less than 5 miles from larger stands	~Rare cowbird host ~Winters south to southern Mexico

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Bewick's Wren (BEWR) *Thryomanes bewickii* Level III M Score = 18 AI = 3 PT = 3	~Pine-juniper woodland chaparral ~Dense growths of alder, cottonwood, and willow	~Requires adequate nest cavities; may rely on mature woodlands for senescent trees used for nest sites ~ Intermediate grass cover, tree height, and moderate amount of juniper regeneration ~Edge habitats		~Prescribed burning or other techniques that maintain early successional stages (open scrub woodland) may be beneficial ~May be limited by the distribution of pinyon pine in southwestern Wyoming	~House Sparrows, European Starlings, and House Wrens compete for nest cavities ~Will use nest boxes ~Uncommon cowbird host ~In winter, largely resident but some move south to central Mexico

5) Biological objectives and recommendations:

Cassin's Kingbird

The Cassin's Kingbird would appear here based on priority, but this species is currently documented as a peripheral breeder in Wyoming, and will not be addressed in the Wyoming Bird Conservation Plan at this time.

X Gray Flycatcher

Scattered across central and southwestern Wyoming in juniper woodlands and adjacent sagebrush. Inhabits semi-arid woodlands and brushy areas. Occupies a wide range of conditions within mature juniper woodlands in areas where the canopy cover is high; is more abundant in low elevation than in high elevation woodlands. Prefers stands with large, decadent or dead trees, which it uses for sallying perches and song posts. Builds a cup nest of bark, plant down, weed stems, and grass, lined with feathers and hair, in a crotch of juniper or sagebrush, or near the base of a thornbush, from 2 to 9 feet above ground. Sometimes nests in loose colonies. Eggs [3 to 4, 0.7 inch (18 mm)] are creamy white and unmarked. Is a frequent cowbird host. Feeds exclusively on insects. Forages in the spaces between shrubs. Flycatches close to the ground, sallying out from the tops of shrubs and trees. Also catches and gleans insects from the ground and low plants. Winters south to central Mexico. Has a relatively high tolerance for habitat disturbance, but is vulnerable to clearing and fragmentation of juniper woodlands. Occurs in stands of less than 2.5 acres (1 ha), but not in such stands isolated from larger stands by 0.6 mile (1 km) or more. Reproduction may be confined to the juniper vegetation type in Wyoming, and possibly limited by the presence of pinyon pine. Other species that may benefit from habitat management for this species include the Ash-throated Flycatcher, Western Scrub-Jay, Pinyon Jay, Juniper Titmouse, and Bewick's Wren.

Y Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Gray Flycatcher in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

Z Habitat Objectives

1) Maintain large, non-fragmented stands of mature juniper woodlands.

2) Maintain large-statured sagebrush adjacent to juniper woodlands.

3) Maintain pinyon pine stands wherever they occur in southern Wyoming.

AA

BB Recommendations

1) Implement woodland management practices that provide continuous, non-fragmented stands of juniper woodlands where Gray Flycatchers occur.

2) Implement woodland management practices that leave large, decadent, or dead trees intact for sallying perches and song posts in areas where Gray Flycatchers occur.

3) In areas where chaining for forage improvement occurs, limit clearing widths to 650 feet (200 m), use light chain or cable, and cease chaining during winter.

4) Implement woodland management practices that encourage pinyon pine survival wherever it occurs.

5) Avoid or minimize insecticide use in woodland habitats to maintain a food source for Gray Flycatchers (and other insectivores). Postpone all insecticide use until Gray Flycatchers and other insectivores have completed their breeding cycle.

6) Rotate livestock use during the songbird breeding season in order to rest units from cowbird concentration in alternate years and to give local songbird populations [within a radius of 4 miles (6.5 km)] the opportunity to nest without high parasitism pressure.

CC Juniper Titmouse

Found almost exclusively in the juniper woodlands of southwestern Wyoming. Rarely found far from juniper tree cover, but readily makes use of sagebrush and other shrubs interspersed among the junipers; few species are as closely tied to a single habitat. Requires old growth woodland and may prefer woodlands on south and west aspects that support more productive understories and higher herbaceous ground cover. Nests in a knothole or other natural or woodpecker-excavated cavity 3 to 10 feet above the ground; often partially excavates the nest cavity. Will also use nest boxes. Nest is constructed of moss, grass, and forbs, and lined with fur and feathers. Eggs [3 to 9, 0.7 inch (17 mm)] are white and unmarked, or faintly marked with reddish-browns. Eats a wide variety of insects and spiders, fruits, and seeds up to the size of juniper berries. Requires juniper berries and invertebrate eggs in winter. Generally forages acrobatically on the trunks and thicker branches of old growth juniper, but also on the thinner branches of juniper and deciduous shrubs, including sagebrush. Is a year-round resident of Wyoming. May form permanent pair bonds and defend the same territory throughout the year. Required habitat is restricted in distribution in Wyoming, making it vulnerable to extirpation. Because of its need for larger, mature trees which are often found in more mesic, deep-soiled sites, it may be quite adversely affected by tree removal. Could be threatened by soil erosion, isolation from other populations in neighboring states, or by cessation of natural juniper stand rejuvenation, primarily through fire suppression. Other species that may benefit from habitat management for this species include the Hairy Woodpecker, Gray Flycatcher, Ash-

throated Flycatcher, Mountain Chickadee, White-breasted Nuthatch, Bewick's Wren, and Black-throated Gray Warbler.

DD Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Juniper Titmouse in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

EE Habitat Objectives

FF 1) Maintain large, old growth stands of juniper woodlands.

2) Maintain a mosaic of large trees and snags in areas where Juniper Titmice occur.

GG Recommendations

1) Retain snags and all trees with nest cavities. Retain mature and decadent trees for future snag production, particularly where existing snags are few.

2) Implement woodland management practices that provide large, old growth stands of juniper woodlands where Juniper Titmice occur. Habitat alterations should be designed to promote habitat interspersion but not to the detriment of old growth stands of juniper.

3) Increase the quantity and quality of shrub cover near to or interspersed among mature juniper stands to enhance foraging.

4) Where snags are unavailable and the lack of nest sites is limiting Juniper Titmouse reproduction, a well-maintained nest box program may be beneficial. Because trees may take over 150 years to develop cavities, erecting nest boxes may mitigate snag loss. Nest boxes should have a 1.5-inch entrance hole to exclude European Starlings. Place boxes 3 to 6 feet above the ground in mature juniper woodland. Monitor nest boxes regularly throughout the nesting season to evict House Sparrows, rodents, and insects, and to clean out "dummy" nests built by wrens.

5) Avoid or minimize insecticide use in woodland habitats to maintain a food source for Juniper Titmice (and other insectivores). Postpone all insecticide use until Juniper Titmice and other insectivores have completed their breeding cycle.

6) Do not encourage European Starlings to nest, and control, reduce, or remove European Starling populations where nesting cavity competition is a concern.

<u>Scott's Oriole</u>

Currently found only in the juniper woodlands of southwestern Wyoming. Occupies mature woodlands with moderate to sparse canopy closure. Nests at the lower elevations, where junipers create a savannah with herbaceous vegetation and

desert shrubs. Nests in a juniper, toward the end of a branch, 4 to 18 feet (1.2 to 5.5 m) above the ground. Builds a pendant nest suspended from twigs, constructed of grasses on the outside, and fine grasses, hair, and soft white material from various sources on the inside. Eggs [2 to 4, 1.0 inch (24 mm)] are pale blue, marked with browns, black, purples, and grays. Is a rare cowbird host. Forages among juniper branch tips and shrubs, gleaning primarily insects from the foliage. Also probes flowers for nectar and small insects. Will come to sugar-water solutions at bird feeders. Winters from northern and northwestern Mexico south to southern and southwestern Mexico. Its required habitat is restricted in distribution in Wyoming, making it vulnerable to extirpation. Readily abandons historical nesting areas and establishes new ones, making the monitoring of population trends difficult. Natural history and habitat requirements are poorly known. Could be threatened by extensive tree removal, soil erosion, isolation from other populations in neighboring states, or by cessation of natural juniper stand rejuvenation, primarily through fire suppression. Other species that may benefit from habitat management for this species include the Ferruginous Hawk, Mourning Dove, Cassin's Kingbird, Western Scrub-Jay, Bushtit, Northern Mockingbird, and Western Meadowlark.

HH Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Scott's Oriole in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

II Habitat Objectives

JJ 1) Maintain mature stands of juniper in a savannah with herbaceous vegetation and shrubs.

KK Recommendations

1) Due to a lack of information on this species, determine additional habitat requirements through inventory, monitoring, and research.

2) Use prescribed fire to create habitat for Scott's Orioles by opening dense stands.

3) Natural fires less than 1,235 acres (500 ha) should not be suppressed except when significant stands are threatened or when fragmentation of old growth stands will become too severe.

4) Increase the quantity and quality of shrub cover near to or interspersed among mature juniper stands to enhance foraging.

5) Because of the Scott's Oriole's restricted range, limit congested recreation where this species occurs.

6) Avoid or minimize insecticide use in woodland habitats to maintain a food source for Scott's Orioles (and other insectivores). Postpone all insecticide use until Scott's Orioles and other insectivores have completed their breeding cycle.

7) Rotate livestock use during the songbird breeding season in order to rest units from cowbird concentration in alternate years and to give local songbird populations [within a radius of 4 miles (6.5 km)] the opportunity to nest without high parasitism pressure.

LL Western Bluebird

Scattered across most of Wyoming, primarily along the southern edge of the state. Inhabits open woodlands, primarily ponderosa pine and juniper. Prefers edge habitat with scattered trees, exposed perches, and fairly sparse ground cover. A combination of woodlands with plenty of cavities for nesting, and nearby open grassy areas with plenty of perches for foraging provides optimum habitat. Breeding also extends to the level of mountain meadows, sometimes at 10,000 feet. Nests in a natural cavity or old woodpecker cavity, from 2 to 50 feet above ground, which it lines with grass, weed stems, pine needles, twigs, or occasionally with hair or feathers. Will use, and sometimes prefers, nest boxes. Eggs [3 to 8, 0.8 inch (21 mm)] are pale blue to bluish-white, or occasionally white, and unmarked. Is a rare cowbird host. Ground-sallies or hovers to catch insects or pluck berries from branches. Forages primarily from perches, for which it prefers dead branches to living ones. Winters mostly within the U.S., usually within its breeding range at a lower elevation. Benefits from moderate disturbance, such as prescribed fire, especially if it reduces shrubs and understory trees. However, felling dead trees and removing dead branches reduces nest cavities and increases competition with other cavity-nesting species, particularly House Sparrows and European Starlings. Populations dropped severely from 1900 to the 1940s due to loss of habitat and competition for nest cavities. Some populations may have declined due to forest closure as a result of fire suppression. Will likely respond to nest box programs in appropriate habitat where nest cavities are a limiting factor. Other species that may benefit from habitat management for this species include the Williamson's Sapsucker, Northern Flicker, Olive-sided Flycatcher, Bushtit, and Pygmy Nuthatch.

MM Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Western Bluebird in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

NN Habitat Objectives

1) Maintain a mosaic of large trees and snags, in clusters, with an open, grassy understory in areas where Western Bluebirds occur.

OO Recommendations

1) Retain snags and all trees with nest cavities. Retain mature and decadent trees for future snag production, particularly where existing snags are few.

2) Use prescribed fire to maintain open stands of forest and woodland, and reduce shrub and understory trees where Western Bluebirds occur.

3) Refrain from salvage logging after burning. If salvage logging is unavoidable (for sanitary or firebreak reasons), then some areas should be left untouched rather than thinning the entire unit.

4) Where snags are unavailable and the lack of nest sites is limiting Western Bluebird reproduction, a well-maintained nest box program may be beneficial. Nest boxes should be 5x5x8 inches with a 1.56-inch entrance hole located 6 inches from the floor. The standard entrance hole size to exclude European Starlings is 1.5 inches, but Western Bluebirds have better success with a slightly larger opening. Place boxes 3 to 6 feet above the ground in open country with scattered trees and low or sparse ground cover, or at forest edges. Where possible, place nest boxes on trees rather than fence posts, and face the entrance hole toward an open field, preferably east, north, south, then west. Monitor nest boxes regularly throughout the nesting season to evict House Sparrows, rodents, and insects, and to clean out "dummy" nests built by wrens.

5) Avoid or minimize insecticide use in woodland habitats to maintain a food source for Western Bluebirds (and other insectivores). Postpone all insecticide use until Western Bluebirds and other insectivores have completed their breeding cycle.

6) Do not encourage European Starlings to nest, and control, reduce, or remove European Starling populations where nesting cavity competition is a concern.

Western Scrub-Jay

Currently nests only in the juniper woodlands of southwestern Wyoming. Individuals found in Wyoming outside of the southwest corner are probably dispersing juveniles. Is associated with mature juniper woodlands but seems to avoid dense stands. Mature trees and high canopy cover are important to nesting and large trees also function as sentinel posts. Forages in open sagebrush-grassland as well as the juniper woodlands in which it nests. Area around the nest usually has relatively sparse canopy cover and moderate amounts of exposed rock. Builds a cup nest 3 to 20 feet above ground toward the tip of a juniper branch. Nest is composed of small juniper and sagebrush twigs outwardly and lined with fine grass and occasionally animal hair. Eggs [2 to 7, 1.1 inches (28 mm)] are pale green, marked with reddish-browns or greens. Is an omnivorous and opportunistic forager. Gleans a variety of invertebrates, small vertebrates, eggs, nuts, seeds, and fruit from the ground, small shrubs, and lower branches of junipers. Will come to bird feeders. Requires a reliable food source, such as juniper berries, in winter. Is a year-round resident of Wyoming. Is inclined to form pair bonds; pair or family group remains year-round on a permanent territory. Is sensitive to human activities around the nest and has been known to abandon nests rather quickly. Its required habitat is restricted in Wyoming, making it vulnerable to extirpation. Could be threatened by extensive tree removal, soil erosion, isolation from other populations in neighboring states, or by cessation of natural juniper stand rejuvenation, primarily through fire suppression. Other species that may benefit from habitat management for this species include the Gray Flycatcher, Ash-throated Flycatcher, Bewick's Wren, and Scott's Oriole.

PP Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Western Scrub-Jay in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

QQ

RR Habitat Objectives

SS

TT 1) Maintain mature juniper woodlands with an open canopy and well interspersed with sagebrush and other shrubs.

UU Recommendations

1) Implement woodland management practices that leave large, mature trees intact for nesting and sentinel posts in areas where Western Scrub-Jays occur.

2) Increase the quantity and quality of shrub cover near to or interspersed among mature juniper stands to enhance foraging.

3) Avoid approaching nests or disturbing nesting activities, as Western Scrub-Jays have been known to abandon nests rather quickly.

4) Use prescribed fire to maintain open stands of juniper woodland where Western Scrub-Jays occur. Habitat alterations should be designed to promote habitat interspersion but not to the detriment of old growth stands.

5) Natural fires less than 1,235 acres (500 ha) should not be suppressed except when significant stands are threatened or when fragmentation of old growth stands will become too severe.

6) Avoid or minimize insecticide use in woodland habitats to maintain a food source for Western Scrub-Jays (and other insectivores). Postpone all insecticide use until Western Scrub-Jays and other insectivores have completed their breeding cycle.

<u>Ash-throated Flycatcher</u>

Currently nests only in the juniper woodlands of southwestern Wyoming. Individuals found in Wyoming outside of the southwest corner are usually migrating. Typically found on steep, rocky slopes sparsely covered by old growth juniper, a sparse understory, and an abundance of snags. More abundant in lower elevation juniper woodlands. Nests in a natural cavity, old woodpecker hole, or hole in a fence post, 3 to 20 feet above ground. Will use nest boxes. Builds a soft nest of hair, fur, feathers, grass, and occasionally snakeskin. Eggs [4 to 5, 0.9 inch (22 mm)] are creamy, marked with browns, purples, or olive. Takes a wide variety of insects by hover-gleaning, hawking,

and ground-gleaning. Usually flies out from a perch to capture an insect, then lands on a different perch. Also eats small fruits and seeds. Winters south to northeast Costa Rica. Is vulnerable to extirpation in Wyoming because its required habitat is restricted in the state. Could be threatened by extensive tree removal, soil erosion, isolation from other populations in neighboring states, or by cessation of natural juniper stand rejuvenation, primarily through fire suppression. Other species that may benefit from habitat management for this species include the Gray Flycatcher, Western Scrub-Jay, Juniper Titmouse, Bewick's Wren, and Black-throated Gray Warbler.

VV Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Ash-throated Flycatcher in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

WW Habitat Objectives

XX 1) Maintain mature juniper woodlands with an open canopy and well interspersed with sagebrush and other shrubs.

2) Maintain a mosaic of large trees and snags in areas where Ash-throated Flycatchers occur.

YY Recommendations

1) Implement woodland management practices that leave large, decadent, or dead trees intact for nesting, sallying perches, and song posts in areas where Ash-throated Flycatchers occur.

2) Retain snags and all trees with nest cavities. Retain mature and decadent trees for future snag production, particularly where existing snags are few.

3) Use prescribed fire to maintain open stands of juniper woodland where Ash-throated Flycatchers occur. Habitat alterations should be designed to promote habitat interspersion but not to the detriment of old growth stands.

4) Natural fires less than 1,235 acres (500 ha) should not be suppressed except when significant stands are threatened or when fragmentation of old growth stands will become too severe.

5) Increase the quantity and quality of shrub cover near to or interspersed among mature juniper stands to enhance foraging.

6) Where snags are unavailable and the lack of nest sites is limiting Ash-throated Flycatcher reproduction, a well-maintained nest box program may be beneficial. Because trees may take over 150 years to develop cavities, erecting nest boxes may mitigate snag loss. Nest boxes should have a 1.75-inch entrance hole, and should be placed 3 to 6

feet above the ground in mature juniper woodland. Monitor nest boxes regularly throughout the nesting season to evict House Sparrows, rodents, and insects, and to clean out "dummy" nests built by wrens.

7) Avoid or minimize insecticide use in woodland habitats to maintain a food source for Ash-throated Flycatchers (and other insectivores). Postpone all insecticide use until Ash-throated Flycatchers and other insectivores have completed their breeding cycle.

8) Do not encourage European Starlings to nest, and control, reduce, or remove European Starling populations where nesting cavity competition is a concern.

Bushtit

Found almost exclusively in the juniper woodlands of southwestern Wyoming. Most often found in younger junipers which have not yet developed cavities but are reproductively mature, between 35 and 100 years old. Forages throughout the junipers but especially at the edge of juniper stands, in openings, and in the sagebrush and mountain mahogany understory. Builds a hanging gourd-shaped nest 7 to 10 inches [18 to 24 cm] long, supported by twigs above and occasionally below. Nest is constructed of moss, lichen, leaves, cocoons, grass, and flowers; secured by spider silk; and lined with plant down, hair, and feathers. Eggs [5 to 7, 6.0 inch (14 mm)] are white and unmarked. Is a rare cowbird host. Feeds acrobatically, gleaning insects and spiders from the bark, branches, and foliage of trees and shrubs. Also eats seeds and fruits. Will come to bird feeders. Is a year-round resident of Wyoming. Shows a high tolerance for other Bushtits in its territory, and is found in local concentrations, with nearby areas of appropriate habitat unoccupied. During nest building, egg laying, and early incubation, human presence or changes in weather can cause desertion and even pair bond dissolution. This sensitive period can be very long as nests may take up to 50 days to complete. Is vulnerable to extirpation in Wyoming because its required habitat is restricted in the state. Could be threatened by extensive tree removal, soil erosion, isolation from other populations in neighboring states, or by cessation of natural juniper stand rejuvenation, primarily through fire suppression. Other species that may benefit from habitat management for this species include the Common Poorwill, Western Bluebird, and Scott's Oriole.

ZZ Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Bushtit in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

AAA Habitat Objectives

BBB 1) Maintain stands of younger age-classes of juniper.

2) Maintain a mosaic of edges, open areas, and shrubs in juniper woodlands.

CCC

DDD Recommendations

1) Implement woodland management practices that increase the quantity and quality of shrub cover near to or interspersed among juniper stands to enhance foraging.

2) Use prescribed fire to maintain open stands of juniper woodland where Bushtits occur. Habitat alterations should be designed to promote habitat interspersion but not to the detriment of old growth stands.

3) Avoid approaching nests or disturbing nesting activities, as Bushtits have been known to abandon nests rather quickly. While nest-building, Bushtits make frequent trips to the same material source, so if nests must be identified for monitoring purposes, the general location of the nest can be determined by standing near the line of flight.

4) Avoid or minimize insecticide use in woodland habitats to maintain a food source for Bushtits (and other insectivores). Postpone all insecticide use until Bushtits and other insectivores have completed their breeding cycle.

5) Rotate livestock use during the songbird breeding season in order to rest units from cowbird concentration in alternate years and to give local songbird populations [within a radius of 4 miles (6.5 km)] the opportunity to nest without high parasitism pressure.

EEE Virginia's Warbler

Currently nests only in southern Wyoming. Inhabits arid, brushy slopes and riparian woodlands from 5,500 to 9,000 feet, particularly pine-juniper and woodland chaparral. Utilizes a variety of dry, shrubby habitats, often with some coniferous tree component, and may be dependent on riparian habitats during some seasons. Usually nests in dry gulches. Uses trees and taller shrubs for singing and foraging posts, while nests are located at ground level under shrubs. Builds a cup nest of coarse grass and bark strips, lined with fine materials. Locates nest on the ground, among dead leaves or embedded in loose soil, sometimes at the base of a shrub, or hidden under a tussock of grass, but usually concealed by overhanging vegetation. Eggs [3 to 5, 0.6 inch (16 mm)] are white to creamy, marked with reddish-brown or brown. Is a rare cowbird host. Feeds exclusively on insects; usually gleans them from the ground, but also hawks and gleans them from foliage. Winters in central and southern Mexico. May be vulnerable due to its narrow geographic distribution on breeding and wintering ranges, and small populations in its breeding range. Declines immediately after fires that remove shrub habitats and brushy understories, but should benefit in the long-term from burns that promote regeneration of shrubs and native understory grasses. Intentional alteration of habitat to enhance livestock grazing disturbs nesting, resting, and foraging habitat. Breeding biology needs more study. Other species that may benefit from habitat management for this species include the Common Poorwill, Green-tailed Towhee, Spotted Towhee, Black-headed Grosbeak, and Broad-tailed Hummingbird.

Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Virginia's Warbler in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

FFF Habitat Objectives

1) Maintain juniper woodlands and montane shrublands where Virginia's Warblers occur.

2) Maintain herbaceous vegetation for nesting cover where Virginia's Warblers occur.

3) Produce a mosaic of altered and unaltered habitat on a landscape scale.

GGG

HHH Recommendations

1) Limit activities that reduce or remove preferred shrub habitats (e.g. shrub eradication, some grazing, campgrounds, off-road vehicle travel, urbanization) where Virginia's Warblers occur.

2) Conduct prescribed burns in early spring before birds arrive, and leave adequate amounts of unburned shrubs to provide breeding habitat. Use burns that promote the regeneration of shrubs and native understory grasses.

3) Retain shrubs that are in old growth stages. Managing large acreages of mountain shrubland in young growth stages for deer and elk does not benefit the Virginia's Warbler, which requires larger shrubs.

4) Prevent invasion of exotic plants, such as cheatgrass. Select native plant species for revegetation.

5) Avoid or minimize insecticide use in woodland habitats to maintain a food source for Virginia's Warblers (and other insectivores). Postpone all insecticide use until Virginia's Warblers and other insectivores have completed their breeding cycle.

6) Exclude grazing until after July 20th in areas where Virginia's Warblers occur to avoid trampling nests.

7) Rotate livestock use during the songbird breeding season in order to rest units from cowbird concentration in alternate years and to give local songbird populations [within a radius of 4 miles (6.5 km)] the opportunity to nest without high parasitism pressure.

III ***Black-throated Gray Warbler***

Scattered across central and southwestern Wyoming in pine-juniper, woodland-chaparral, and mountain-foothills shrublands. Considered a specialist within the juniper woodland community in Wyoming. Found in mature woodlands with north and east aspects, in conjunction with low grass cover, low tree height, and high canopy cover of seedlings and saplings. Prefers, and is perhaps limited to, dry slopes. May be limited by the distribution of pinyon pine in southwest Wyoming. Builds a neat cup nest of weed stalks, grass, and plant fibers, always lined with feathers, and often hair and moss. Usually nests far out on a horizontal branch, 1 to 50 feet above ground. Eggs [3 to 5, 0.6 inch (16 mm)] are white to creamy, marked with browns, and usually wreathed. Is a rare cowbird host. Feeds largely or entirely on insects during nesting. Usually gleans insects from dense terminal foliage, but also hovers and gleans, and hawks. Winters south to southern Mexico. Impacted by overstory tree removal. Density in small tracts [<40 acres (<16 ha)] appears to be just as high as it is in large acreages. Small tracts isolated by more than 5 miles (8 km) may have sparser populations than those less than 5 miles (8 km) from larger stands. Breeding biology needs more study. Other species that may benefit from habitat management for this species include the Ash-throated Flycatcher, Mountain Chickadee, Juniper Titmouse, White-breasted Nuthatch, Bewick's Wren, and Chipping Sparrow.

JJJ Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Black-throated Gray Warbler in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

KKK Habitat Objectives

LLL

1) Maintain large, mature tracts of juniper woodlands.

2) Maintain pinyon pine stands wherever they occur in southern Wyoming.

MMM Recommendations

1) Implement woodland management practices that provide large, mature stands of juniper woodlands where Black-throated Gray Warblers occur. Provide small-scale openings of habitat and maintain overstory trees.

2) Implement woodland management practices that encourage pinyon pine survival wherever it occurs.

3) Avoid or minimize insecticide use in woodland habitats to maintain a food source for Black-throated Gray Warblers (and other insectivores). Postpone all insecticide use until Black-throated Gray Warblers and other insectivores have completed their breeding cycle.

4) Exclude grazing until after July 31st in areas where Black-throated Gray Warblers occur.

NNN Bewick's Wren

Scattered across southern and east-central Wyoming in pine-juniper, woodland-chaparral, and mountain-foothills shrublands. Considered a specialist within the juniper woodland community in Wyoming. Occupies dense, mature woodlands with adequate nesting cavities, intermediate grass cover and tree height, and a moderate amount of juniper regeneration. Prefers broken and rather low, brushy areas, especially where heavier cover is present overhead. Often inhabits edge habitats. Requires a brushy understory and cavities for nesting. Nests 0 to 20 feet above ground in secluded natural tree cavities, old woodpecker cavities, rock crevices, amid roots of upturned trees, or in almost any cavity where a nest can be built. Will use nest boxes. Lines cavity with twigs, grass, and feathers. Eggs [4 to 11, 0.7 inch (17 mm)] are white, flecked with browns, purple, and occasionally wreathed; occasionally almost unmarked. Uncommon cowbird host. Gleans insects and spiders from the ground, low trunks, and branches of trees and shrubs, usually under dense cover. Is largely a year-round resident of Wyoming, but some winter south to central Mexico. Declines may be due to interspecific competition (i.e. European Starlings, House Sparrows, House Wrens), habitat changes (i.e. forest regrowth and suburban development), inclement weather, and predators. Prescribed burning or other techniques that maintain shrubby woodlands may be beneficial. Nest box programs may be beneficial if nest sites are a limiting factor. Other species that may benefit from habitat management for this species include the Gray Flycatcher, Ash-throated Flycatcher, Western Scrub-Jay, Black-throated Gray Warbler, and Scott's Oriole.

OOO Population Objectives

1) Breeding Bird Survey (BBS) data from 1968 through 1998 are inadequate to determine population trends for the Bewick's Wren in Wyoming. Determine population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

PPP Habitat Objectives

1) Maintain large, mature tracts of juniper woodlands.

2) Maintain a mosaic of large trees and snags in areas where Bewick's Wrens occur.

Recommendations

QQQ

1) Implement woodland management practices that provide large, mature stands of juniper woodlands where Bewick's Wrens occur.

2) Retain snags and all trees with nest cavities. Retain mature and decadent trees for future snag production, particularly where existing snags are few.

3) Refrain from salvage logging after burning. If salvage logging is unavoidable (for sanitary or firebreak reasons), then some areas should be left untouched rather than thinning the entire unit.

4) Where snags are unavailable and the lack of nest sites is limiting Bewick's Wren reproduction, a well-maintained nest box program may be beneficial. Nest boxes should have a 1.5-inch entrance hole to exclude European Starlings. Nest boxes should be placed low in areas where Bewick's Wrens are known to occur. Monitor nest boxes regularly throughout the nesting season to evict House Sparrows, rodents, and insects, and to clean out "dummy" nests built by wrens.

5) Avoid or minimize insecticide use in woodland habitats to maintain a food source for Bewick's Wrens (and other insectivores). Postpone all insecticide use until Bewick's Wrens and other insectivores have completed their breeding cycle.

6) Do not encourage European Starlings to nest, and control, reduce, or remove European Starling populations where nesting cavity competition is a concern.

6) Inventory, monitoring, and research needs:

QQQ.1

QQQ.2 Inventory and Monitoring Needs

QQQ.2.1.1

"Monitoring Wyoming's Birds: The Plan for Count-based Monitoring" would appear here, but was previously presented under Inventory and Monitoring Needs in the Plains/Basin Riparian habitat section.

QQQ.3 Research Needs

Research needs will become more apparent once the inventory and monitoring needs have been met. Therefore, research needs will be addressed in a later version of the Wyoming Bird Conservation Plan.

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QQQ.3.1.1.1.1.1.1.1 Shrubland Habitat Group

Mountain-foothills Shrub

1) Describe the habitat (Arno and Wilson 1986; Beidleman 2000; Bennet 1999; Brotherson et al. 1994; Cook et al. 1994; Hammond 1990; Howard 1997; Johnson 2000; Kay 1995; Knight 1994; Marshall 1995a, 1995b; Olson 1989; Zlatnik 1999b):

a) Historic conditions: Formed a patchy mosaic that included but was not limited to mountain mahogany, serviceberry, Gambel oak, antelope bitterbrush, skunkbush sumac, snowberry, hawthorn, wild plum, chokecherry, and boxelder. Frequent wildfires favored the expansion of many shrub communities, such as Gambel oak and serviceberry. Wildfires may have limited the expansion of other communities, such as mountain-mahogany, which was largely confined to extremely rocky sites where fuel was sparse. Most communities probably exhibited an open canopy, young age classes, and low density, although multiple age classes existed. Fires in presettlement times were usually of low severity because of fuel discontinuity.

b) Present conditions: Mountain-foothills shrublands form pure or mixed stands that often include, but are not limited to mountain mahogany, serviceberry, Gambel oak, antelope bitterbrush, skunkbush sumac, snowberry, hawthorn, wild plum, chokecherry, and boxelder. Big and silver sagebrush stands often form mosaics with these shrubs, and numerous grass and forb species are associated with the shrub habitat. The mountain-foothills shrub community, which amounts to about 560,000 acres in Wyoming, usually exhibits a patchy mosaic of several codominant shrub species distributed across a heterogeneous landscape. Shrubland communities have demonstrated a variety of responses to human settlement, depending on which of the diverse shrub species are dominant. Fire suppression has allowed a gradual succession of many formerly open stands to dense shrublands or woodlands dominated by conifers. Serviceberry, Gambel oak, and skunkbush sumac communities have declined under the shade of developing canopies. Other communities, such as chokecherry and hawthorn, have increased in density and expanded into former grasslands due to fire exclusion and livestock grazing. The absence of fire has allowed mountain mahogany to increase in abundance, but it is becoming decadent on many sites and is unable to compete with associated conifers on some sites. Antelope bitterbrush communities have spread into ponderosa pine stands, but are becoming decadent as older plants are not replaced. Many formerly open shrub stands provide much greater fuel loads today, so when fires do occur they are likely to be more severe. Most shrub communities are stimulated by moderate browsing, but some may have deteriorated from overbrowsing by native ungulates and/or livestock.

2) Identify the issues:

a) Use: Foothills are linear features that add diversity to the plains and basins, usually providing more cover and a more mesic (more moist) environment for plants and animals. Shrub communities provide important seasonal food and cover for many wildlife species at critical times of the year. In spring, many shrubs provide early forage and nesting opportunities both in cavities and on branches. In summer, many species use the shade that shrubs provide for feeding and resting. In late summer and fall, many shrubs produce edible seeds and fruits that are important to birds, bears, and other wildlife. In winter, they provide important cover and a large selection of forage types for wildlife species that have spent the summer at higher elevations. Shrublands also provide hunting opportunities and watershed protection.

b) Access: May be limited due to private ownership; however, privately owned areas are popular for housing and resort developments. In areas of public ownership, use and access have increased; there is now more recreation occurring in this habitat on public lands.

c) Problems: Lack of fire has changed the habitat, but ranches, summer homes, and resorts located in the foothills environment often prevent the use of prescribed burns. Housing and associated developments consume and fragment the habitat. Incompatible wildlife and livestock grazing place pressure on decadent shrub stands, and resprouting is often unsuccessful. Shrublands are occasionally cleared to increase forage for livestock or big game. Cheatgrass and other invasive species often invade shrub habitats after disturbances. The proximity of shrublands to

environments that support cowbirds makes nest parasitism a problem. Conflicts over proper land use occur, primarily because of differing management priorities for private and public lands and because foothills landscapes provide an exceptional diversity of plants and animals, as well as desirable habitats for people.

d) What has been the cause of change to the habitat: Throughout Wyoming, the health, vigor, and reproduction of many mountain-foothills shrub communities are in decline. The two primary factors driving this trend are fire suppression and overbrowsing by wild and domestic ungulates. Shrub species differ in their responses to fire. In some cases, shrub communities have expanded into the surrounding grassland and conifer communities. In other cases, shrub communities have diminished under the shade of encroaching conifers. In general, however, fire suppression has caused most shrub communities to become dominated by old, decadent shrubs with considerable standing dead organic matter. Consequently, when fires do occur, they are high in intensity and shrub recovery is slow. Recovery is made even slower in areas where browsing pressure is high. In some areas, particularly the Greater Yellowstone Ecosystem, large populations of native ungulates are having dramatic impacts on shrub growth and seed/berry production. Other shrub communities are impacted by heavy concentrations of domestic livestock, especially where it is compounded by winter use by native ungulates.

3) Best Management Practices:

Wyoming Partners In Flight Best Management Practices for Mountain-foothills Shrublands to Benefit Birds in Wyoming.

Introduction

It is challenging to establish clear guidelines for managing mountain-foothills shrublands for birds because of the variety of shrub species in the community and the diversity of their responses to management strategies. In addition, most research has been concentrated on those shrubs that are desirable for livestock and big game forage, and the management strategies that increase the forage productivity of those species. These guidelines do not always work for all shrubs in the community, and are not always in the best interest of the birds that use the habitat.

General

1) Maintain plant species diversity and manage for a patchwork or mosaic of native plant communities and age classes across the local landscape.

2) Strive for no net loss of mountain-foothills shrublands on a landscape scale. Limit activities that reduce or remove shrub habitats (e.g. shrub eradication, some grazing, campgrounds, off-road vehicle travel, urbanization, roads, and wellpads). Avoid operating vehicles when soil is wet; driving in the same tracks repeatedly, causing ruts; and driving over sensitive areas, such as steep slopes.

3) Conserve unique representatives and/or large, ecologically functioning examples of mountain-foothills shrubland habitat.

4) Retain some blocks of tall, older, dense stands of shrubs for those species that require them (e.g. Virginia's Warbler and Black-throated Gray Warbler).

5) Provide small-scale openings of habitat for those species that require them (e.g. Common Poorwill and Black-throated Gray Warbler).

6) To help maintain shrublands, eliminate conifers that grow higher than the native shrubs.

7) Maintain existing larger stands of shrublands and continuity between stands wherever possible. Avoid designs and practices that create or increase the amount of edge between shrubland habitat and converted or highly altered land. These edges support cowbirds, nest predators, and invasive grasses and forbs, and they expose wildlife to pesticides, shooting, collisions with vehicles, and other hazards.

8) Prevent the invasion of exotic plants (e.g. cheatgrass). To reduce the likelihood of weed invasion in stands that contain a community of native grasses and forbs, maintain the vigor of native species, control livestock stocking levels, avoid large-scale soil disturbances, and minimize habitat fragmentation. Weed control with herbicides, biological agents, and mechanical techniques should be followed by reseeding and restoring native plant species to prevent reinvasion of weeds.

9) Discourage road construction where it would reduce shrubland patch size. Limit the number of roads in shrubland habitat and consider rehabilitating old roads. This will reduce weed invasion, roadkills, and fragmentation. Reduce the number of roads to the minimum needed to cross the habitat, and cross at the narrowest point of the stand where feasible.

10) Minimize or eliminate insect control. 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 control can greatly reduce the food base of many bird species by killing far more than just the target species.

11) 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.

12) Be aware of the impacts that cowbird nest parasitism and predators have on nesting birds. Increased nest parasitism results when forests are fragmented or livestock grazing occurs near woody habitats during the nesting season, and predators like raccoons, skunks, and crows often increase in number around human developments. Manage nest parasite and predator issues where negative impacts to birds occur.

Grazing

Concerns about the impacts of intensive use of mountain-foothills shrubs have been voiced for many years. Overbrowsing may result in significant habitat deterioration, increased water runoff and soil erosion, and greatly reduced community herbage production (Fisser 1983). In some areas, large populations of native ungulates are having dramatic impacts on shrub growth and seed/berry production (Kay 1995). However, it is well documented that some level of browsing does prevent stagnation and increases the productivity of the shrub community. Proper stocking levels and grazing regimes can be effective habitat management tools and compatible with shrubland maintenance and improvement. Sustained high shrub vigor is best obtained by moderate use of the vegetation (Fisser 1983). These Best Management Practices for grazing focus on protecting shrubland areas during crucial growing periods.

1) On a landscape level, use livestock grazing practices that allow large acreages of shrublands to go to a climax successional stage for those species that require it (e.g. Virginia's Warbler and Black-throated Gray Warbler).

2) On a landscape level, use livestock grazing and fire together to produce a mosaic of habitat patches to benefit a variety of shrubland species.

3) Where possible, consider rotating livestock use during the songbird breeding season (April through July for most songbirds) in order to rest units from cowbird concentration in alternate years and to give local songbird populations [within a radius of 4 miles (6.5 km)] breeding opportunity without high parasitism pressure.

4) Limit grazing in areas where ground nesting species (e.g. Virginia's Warbler and Common Poorwill) are nesting to avoid trampling nests.

5) Fruiting shrubs are often stunted and produce little fruit due to heavy browsing by wild and domestic ungulates. Minimize livestock grazing in areas where productive stands of berry-producing shrubs are desired (Hammond 1990).

6) Remove some mountain-foothills shrubland habitat from livestock grazing or reduce livestock grazing to improve the habitat and to recreate a heterogeneous landscape mosaic. Set aside pastures for permanent or long-term rest (at least 25 to 50 years) (Beidleman 2000).

Fire

Prior to human settlement and agricultural development, shrublands evolved with periodic burning. Although fires can be detrimental to 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 as unburned shrubland is slowly replaced by conifers, and old, decadent shrubs begin to die out without regenerating. Many shrub species require fire to top-kill the older plants so they may resprout from the root crown, regenerating the community. Other species regenerate from seed and require bare mineral soil cleared by fire for seedlings to thrive. Most shrub species are intolerant of shade and as the absence of fire allows tall conifer species to establish themselves, the shrubs begin to die out. Many species of shrubs sprout prolifically after a fire; in such communities, the vegetation density increases immediately after a fire and remains so for several years. Consequently, 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 shrubland fire is a necessity, not a disaster. Temporary shifts in species composition may occur following a fire because some species lack the ability to reproduce vegetatively, but most other shrubs are

capable of sprouting. Preburn composition, fire damage to perenniating parts, use by ungulates, and postburn competition could all influence shrub recovery (Bartos et al. 1994).

1) Reestablish fire to recreate a heterogeneous landscape mosaic. Fire must be carefully implemented so that it will not establish large areas of the same age and structure, but will leave healthy mosaic patterns of various aged stands. Fires should not remove all shrubs but leave pockets of unburned shrubs. Prevent large scale fires that will eradicate large, continuous areas of shrubland or result in cheatgrass invasion. Use small, patchy, cool burns.

2) Burn at intervals within the natural fire frequency of about 10 to 25 years, depending on the dominant species in the community (Cook et al. 1994, Merril and Peek 1982).

3) Burns should be timed to consider the development and vulnerability of desired plants. Mid-summer burns can devastate native plants, as they destroy foliage before it reaches maturity. Mid-summer fires also favor cheatgrass, and can increase erosion when the soil is exposed to severe rainstorms. Early spring and late fall burns when the soil is moist and plants are dormant (before growth begins or after maturity) usually have a less negative impact (Cook et al. 1994).

4) On a landscape level, use fire as a tool to maintain open areas and clearings for those species that require them (e.g. Common Poorwill).

5) On areas known to support nesting birds, conduct prescribed burns in early spring before birds arrive or in late fall after nesting is completed. Leave adequate amounts of unburned shrubs to provide breeding habitat. Burn size should be scaled appropriately to the landscape so that a portion of the area contains nesting cover at all times.

6) Following a prescribed burn or wildfire (especially a hot fire), the area may require reseeding or replanting with container plants 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. Avoid revegetating with only grasses and forbs, which leaves out the landscape structure (i.e. shrubs) important to nesting birds. Use seeds and container plants that include appropriate native shrubs.

7) Keep cattle off recovering sites for one to two growing seasons; grazing after a burn can seriously damage soil and native perennials, delaying recovery.

Wildlife

1) Maintain big game populations at a level that the shrub community can support and continue to regenerate.

2) Fruiting shrubs are often stunted and produce little fruit due to heavy browsing by wild and domestic ungulates. Monitor browsing by wild ungulates in areas where productive stands of berry-producing shrubs are desired (Hammond 1990).

Shrub Species Accounts

Because the mountain-foothills shrub habitat is so diverse, blanket management recommendations may not be suitable for all communities. The efficacy of shrubland management depends upon knowledge of the ecological requirements of the dominant species in the community. Refer to the species accounts below for specific recommendations for selected shrub species.

True Mountain Mahogany

Occurs in the Black Hills and across the southern half of Wyoming. Is most common on semiarid foothills ranges where it often grows in almost pure stands. Generally occurs on drier sites and is limited to shallow, rocky soils on steep slopes. Although there is little overlap with the range of curlleaf mountain mahogany, true mountain-mahogany usually grows at lower elevations where overlap does occur. Provides valuable forage, especially in winter, because of its high mineral content in winter and spring. Provides cover for a wide variety of wildlife. Is

somewhat shade tolerant, but occurs more often and is more vigorous on sites without a forest canopy. Is capable of nitrogen fixation, which enables it to become established on relatively infertile soils. Exhibits relatively low seedling vigor and initial growth rates; requires abundant sheltering and shading, and presence of litter for successful seedling establishment. Is usually top-killed by fire, but usually sprouts vigorously from the root crown afterward. In open, dry habitats where it is likely to occur, fires in presettlement times were of low severity because of fuel discontinuity. Today, many formerly open stands are dominated by conifers and decadent shrubs which provide greater fuel loads. When fires occur, they are likely to be more severe. Disturbance and moderate browsing may promote health and vigor, but overuse has greatly restricted distribution. Many remaining stands have become decadent with little living browse matter and require active management. (Beidleman 2000, Elliot and Anderson 1997, Fisser 1983, Knight 1994, Marshall 1995b)

1) Reduce losses from fire by conducting prescribed burns in the spring (Cook et al. 1994).

2) Do not allow livestock to browse true mountain-mahogany stands too early in the growing season. If this precaution is not taken and yearly growth is retarded, permanent injury to the browse may result. Leaves should be ¼ to ½ developed before allowing stock to graze on the area in the spring. If livestock browses the accessible twig growth year after year, plants will be reduced in vigor, but if part of the current year's growth remains, each with 1 or 2 lateral buds, then new growth is assured the following year. (Baumgartner 1983)

3) May use seeds or container plants for revegetation. Use regional seed sources and transplant in the fall. May need to protect shrubs from overbrowsing. Keep competing vegetation to a minimum. Do not use nitrogen fertilizers. (Elliot and Anderson 1997, Marshall 1995b)

Curlleaf Mountain Mahogany

Found primarily in western and northern Wyoming and on the foothills of the Bighorn Mountains. Grows on xeric (drier) sites, usually in isolated, pure patches that are often very dense. Inhabits rocky areas with shallow soils. Capable of nitrogen fixation, which enables it to establish on relatively infertile soils. Somewhat shade tolerant, but most vigorous on sites without forest canopy. Provides important browse for wildlife and livestock. Sustained protein levels through the winter provide considerable value as forage. In mature stands, much of the foliage is out of reach of browsing animals but provides excellent winter cover. Reproduces by seed, but natural germination is very difficult, and seedlings usually exhibit low vigor and slow initial growth rates. Its ability to sprout after top-kill is weak; sprouting appears limited to plants that are 20 to 30 years old. Although individual plants are severely damaged by fire, communities may depend on fire to reduce conifer competition and produce favorable soil conditions for seedling establishment. Seeds are not fire resistant, so reestablishment from seedlings after fire depends on some mature plants surviving the fire and providing seeds. Frequent wildfires prior to 1900 kept it largely confined to extremely rocky sites where fuel was sparse, but fire suppression has allowed it to expand into some adjacent communities. However, it is currently becoming decadent on many sites and seems unable to compete with associated conifers. Because mature plants are shade intolerant, their competitive ability is lost and they become senescent. Plants are often severely hedged from years of concentrated use by wintering ungulates. Young plants, particularly if abundant, appear to be able to overcome the stress of herbivory, but not the additive effects of herbivory and intraspecific competition. Attempts to grow the plant from seed have been generally unsuccessful, and the potential for the use of fire in management is limited because of the weak sprouting response. However, under proper conditions, prescribed fire and/or removal of conifers might induce regeneration through seeding or improve the vigor and productivity of existing stands. Closure of the species canopy can restrict regeneration, so a patchy fire can cause openings in the canopy and allow regeneration. In large stands where it does not kill all seed-producing plants, fire can reduce competition and stimulate seed production. Reduction of litter, by means of fire, will provide more favorable sites for seedling establishment. (Arno and Wilson 1986, Elliot and Anderson 1997, Fisser 1983, Knight 1994, Marshall 1995a , Olson 1989, Schultz et al. 1990)

1) Use small, cool, patchy burns conducted in the fall to create openings in the canopy and allow regeneration. However, burning is not recommended for all communities, and decisions about fire should be made on a site-by-site basis. Young, vigorous stands, such as those that have regenerated since 1920; stands surrounded by volatile fuels such as sagebrush; and stands where distribution is scattered (≤0.5 plant/acre) are not candidates for prescribed burning. Fire is not recommended for small stands, especially where there is a large amount of woody fuel. A hot fire can destroy all plants, removing seed sources. (Elliot and Anderson 1997, Marshall 1995a)

2) Pruning decadent plants to improve winter range should be considered only for areas having favorable moisture regimes and soil conditions to maximize regeneration response and production of current annual leader growth. Pruning can increase available browse by over 200% for 5 years, sustain increased forage production for up to 20 years, encourage the establishment of new seedlings, and increase understory vegetation. Since curlleaf mountain-mahogany only sprouts from live branches, removal of the complete canopy kills the plant. Therefore, 80-98% of the canopy should be removed. Pruning should be carried out in small stands on crucial winter range and only young trees should be pruned in spring or early fall to decrease mortality. Pruning trees less than 12 feet tall, with stem diameters of 2 to 4 inches yields best results. Large, mature trees are difficult to prune, have fewer branches suitable for pruning, and often die as a result of pruning. (Elliot and Anderson 1997, Marshall 1995a, Olson 1989)

3) It may be beneficial to eliminate conifers or other trees that are outcompeting curlleaf mountain mahogany stands (Elliot and Anderson 1997).

Serviceberry

Is a conspicuous but widely scattered shrub in mixed foothill shrublands and often forms very dense thickets, mats, or grows in clumps. Two species are common in Wyoming: Saskatoon, which occurs throughout the state, and Utah, which is found in drier foothill habitats to the west and south. The two generally share most characteristics. Serviceberry is an important component of the ungulate winter diet, and leafs out earlier in the spring than associated species. Its berries are important food for bears, and important winter food for birds since the berries stay on the shrub through the winter. Regeneration by sprouting from the root crown or rhizomes is most common; reproduction by seed is rare. Is top-killed by fire, but the plant is fire tolerant. Intolerant of deep shade and declines with canopy closure. Fire stimulates production by killing understory conifers, removing old top growth, and promoting sprouting. Recovery following fire is approximately 25 years. Heavy litter accumulations may increase the likelihood of fire-caused mortality. Vigor declines under combined domestic stock and wildlife browsing use. (Beidleman 2000, Cook et al. 1994, Hammond 1990, Howard 1997, Knight 1994, Tweit and Houston 1980, Yake and Brotherson 1979, Zlatnik 1999a)

1) Livestock grazing should minimized where berry-productive stands of serviceberry are desired. Leaves should be ¼ to ½ developed before allowing stock to graze on the area in the spring. (Baumgartner 1983, Hammond 1990)

2) Even decadent plants may be successfully treated with fire, and season is not critical to postfire response. Limit browsing pressure after fire to prevent slow recovery. Sites where prescribed burning may cause harm in the long-term include harsh (especially very dry) sites with low plant density, and very cold sites where postfire growth would be limited by temperature. (Howard 1997)

3) Stands should occasionally be thinned and protected from encroaching timber species (Hammond 1990).

Gambel Oak

Occurs in extreme southcentral Wyoming, on the west side of the Sierra Madre range. Spring frosts and summer drought have limited its spread northward into Wyoming by preventing seedling establishment. Occurs on mesic (more moist) sites with deeper soils, usually as clones of shrubs in dense patches. A healthy stand contains shrubs of varying heights, has robust native bunchgrasses and forbs growing between them, and has very little bare ground. Provides winter forage for big game, and its energy-rich acorns are consumed by deer, elk, wild turkeys, and squirrels. Young pole stands provide sites for foliage-nesting birds. Old stands containing large amounts of dead crown and hollow boles or limbs provide nesting sites for small mammals and birds. Is a good source of fuel wood. Reproduces by suckering, and very large areas can be populated by clones. Resprouts vigorously from roots, rhizomes, and basal stems after fire, sometimes within 10 days. Fire usually increases density of previously open stands and merges scattered stands into continuous thickets. Can recover to original heights from a fire in 30 to 40 years. With fire exclusion, stands are invaded and canopy is suppressed by less fire-adapted species. In some areas of its range, Gambel oak is eradicated to improve forage for livestock and big game. However, in Wyoming, it can be considered a unique representative of its species, and because many species of wildlife are dependent upon oak associations, management strategies for Gambel oak rangelands that contain prescriptions for maintaining or

improving these valuable habitats are necessary. (Beidleman 2000, Clary 1987, Engle et al. 1983, Knight 1994, Lauver et al. 1989, Neilson and Wullstein 1985, Simonin 2000)

1) Gambel oak should not be removed at all. If it is absolutely necessary for forage improvement, thinning of younger stands (6-10 years of age) should maintain 35 to 45% average oak cover; this will promote growth of the remaining stems and result in some forage increases. A partial wood harvest is an alternative for older mature stands. A partial harvest designed to maintain or improve the mature stand may be preferable to a complete harvest that would most likely return the area to a sprout-dominated community. (Clary 1987, Lauver et al. 1989)

Antelope Bitterbrush

Occurs throughout Wyoming, often intermixed with sagebrush. Often occurs in ravines and on sites where snow accumulates. Is capable of nitrogen fixation, which enables it to establish on relatively infertile soils. Is a very important browse plant for mule deer, pronghorn, and cattle because of its widespread abundance and forage value. Ungulates, birds, and rodents also use it for cover. Most plants in bitterbrush stands become established from rodent seed caches, but seedling survival can be very low. Is shade intolerant and is an early colonizer on disturbed sites. Is vulnerable to being displaced by competitive noxious weeds (e.g. cheatgrass and leafy spurge). Is moderately browse tolerant, but serious deterioration can occur when it is utilized in the winter by big game and again during the summer by livestock. Sheep, deer, and elk generally browse only current annual growth, but cattle can be detrimental because they consume woody branches up to ¼ inch (6 mm) in diameter, as well as current annual growth. Moderate browse use may stimulate twig production, but continued heavy use will cause a decline in shrub vigor and an eventual loss of the stand. There are many methods that can be used to improve the vigor of stands, such as seeding, prescribed burning, pruning, rotomowing, proper grazing, and the introduction of new varieties. The most controversial improvement technique is prescribed fire, as bitterbrush does not sprout abundantly. However, fire creates litter-free sites that are necessary for seed germination. Also, bitterbrush communities are now widespread in ponderosa pine ecosystems due to decades of fire exclusion, but many existing stands have no seedling recruitment and are decadent with little browse production. Regular but not too frequent fires are necessary to clear out older, decadent plants; establish new seedlings; and/or to encourage sprouting. Sprouting ability after fire depends on fire intensity, genetic capability, soil moisture and type, and season of burn. When soils are moist at the time of the burn, the root crown incurs less damage, and plants are more likely to sprout. Is often killed by summer or fall fires, but may sprout after a light-severity spring fire. Very young and very old plants (<5 or >40-60 years) are least likely to sprout. Low-growing plants sprout better than upright forms. (Beidleman 2000, Bennet 1999, Clark et al. 1982, Clements and Young 1996, Guenther 1989, Kituku et al .1994, Knight 1994, Mozingo 1987, Tweit and Houston 1980, Zlatnik 1999b)

1) Prescribed burns should be conducted in the spring and should not be repeated frequently. Soil moisture should be greater than 60% of field capacity at the time of burning. Enhance reestablishment on burned areas by leaving intact an ample seed source and/or by planting. (Clark et al. 1982, Cook et al. 1994, Guenther 1989, Tweit and Houston 1980).

2) Late summer and/or fall grazing is preferable. Grazing during spring and early summer is the most detrimental to bitterbrush vigor, as its carbohydrate reserves are at a low from May through mid-July. (Mozingo 1987, Tweit and Houston 1980)

3) Seedling establishment should be protected from overgrazing and should include good weed control (Guenther 1989).

Skunkbush Sumac

At lower elevations, where the frost-free period is longer, skunkbush sumac is common, especially on the east side of the Bighorn and Laramie mountains. Is capable of nitrogen fixation, which enables it to establish on relatively infertile soils. Fruit persists through the fall and winter, and can provide a ready food source for birds and small mammals when other foods are scarce or unavailable. Is low in palatability for livestock but may receive considerable use by deer in winter, especially if other browse is limited. Forms dense thickets that provide good hiding cover for many small birds and mammals. Has spreading woody rhizomes and sprouts readily from both root and crown after disturbances. Sprouts vigorously following fire. Crown width and overall coverage often increase

in response to fire. Seedlings are intolerant of crowding, even under optimal conditions, and competition with other species can be detrimental to the growth of young seedlings. Is tolerant of heavy grazing; heavy summer use by livestock will possibly cause an increase in skunkbush sumac. (Knight 1994, Tirmenstein 1987, Tweit and Houston 1980)

Snowberry

The two common species in the mountain-foothills shrublands of Wyoming are common snowberry and mountain snowberry. Is important browse for wildlife and livestock. While not highly nutritious or palatable, it is one of the first plants to leaf out in spring. Provides important hiding cover and food for small mammals and birds. Rhizomes are the primary method of reproduction. Is top-killed by fire, but root crowns usually survive even severe fire and sprout. May show decreases the first few years after severe fire, but coverages are usually regained by 15 years. Communities on dry sites will not sprout as well after fire as will taller shrub communities on more mesic sites. Annual or very frequent fires may be detrimental. Postfire browsing may slow recovery time. Trampling and heavy browsing can cause the loss of snowberry stands. Increases in cover and forms low thickets after logging. (Aleksoff 1999, McWilliams 2000, Merrill and Peek 1982, Welch 1983)

1) Leaves should be ¼ to ½ developed before allowing livestock to graze on the area in the spring. Herbage production can best be increased by light grazing on alternate years in the middle of the growing season, or by use of a rest-rotation grazing system. (Baumgartner 1983, Willard and McKell 1978)

Hawthorn

Provides extremely valuable wildlife food and cover. Succulent shoots and young leaves are a palatable browse for deer, cattle, and rabbits. Dense, thorny stands and thick, intricate branching deter predators and provide excellent nesting sites or brood rearing areas. The fruit is eaten by many game and songbird species. Stands may be so dense as to preclude most livestock use. A shallow, diffuse root structure allows for sprouting and sucker-rooting. Is highly flammable; usually the entire thicket is consumed by fire. Removal of the plant may require years of growth for full reestablishment. Its range is limited by fire; frequent fires may confine plants to dense thickets. (Habeck 1991, Knight 1994, Knudson et al 1990)

Wild Plum

Often occurs in hardwood draws as part of a mosaic comprising grassland and ponderosa pine woodland in eastern Wyoming. Typically forms thickets and colonies. Is valuable as wildlife habitat. Is presumed to be somewhat resistant to fire mortality due to its ability to spread from underground rootstocks, but postburn response has not been widely documented. (Knight 1994, McMurray 1987)

Chokecherry

Grows throughout Wyoming at low to mid elevations where moisture accumulation is greater than average. Rarely dominates large areas, but often forms mixed stands with other tall shrubs. Important wildlife food and cover plant. Produces dependable berry crops, which are important to birds, bears, and other mammals. Browsed by deer and other big game. Foliage is toxic in large amounts but livestock normally do not eat fatal quantities except when other forage is scarce. Spreads by underground stems, forming clumps and thickets; also reproduces by seed. Is well adapted to disturbance by fire. Is susceptible to top-kill by fire, but resprouts rapidly and prolifically from root crowns and rhizomes. Seed germination improves with heat treatment. Is shade-tolerant, but reaches its greatest density near forest edges. Moderately tolerant of browsing, but heavy browsing has impacted populations in many areas. Has developed in former grasslands due to fire exclusion and grazing. (Beidleman 2000, Hammond 1990, Johnson 2000, Knight 1994, Knudson et al. 1990)

1) Thin stands occasionally and protect them from encroaching timber species (Hammond 1990).

2) Minimize livestock grazing where berry-producing stands of chokecherry are desired (Hammond 1990).

Boxelder

Often occurs in hardwood draws as part of a mosaic comprising grassland and ponderosa pine woodland in eastern Wyoming. Provides cover for wildlife and livestock, and the seeds are eaten by birds. Is susceptible to mechanical damage by livestock. Is injured by fire, but how it regenerates after fire is not known. Produces a large yearly crop of wind-dispersed seeds which germinate on a wide variety of soils; this is most likely its primary fire survival strategy. It may also sprout from the roots, the root collar, or stump if girdled or top-killed by fire. (Knight 1994, Rosario 1988)

4) Highest priority bird species and their habitat requirements (note: see Tables 6-9 for a description of status information for each species)**:**

Note: Brewer's Sparrow (*Spizella breweri*), Level I, CA, M, R, Score = 23, AI = 5, PT = 5, would appear here based on priority, but this species was already addressed in the Shrub-steppe habitat section.

Note: Sage Sparrow (*Amphispiza belli*), Level I, CA, M, R, Score = 22, AI = 5, PT = 2, would appear here based on priority, but this species was already addressed in the Shrub-steppe habitat section.

Note: Gray Flycatcher (*Empidonax wrightii*), Level II, M, Score = 21, AI = 3, PT = 3, would appear here based on priority, but this species was already addressed in the Juniper Woodland habitat section.

Note: Dusky Flycatcher (*Empidonax oberholseri*), Level II, M, Score = 19, AI = 3, PT = 2, would appear here based on priority, but this species was already addressed in the Aspen habitat section.

Note: Virginia's Warbler (*Vermivora virginiae*), Level III, M, Score = 24, AI = 3, PT = 3, would appear here based on priority, but this species was already addressed in the Juniper Woodland habitat section.

Note: Black-throated Gray Warbler (*Dendroica nigrescens*), Level III, M, Score = 22, AI = 3, PT = 3, would appear here based on priority, but this species was already addressed in the Juniper Woodland habitat section.

SPECIES & STATUS	VEGETATION COMPOSITION	VEGETATION STRUCTURE	ABIOTIC FACTORS	LANDSCAPE FACTORS	SPECIAL FACTORS
Common Poorwill (COPO) *Phalaenoptilus nuttallii* Level III M Score = 19 AI = 3 PT = 3	~Rocky sagebrush, mountain-foothills shrublands, juniper woodlands, and ponderosa pine woodlands	~Open woodlands ~Dry, brushy areas ~Inhabits all stages of shrub areas, preferring clearings and open stages for foraging ~Nests on ground, often partially shaded by a shrub, tuft of grass, rock, or log	~Elevation <8000 feet ~Rocky areas and canyons ~Nests on gravelly ground or flat rock	~Forages in grassy meadows, riparian zones, and forest edges within 0.3 mile (500 m) of the nest	~Feeds exclusively on insects ~Perennial nest site ~Is able to enter torpor to conserve energy resources during cold weather ~Lack of specific information on habitat requirements ~Winters south to central Mexico

Note: Sharp-tailed Grouse (*Tympanuchus phasianellus*), Level III, M, Score = 19, AI = 3, PT = 3, would appear here based on priority, but is classified as a game species in Wyoming.

5) Biological objectives and recommendations:

RRR Brewer's Sparrow

SSS The Brewer's Sparrow is also a priority species in Shrub-steppe habitat, and was addressed in that section.

TTT Sage Sparrow

UUU The Sage Sparrow is also a priority species in Shrub-steppe habitat, and was addressed in that section.

Gray Flycatcher

The Gray Flycatcher is also a priority species in Juniper Woodland habitat, and was addressed in that section.

Dusky Flycatcher

The Dusky Flycatcher is also a priority species in Aspen habitat, and was addressed in that section.

Virginia's Warbler

The Virginia's Warbler is also a priority species in Juniper Woodland habitat, and was addressed in that section.

Black-throated Gray Warbler

The Black-throated Gray Warbler is also a priority species in Juniper Woodland habitat, and was addressed in that section.

Common Poorwill

Found across most of Wyoming, particularly the drier eastern and southern parts of the state, in a variety of dry, rocky, open habitats below 8000 feet. Inhabits sparse, rocky sagebrush; open prairies; all stages of mountain-foothills shrublands; juniper woodlands; brushy, rocky canyons; and ponderosa pine woodlands. Prefers clearings and open stages, including grassy meadows, riparian zones, and forest edges for foraging within 0.3 mile (500 m) of the nest. Builds no nest, but lays eggs directly on gravelly ground, flat rock, or litter of woodland floor. Occasionally scrapes a slight depression in the dirt. Nest is often placed near a log, rock, shrub, or tuft of grass for some shade, yet with a wide-angle view of the surroundings. Eggs [2, 1.0 inch (26 mm)] are pinkish-white or pinkish-cream, darkly mottled with lavender. Feeds exclusively on insects, especially nocturnal insects such as moths and beetles, and occasionally flies, grasshoppers, and flying ants. Catches insects by leaping from the ground or a perch, or by picking them up from the ground. Winters south to central Mexico. Nocturnal

or crepuscular (active at dusk and dawn); may increase foraging activity during moonlit nights. Specific habitat requirements and status are poorly understood. Population declines in the West are due to habitat degradation and permanent conversion of shrublands to other cover types. Other species that may benefit from habitat management for this species include the Wild Turkey, Plumbeous Vireo, Orange-crowned Warbler, Virginia's Warbler, Black-headed Grosbeak, and Green-tailed Towhee.

VVV Population Objectives

1) Determine statewide population trend data by implementing "Monitoring Wyoming's Birds: The Plan for Count-based Monitoring".

2) Breeding Bird Survey (BBS) data from 1968 through 1998 indicate Common Poorwills have been detected on 20 BBS routes in Wyoming, including 11 on which they were observed a minimum of 3 years.

a) Maintain Common Poorwills on the 20 BBS routes on which they were observed (Figure 31).

b) Maintain the average number of individuals observed per route over the past 5 years at a level equal to or above the average number of individuals observed during all the years the route was run (as established in 1999 in Table 42).

[Insert figure here]

Figure 31. Bold lines indicate Breeding Bird Survey routes on which Common Poorwills have been observed from 1968 through 1998.

Table 42. Breeding Bird Survey routes in Wyoming (out of 108 available routes) on which Common Poorwills were observed from 1968 through 1998.

[Insert table here]

WWW Habitat Objectives

1) Maintain shrublands where Common Poorwills occur.

2) Produce a mosaic of altered and unaltered habitat on a landscape scale.

XXX

YYY Recommendations

1) Manage for a diversity of shrubby vegetation near clearings and open areas for foraging.

2) Limit activities that reduce or remove preferred shrub habitats (e.g. shrub eradication, some grazing, campgrounds, off-road vehicle use, urbanization) where Common Poorwills occur.

3) Use prescribed burns to prevent the formation of dense stands and promote the regeneration of shrubs. Conduct prescribed burns in early spring before birds begin nesting.

4) Prevent the invasion of exotic plants, such as cheatgrass. Select native seed for revegetation.

5) Avoid or minimize insecticide use in shrubland habitats to maintain a food source for Common Poorwills (and other insectivores). Postpone all insecticide use until Common Poorwills and other insectivores have completed their breeding cycle.

6) Limit grazing in areas where Common Poorwills are nesting to avoid trampling of nests.

Sharp-tailed Grouse

The Sharp-tailed Grouse is classified as a game species in Wyoming, and will not be addressed in the Bird Conservation Plan.

6) Inventory, monitoring, and research needs:

YYY.1

YYY.2 Inventory and Monitoring Needs

YYY.2.1.1

"Monitoring Wyoming's Birds: The Plan for Count-based Monitoring" would appear here, but was previously presented under Inventory and Monitoring Needs in the Plains/Basin Riparian habitat section.

YYY.3 Research Needs

Research needs will become more apparent once the inventory and monitoring needs have been met. Therefore, research needs will be addressed in a later version of the Wyoming Bird Conservation Plan.

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