UTAH PARTNERS IN FLIGHT
AVIAN CONSERVATION STRATEGY
VERSION 2.0

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EXECUTIVE SUMMARY

JUSTIFICATION

The decline of avian populations, particularly Neotropical migratory birds (NTMBs), in North America and several areas of the Western Hemisphere, is well documented. The reasons for declines are complex, and include loss of breeding habitat due to fragmentation, alteration, urban expansion, and natural disasters, loss or alteration of habitat in non-breeding areas and along migratory routes, and brood parasitism as the primary factors responsible.

Nationally, Partners in Flight (PIF) began in 1989 as a coordinated, multi-faceted effort with the goal of documenting and reversing these apparent declines in NTMBs (e.g., those landbirds that breed north of Mexico and then migrate to Mexico, Central and South America, and the Caribbean). These species were not included in initiatives directed towards waterfowl (North American Waterfowl Management Plan), shorebirds (Western Hemispheric Shorebird Reserve Network), or colonial waterbirds (Colonial Waterbird Group), or with initiatives addressing tropical biodiversity (Hunter and Pashley 1999). Utah PIF was organized in 1993 for the purpose of addressing the status of avian populations within the state and to provide data relevant to issues raised concerning the status of NTMBs in the Western Hemisphere.

Today, PIF has grown to become an international organization (PIF Canada and PIF Mexico have been established) with full-time Eastern and Western Regional Coordinator positions in the United States, numerous working groups and organizational committees, as well as government and non-government employees dedicated either full-time or part-time to the overall PIF conservation effort. In addition, the scope of PIF has now grown to include all birds except waterfowl. Each state in the Western Region of PIF has been established as a Conservation Planning Unit and is developing a Bird Conservation Plan to identify priority species in need of conservation action. The Utah Avian Conservation Strategy is the title given to the Bird Conservation Plan for Utah. The Strategy has resulted from coordinated and cooperative efforts by state and federal agency professionals, university faculty, non-governmental conservation organizations, and private individuals.

PURPOSE

Effective and efficient ecological management involves determining which of Utah’s avian species and their habitats are most in need of conservation. One purpose of the Strategy is to prioritize avian species and their habitats and to set objectives designed to determine which are most in need of immediate and continuing conservation efforts. Attempts to reverse or at least curb declining trends will also require a coordinated and cooperative effort. Thus, the other purpose of the Strategy is to recommend appropriate conservation actions required to accomplish stated objectives.

SCOPE

Portions of 5 physiographic regions (i.e., Utah Mountains, Colorado Plateau, Basin and Range, Wyoming Plateau, and Mojave Desert) and their associated avifaunas are located in Utah. Approximately 231 species of birds, excluding waterfowl, breed in Utah on a regular basis. Of these, 24 species have been prioritized for conservation efforts. These 24 priority species utilize at least 18 priority habitats within Utah which are also identified and discussed in this document. Additional species that may benefit from conservation actions recommended herein are also listed as part of the narratives describing each priority avian species. Narratives are composed in such a way as to provide as much information that is specific to the Utah portion of the species’ range as possible.

OBJECTIVES AND STRATEGIES

Objectives

Utah PIF is organized into five working committees made up of professionals from state and federal natural resources agencies, universities, and non-governmental organizations. A multi-agency Steering Committee was established with the objectives of coordinating and directing the Bird Conservation Plan process. A multi-agency Rankings Committee was established with the objective of evaluating available data on Utah's avian species and ranking each species according to priority for possible conservation action. A multi-agency Habitat Committee has functioned with the objective of assessing habitat requirements for avian populations and to provide recommendations for conservation efforts within high priority avian habitats. A GAP (Geographic Approach to Planning) Committee has provided statewide habitat data using the GAP models produced for Utah and has functioned to revise and update selected avian GAP models for Utah. Finally, an Information and Education Committee has functioned with the overall objective of identifying information needs relevant to the Utah PIF process and relevant issues regarding avian conservation in the state.

Strategies

The strategy of Utah PIF to meet the stated objectives has been to solicit and encourage participation from as many state and federal agencies as possible in evaluating Utah's avian resources for planning purposes. Utah PIF recognized early on that no single individual or agency has the resources necessary to effectively evaluate the state's avian resources for the purpose of producing a comprehensive plan that establishes priority species and identifies priority habitats. Thus, Utah PIF has sought to meet objectives through a cooperative approach involving Memorandums of Understanding/Agreement (MOU/MOAs) with state and federal agencies, universities, and non-governmental organizations and by expanding partnerships with other organizations and individuals seeking to enhance the state's avian resources.

EVALUATION OF PROGRESS

The Strategy should be considered as part of a dynamic process that will be updated and revised periodically. Periodic review of progress towards the objectives and strategies identified in UTACS is anticipated and will be carried out by the standing committees. Research and monitoring needs are listed that relate directly to the priority species identified and pertinent management questions, and we envision research and monitoring fulfilling a critical link in the adaptive nature of this plan.

COORDINATION

Coordination and cooperation among existing and new partners will determine in no small part the overall success of UTACS. In order to effectively implement UTACS into existing and future working plans (e.g., forest plans, district and statewide management plans, etc.), informational and educational briefings and additional networking should be pursued. On a broader scale, Utah PIF is now pursuing partnerships with other avian management organizations, including the North American Bird Conservation Initiative and the Joint Venture programs, for future cooperation and coordination. International coordination with PIF Canada and PIF Mexico is already underway as part of the overall implementation efforts for the Bird Conservation Plans and conservation strategies throughout North America and the Western Hemisphere.

While coordination and cooperation among partner agencies and organizations is a very important component of UTACS, on-the-ground wildlife and habitat management must not be overlooked. Local wildlife and habitat managers are generally more familiar with their resource management areas than anyone else and will be front-line in effecting the successful implementation of UTACS objectives and recommendations.

ORGANIZATION OF THIS DOCUMENT

This document represents one of the most comprehensive compilations of Utah avian information ever attempted, providing general information for hundreds of Utah's breeding birds and detailed information for over 20 priority species. It also provides detailed descriptions and maps of Utah's bird habitats.

The **INTRODUCTION** provides background information and a brief history of PIF. The **UTAH PARTNERS IN FLIGHT MISSION STATEMENT** declares that "the mission of Utah PIF is to ensure the conservation of Utah bird populations and their associated habitats through cooperative planning and coordinated management." The **UTAH PARTNERS IN FLIGHT PRINCIPLES** provide the framework for accomplishing the Utah PIF mission.

The **STATUS AND DISTRIBUTION OF BIRDS IN UTAH** provides general information on breeding and winter habitat use, distribution within the state, and migratory status of 231 breeding species. This section also illustrates the relative use of Utah's habitats by the state's bird species.

The **ECOLOGICAL SUMMARY OF UTAH** discusses which birds and habitats occur in each of the state's physiographic regions and looks at the influence of latitude and elevation on Utah's birds and bird habitats. This section also provides detailed information on nest characteristics, prey items, and foraging strategies for Utah's breeding birds and arranges birds into foraging guilds and nesting groups.

BIRDS IN UTAH MOST IN NEED OF CONSERVATION provides a description of the process used to evaluate and rank each of Utah's bird species. Detailed species accounts are given for 24 Priority Species, those that ranked highest for consideration for conservation actions. Each species account details distribution, ecology, and habitat requirements and lists associated species. These accounts also provide management issues and conservation recommendations and include suggestions for research and educational outreach.

HABITATS IN UTAH MOST IN NEED OF CONSERVATION gives detailed descriptions of Utah's bird habitats including dominant and associated vegetation, distribution, and bird use; habitats are mapped using products modified from Utah's GAP analysis. The section also discusses the selection of Priority Habitats for Utah.

Conservation topics important to the overall strategy of conserving birds in Utah are discussed in the **ADDITIONAL CONSERVATION CONSIDERATIONS** section. While some of these issues may have been discussed in specific species or habitat accounts, they have broad implications to a wide variety of Utah birds and are thus emphasized in this section.

The **UTAH AVIAN CONSERVATION STRATEGY IMPLEMENTATION** section states the initial Goals and Objectives of the Utah PIF program. This section also provides a brief description of the North American Bird Conservation Initiative (NABCI) and a Recommendation Summary Matrix of conservation issues and recommendations provided in this document for each of the priority species grouped by habitat. Continued partnerships and funding opportunities are discussed, as are development/revision of new policies and initiatives.

The **INFORMATION AND EDUCATION** section provides suggestions to be used as a starting point for developing and expanding Information and Education Outreach for the Utah PIF Program.

Finally, the **LITERATURE CITED** section provides an extensive, but not exhaustive, bibliography of bird conservation and habitat with particular emphasis on Utah birds, their habitats, and their conservation.

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Several authors who have written species accounts for the Utah Partners in Flight Priority Species discussed in this document. Individual partners were selected based on their knowledge of the species, knowledge of published information relating to the species, and willingness to work. Without question, each author has done an outstanding job, and the contribution of their time and expertise to the writing of this draft of the Utah Avian Conservation Strategy has greatly enhanced this endeavor. Priscilla Summers (USFS) is the author of the Lewis's Woodpecker, Lucy's Warbler, and Three-toed Woodpecker accounts. Steve Hedges (BLM) is the author of the Abert's Towhee and Gambel's Quail accounts. Karen Lindsey (FWS) is the author of the American Avocet and Black-necked Stilt accounts. Ann Ellison (UDWR) is the author of the Mountain Plover account. Dean Mitchell (UDWR) is the author of the Sage-grouse and Sharp-tailed Grouse accounts. Don Paul (UDWR) is the author of the American White Pelican and Long-billed Curlew accounts. Frank Howe (UDWR) is the author of the Bobolink, Brewer's Sparrow, Black Swift, and Yellow-billed Cuckoo accounts. Jim Parrish (UDWR) is the author of the Virginia's Warbler, Black-throated Gray Warbler, and Broad-tailed Hummingbird accounts. John Martin (DOD; U. S. Army Dugway Proving Ground) is the author of the Sage Sparrow and Gray Vireo accounts. Clayton M. White, Brigham Young University, is the author of the Ferruginous Hawk and Black Rosy-Finch accounts. Paul Gardner, Snow College, was instrumental in developing the avian habitat and foraging guild tables presented in this document, as well as A Handbook for Habitat Restoration and Revegetation for the Conservation of Land Birds in Utah (UDWR Report 99-38).

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INTRODUCTION

The decline of avian populations, particularly Neotropical migratory birds (NTMBs), in North America and several areas of the Western Hemisphere are well documented. The reasons for declines are complex, and include loss of habitat due to fragmentation, modification, urban expansion, and natural disasters, loss or alteration of habitat in non-breeding areas and along migratory routes, and brood parasitism as the primary factors responsible. Neotropical migrants are defined as landbirds that fall into 4 basic categories of species that breed in North America north of Mexico, and then migrate to and from the tropics (Finch and Martin 1991, Gauthreaux 1992, Hunter and Pashley 1999). Nationally, Partners in Flight (PIF) was originally formed in 1990 to emphasize conservation of species not otherwise covered by existing conservation initiatives. Nearctic-Neotropical migratory landbirds were not included in initiatives directed towards waterfowl (North American Waterfowl Management Plan), shorebirds (Western Hemispheric Shorebird Reserve Network), or colonial waterbirds (Colonial Waterbird Group), or with numerous other initiatives addressing tropical biodiversity (Hunter and Pashley 1999).

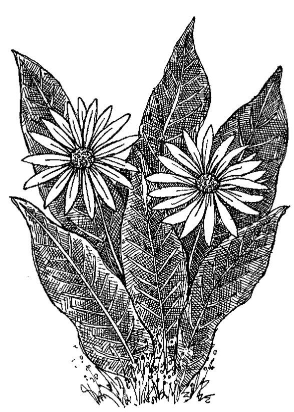
Thus, PIF began as a coordinated, multi-faceted effort with the goal of addressing Neotropical migrants primarily songbirds, in the United States. Conservation Planning Units (CPU) were established as grass roots organizations in each state except Hawaii using volunteers as well as professionals, and work was begun. Today, PIF has grown to become an international organization (PIF Canada and PIF Mexico now established) with full-time Eastern and Western Regional Coordinator positions in the United States, numerous working groups and organizational committees, as well as Chair persons and state and federal agency employees dedicated either full-time or part-time to the overall PIF conservation effort. In addition, the scope of PIF has now grown to include all birds, and each CPU has produced a Bird Conservation Plan (BCP) to identify priority species in need of conservation action. Utah PIF was organized in 1993 for the purpose of addressing the status of avian populations within the state and to provide data relevant to issues raised concerning the status of NTMBs in the western United States.

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 objective of the National PIF Bird Conservation Strategy known as “The Flight Plan.” The Strategy has provided the framework for Bird Conservation Plans (BCPs) that set conservation priorities and specific objectives for bird populations and habitat for every state and ecoregion in the United States. The Strategy also lays out the means by which these Plans can be implemented. The process has involved an unprecedented level of voluntary cooperation and coordination among state and federal agencies, private organizations, industry, and the general public and has been described as cooperative wildlife management at its best. The power in the process lies in the synergy that builds when such diverse and committed organizations and individuals work together for a common goal. The Bird Conservation Strategy and PIF are common sense approaches to the conservation of birds and their habitats.

Initially, the Strategy addressed only nongame land birds in the United States. The development of each BCP has been a simultaneous and interactive process in which actions have been decided upon and taken at grass roots and local levels in the context of priorities set at both local and larger geographic scales. Development of BCPs are underway within each ecoregion and state reflect local conditions and interests. Regional and national levels BCPs will be developed to assure comprehensive attention to priority issues.

Focused, cooperative, and voluntary habitat conservation on a landscape level is the key to avian conservation. Focusing on habitat will improve conditions for all birds, whether migratory or resident, endangered or common, game or non-game, and will contribute to the protection of other forms of wildlife, plants, and ecological communities. Success will not be possible without recognition of landowner objectives and encouragement of compatible land use practices.

Ultimately, the Strategy can be applied to the conservation of over 800 species of birds in the continental United States and close to 4,000 species in the Western Hemisphere. Many of these species bind nations together through annual migrations and dependence on the conservation of habitats across state and international boundaries. On the national level, cooperation and coordination are underway with PIF Canada and PIF Mexico, and with other avian conservation organizations such as the North American Bird Conservation Initiative and the various Joint Venture groups. Many private conservation organizations and various industrial firms are seeking to become active partners in the overall PIF process in North America.



UTAH PARTNERS IN FLIGHT MISSION STATEMENT

The mission of Utah PIF is to ensure the conservation of Utah bird populations and their associated habitats through cooperative planning and coordinated management. As applicable to the Utah PIF mission, federal and state laws, and Western Regional and National PIF initiatives:

STATEMENT 1. Utah Partners in Flight recognize that birds are among the most diverse and abundant forms of wildlife within the global ecosystem.

STATEMENT 2. Utah Partners in Flight agree that conservation of bird populations and their habitats is critical to maintaining long-term health of the global environment.

STATEMENT 3. Utah Partners in Flight further recognize that healthy bird populations and ecosystems contribute substantially to ecological, economic, recreational, scientific, and aesthetic values for our society.

STATEMENT 4. Utah's birds also occur in neighboring states and nations, and Utah Partners in Flight is part of an international partnership effort dedicated to conserving bird populations and their habitats, thus contributing to state, regional, and international goals for bird populations through multi-agency, university, and private sector partnerships to ensure the future of hemispheric bird populations.

STATEMENT 5. The Partners promote stewardship of birds and their habitats for current and succeeding generations through monitoring, research, management, and education.

UTAH PARTNERS IN FLIGHT PRINCIPLES

PRINCIPLE 1. Protection of bird populations and their habitats is mandated within the framework of sound natural resource principles and existing state and federal directives, management goals, and objectives.

PRINCIPLE 2. Sustaining bird populations and their habitats requires long-term planning and the close cooperation and coordination of management activities by state and federal agencies, private interests, and the general public.

PRINCIPLE 3. The maintenance of abundant bird populations in Utah is dependent on the protection, restoration, and management of habitats. Persistent degradation and loss of important bird habitats should be reversed.

PRINCIPLE 4. Priority Utah bird species and their habitats should be identified and their conservation needs established for breeding, migration, and over-wintering requirements.

PRINCIPLE 5. Partnerships consisting of state and federal agencies, private organizations, and the general public are considered the best approach to identifying high priority bird populations and their important habitats. The conservation needs of these species and their habitats can only be addressed through a pooling of resources, expertise, and funding to effect viable, consistent, common sense, and long-term management recommendations.

PRINCIPLE 6. Healthy bird populations and their habitats reflect a positive quality of life for humanity and contribute to economic, recreational, scientific, educational, and aesthetic values for society.

STATUS AND DISTRIBUTION OF BIRDS IN UTAH

Pictographs of birds on Newspaper Rock, reflected in the Utah Partner's In Flight logo, attest to the long history of human-bird interactions in what is now the State of Utah. Parmalee (1980) details the use of birds in the period before European explorers and settlers; Behle (1990) sums up this work by simply noting "the birds identified are essentially the same as those found in the area today". Without concerted action the same will not be said of our tenure.

The intensity and scope of human impacts upon the landscape have soared far beyond our fragmentary knowledge of Utah's avifauna. But despite the incomplete picture, it is clear that the majority of human-induced changes in bird populations and distributions have occurred in the recent past: only 40 years ago American Redstart were regular breeders in the Salt Lake Valley (Frost 1997). This relatively short span of time speaks to the promise and wisdom of the proactive approach embodied in the Utah Avian Conservation Strategy (UTACS): it is not too late. To date over 400 species of birds have been identified in the state. Many of these are only brief visitors and do not warrant conservation action while here. But more than half are regular breeders unsheltered by any comprehensive approach to their conservation. These are the species that must be assessed and prioritized so the real work of conserving species and habitats can begin.

The UTACS Rankings Committee carefully considered the Breeding Bird Survey (BBS) database for Utah, published species records, and expert opinion in deciding on the number of birds that regularly breed in the state. Of the 406 species accepted when this effort began (Utah Ornithological Society Bird Records Committee 1998), 49 were already covered by the 1998 North American Waterfowl Management Plan (1998). Transients, irregular breeders, and other rarities comprised 126 species. The remaining 231 species have been recognized as regular breeders in need of consideration in the UTACS process (Table 1). Of these 231 species, 132 (57 %) are Neotropical migratory birds (NTMB), and 29 (12%) are considered State Sensitive species (Howe 1992, UDWR 1998). Two of the State Sensitive species are also federally listed as Endangered and 4 are listed as Threatened (UDWR 1998).

Primary and secondary breeding habitat preferences were evaluated for each of the 231 species based on expert opinion and several published sources (Behle and Perry 1975, Hayward et al. 1976, Walters and Sorenson 1983, Behle et al. 1985, Ryser 1994). Winter habitat preferences were also considered for those species that regularly overwinter in Utah. Primary breeding habitat was defined as the nesting habitat most commonly used by a species. Secondary breeding habitat was the second most common nesting habitat (habitat specialists were assigned the same primary and secondary breeding habitats). These 'bird-habitat' categories are essentially a set of relevant vegetation types derived from the Utah GAP vegetation classifications (Edwards et al. 1995) as modified by the Utah PIF Rankings Committee to better reflect bird use. Species distributions were also evaluated and updated for each physiographic region to provide the most accurate, up-to-date information available (Table 1).

Tallying the number of species assigned to each habitat category in Table 1 provides a coarse estimate of relative importance of each to Utah's breeding birds. Overall, Lowland Riparian is the single most important habitat type in the state. Other important habitats include Mountain Riparian, Wetland, Agriculture, Low Desert Scrub, and High Desert Scrub. Of Utah's breeding birds, 99 species (43%) leave Utah in winter. Low elevation habitat types are notably important for those that remain. In particular, four habitats, Lowland Riparian, Agriculture, Low Desert Scrub, and Wetland, provide winter habitat for almost 60% of the wintering species in Utah. Birds that use these habitats are a combination of elevational migrants (those that nest at higher elevations), temperate migrants (those that nest at higher latitudes), and permanent resident species. In addition to Lowland Riparian, permanent resident species were associated with Lowland Riparian, Water, Pinyon-Juniper, Sub-Alpine Conifer, and Agriculture.

Table 1. Distribution, Habitat Types, Utah PIF Conservation Scores, and Migration Status of 231 Breeding Bird Species in Utah. Utah PIF Priority Species are listed in bold type.

Common Name[1]	Score[2]	UM[3]	BR[3]	MD[3]	WB[3]	CP[3]	1E Breeding[4]	2E Breeding[5]	Winter Habitat[6]	Status[7]
Abert's Towhee	40			X			Lowland Riparian	Lowland Riparian	Lowland Riparian	P
Acorn Woodpecker	29					X	Desert Oak	Desert Oak	Desert Oak	P
American Avocet	37		X		X	X	Wetland	Playa	Migrant	M
American Bittern	30		X		X	X	Wetland	Wetland	Migrant	M
American Coot	19	X	X	X	X	X	Wetland	Water	Wetland	P
American Crow	16	X	X		X	X	Lowland Riparian	Agriculture	Lowland Riparian	P
American Dipper	30	X	X				Mountain Riparian	Lowland Riparian	Mountain Riparian	P
American Goldfinch	21	X	X		X	X	Lowland Riparian	Mountain Riparian	Lowland Riparian	B
American Kestrel	20	X	X	X	X	X	Lowland Riparian	Agriculture	Agriculture	B
American Pipit	24	X					Alpine	Wet Meadow	Agriculture	B
American Redstart	25				X		Lowland Riparian	Mountain Riparian	Migrant	A
American Robin	16	X	X	X	X	X	Lowland Riparian	Urban	Urban	B
American White Pelican[8]	36		X		X		Water	Wetland	Migrant	M
Ash-throated Flycatcher	23	X	X	X	X	X	Pinyon-Juniper	Low Desert Scrub	Migrant	A
Bald Eagle[9]	27	X				X	Lowland Riparian	Agriculture	Lowland Riparian	P
Band-tailed Pigeon	25	X	X			X	Ponderosa Pine	Mixed Conifer	Migrant	A
Bank Swallow	24		X		X	X	Lowland Riparian	Lowland Riparian	Migrant	A
Barn Owl	24	X	X	X	X	X	Agriculture	Agriculture	Agriculture	P
Barn Swallow	18	X	X	X	X	X	Lowland Riparian	Cliff	Migrant	A
Bell's Vireo[8]	35			X			Lowland Riparian	Lowland Riparian	Migrant	A
Belted Kingfisher	23	X	X	X	X	X	Lowland Riparian	Wetland	Lowland Riparian	B
Bendire's Thrasher	33		X	X		X	Low Desert Scrub	Low Desert Scrub	Migrant	B
Bewick's Wren	26		X	X	X	X	Lowland Riparian	Pinyon-Juniper	High Desert Scrub	P
Black Phoebe	27			X		X	Lowland Riparian	Cliff	High Desert Scrub	P
Black Rosy-Finch	35	X					Alpine	Alpine	Grassland	P
Black Swift[8]	34	X					Lowland Riparian	Cliff	Migrant	A
Black Tern[8]	30		X				Wetland	Wetland	Migrant	M
Black-billed Magpie	24	X	X		X	X	Lowland Riparian	Pinyon-Juniper	Agriculture	P
Black-capped Chickadee	22	X	X	X	X	X	Mountain Riparian	Lowland Riparian	Lowland Riparian	P
Black-chinned Hummingbird	28	X	X	X	X	X	Pinyon-Juniper	Mountain Shrub	Migrant	A
Black-chinned Sparrow	31		X	X		X	Low Desert Scrub	High Desert Scrub	Migrant	A
Black-crowned Night-Heron	24	X	X	X	X	X	Wetland	Lowland Riparian	Wetland	P
Black-headed Grosbeak	27						Lowland Riparian	Mountain Riparian	Migrant	B
Black-necked Stilt	34		X				Wetland	Playa	Migrant	M
Black-tailed Gnatcatcher	33			X			Low Desert Scrub	Lowland Riparian	Low Desert Scrub	P
Black-throated Gray Warbler	32	X	X	X		X	Pinyon-Juniper	Mountain Shrub	Migrant	A
Black-throated Sparrow	27	X	X	X		X	High Desert Scrub	Low Desert Scrub	Low Desert Scrub	B
Blue Grosbeak[8]	30	X	X	X		X	Lowland Riparian	Lowland Riparian	Migrant	A
Blue Grouse	30	X	X		X	X	Sub-Alpine Conifer	Mountain Shrub	Mixed Conifer	P
Blue-gray Gnatcatcher	25	X	X	X	X	X	Pinyon-Juniper	Lowland Riparian	Migrant	A
Bobolink[8]	36		X				Wet Meadow	Agriculture	Migrant	A
Brewer's Blackbird	21	X	X	X	X	X	Agriculture	Wet Meadow	Agriculture	B
Brewer's Sparrow	34	X	X	X	X	X	Shrubsteppe	High Desert Scrub	Migrant	A
Broad-tailed Hummingbird	33	X	X		X	X	Lowland Riparian	Mountain Riparian	Migrant	A
Brown Creeper	25	X	X			X	Mixed Conifer	Sub-Alpine Conifer	Lowland Riparian	B
Brown-crested Flycatcher	33			X			Lowland Riparian	Low Desert Scrub	Migrant	C
Brown-headed Cowbird	15	X	X	X	X	X	Agriculture	Urban	Agriculture	B

Common Name[1]	Score[2]	UM[3]	BR[3]	MD[3]	WB[3]	CP[3]	1E Breeding[4]	2E Breeding[5]	Winter Habitat[6]	Status[7]
Bullock's Oriole	27	X	X	X	X	X	Lowland Riparian	Urban	Migrant	A
Burrowing Owl[8]	28		X	X	X	X	High Desert Scrub	Grassland	Migrant	A
Bushtit	26		X	X		X	Pinyon-Juniper	Mountain Riparian	Mountain Riparian	P
Cactus Wren	28			X			Low Desert Scrub	Low Desert Scrub	Low Desert Scrub	P
California Gull	21	X	X		X		Playa	Water	Water	P
California Quail	24	X	X			X	Northern Oak	Urban	Urban	P
Calliope Hummingbird	30	X	X		X		Mountain Riparian	Mountain Shrub	Migrant	A
Canyon Wren	27	X	X	X	X	X	Cliff	Rock	Cliff	P
Caspian Tern[8]	29		X				Playa	Water	Migrant	M
Cassin's Finch	27	X	X		X	X	Aspen	Sub-Alpine Conifer	Lowland Riparian	B
Cassin's Kingbird	29		X	X		X	Lowland Riparian	Pinyon-Juniper	Migrant	A
Cattle Egret	16		X			X	Wetland	Agriculture	Migrant	M
Cedar Waxwing	25		X	X		X	Mountain Riparian	Lowland Riparian	Lowland Riparian	B
Chipping Sparrow	21	X	X	X	X	X	Mountain Shrub	Mountain Riparian	Migrant	A
Chukar	24	X	X			X	High Desert Scrub	Shrubsteppe	High Desert Scrub	P
Clark's Grebe	31		X				Wetland	Water	Water	P
Clark's Nutcracker	27	X	X		X	X	Mixed Conifer	Sub-Alpine Conifer	Mixed Conifer	P
Cliff Swallow	21	X	X	X	X	X	Lowland Riparian	Cliff	Migrant	A
Common Black-Hawk	32			X			Lowland Riparian	Lowland Riparian	Migrant	C
Common Grackle	22	X			X	X	Lowland Riparian	Urban	Migrant	M
Common Moorhen	27		X	X			Wetland	Water	Wetland	P
Common Nighthawk	23	X	X		X	X	Pinyon-Juniper	Lowland Riparian	Migrant	A
Common Poorwill	28	X	X	X	X	X	Pinyon-Juniper	Lowland Riparian	Migrant	B
Common Raven	17	X	X	X	X	X	Cliff	Pinyon-Juniper	Agriculture	P
Common Snipe	23	X	X	X	X	X	Wet Meadow	Wetland	Wet Meadow	P
Common Yellowthroat[8]	21	X	X		X	X	Wetland	Lowland Riparian	Migrant	A
Cooper's Hawk	26	X	X	X	X	X	Lowland Riparian	Mountain Riparian	Urban	B
Cordilleran Flycatcher	32	X	X		X	X	Sub-Alpine Conifer	Mountain Riparian	Migrant	A
Costa's Hummingbird	31			X			Low Desert Scrub	Low Desert Scrub	Migrant	A
Crissal Thrasher[8]	30			X			Low Desert Scrub	Lowland Riparian	Low Desert Scrub	P
Dark-eyed Junco(Gray-headed)	18	X			X		Sub-Alpine Conifer	Aspen	Lowland Riparian	B
Double-crested Cormorant	20		X		X	X	Water	Lowland Riparian	Migrant	M
Downy Woodpecker	21	X	X		X	X	Aspen	Lowland Riparian	Lowland Riparian	P
Dusky Flycatcher	30	X	X		X	X	Mountain Riparian	Aspen	Migrant	A
Eared Grebe	18		X		X	X	Wetland	Water	Water	P
Eastern Kingbird	25	X	X		X		Lowland Riparian	Agriculture	Migrant	A
European Starling	16	X	X	X	X	X	Agriculture	Lowland Riparian	Agriculture	P
Evening Grosbeak	23	X	X			X	Mixed Conifer	Sub-Alpine Conifer	Lowland Riparian	P
Ferruginous Hawk[9]	33		X		X	X	Pinyon-Juniper	Shrubsteppe	Grassland	B
Flammulated Owl	27	X	X			X	Ponderosa Pine	Sub-Alpine Conifer	Migrant	A
Forster's Tern	26		X			X	Wetland	Water	Migrant	M
Fox Sparrow	25	X	X			X	Mountain Riparian	Mountain Shrub	Migrant	B
Franklin's Gull	31		X				Wetland	Wetland	Migrant	M
Gambel's Quail	32		X	X		X	Low Desert Scrub	Lowland Riparian	Low Desert Scrub	P
Golden Eagle	23	X	X	X	X	X	Cliff	High Desert Scrub	High Desert Scrub	B
Golden-crowned Kinglet	28	X	X			X	Sub-Alpine Conifer	Aspen	Mountain Shrub	B
Grace's Warbler	29	X	X			X	Ponderosa Pine	Mixed Conifer	Migrant	A
Grasshopper Sparrow[8]	32		X		X	X	Grassland	Grassland	Migrant	A
Gray Catbird	29	X	X		X	X	Lowland Riparian	Mountain Riparian	Migrant	A
Gray Flycatcher	32	X	X	X		X	Pinyon-Juniper	High Desert Scrub	Migrant	A

Common Name[1]	Score[2]	UM[3]	BR[3]	MD[3]	WB[3]	CP[3]	1E Breeding[4]	2E Breeding[5]	Winter Habitat[6]	Status[7]
Gray Jay	26	X			X		Mixed Conifer	Sub-Alpine Conifer	Mixed Conifer	P
Gray Partridge	23	X	X				Grassland	Agriculture	Shrubsteppe	P
Gray Vireo	36	X	X	X		X	Pinyon-Juniper	Northern Oak	Migrant	A
Great Blue Heron	25	X	X	X	X	X	Wetland	Lowland Riparian	Wetland	P
Great Horned Owl	19	X	X	X	X	X	Mountain Riparian	Lowland Riparian	Agriculture	P
Greater Roadrunner	28		X	X		X	Low Desert Scrub	High Desert Scrub	Low Desert Scrub	P
Great-tailed Grackle	25		X	X		X	Playa	Lowland Riparian	Lowland Riparian	P
Green Heron	26			X			Lowland Riparian	Wetland	Wetland	P
Green-tailed Towhee	29	X	X		X	X	Mountain Shrub	High Desert Scrub	Migrant	A
Hairy Woodpecker	21	X	X		X	X	Mountain Riparian	Lowland Riparian	Lowland Riparian	P
Hammond's Flycatcher	31	X	X			X	Sub-Alpine Conifer	Aspen	Migrant	A
Hermit Thrush	25	X	X		X	X	Sub-Alpine Conifer	Mountain Riparian	Mountain Riparian	B
Hooded Oriole	26			X			Lowland Riparian	High Desert Scrub	Migrant	A
Horned Lark	14	X	X	X	X	X	Grassland	High Desert Scrub	Grassland	B
House Finch	14	X	X	X	X	X	Lowland Riparian	Urban	Agriculture	P
House Sparrow	14	X	X	X	X	X	Urban	Lowland Riparian	Urban	P
House Wren	20	X	X		X	X	Mountain Riparian	Lowland Riparian	Migrant	A
Inca Dove	24			X			Lowland Riparian	Lowland Riparian	Low Desert Scrub	P
Indigo Bunting	25			X			Lowland Riparian	Mountain Shrub	Migrant	A
Juniper Titmouse	30	X	X	X		X	Pinyon-Juniper	Pinyon-Juniper	Pinyon-Juniper	P
Killdeer	17	X	X	X	X	X	Wetland	Wet Meadow	Agriculture	B
Ladder-backed Woodpecker	21		X	X		X	Low Desert Scrub	Lowland Riparian	Low Desert Scrub	P
Lark Bunting	27		X		X	X	Grassland	High Desert Scrub	Migrant	A
Lark Sparrow	27	X	X	X	X	X	Lowland Riparian	High Desert Scrub	Migrant	A
Lazuli Bunting	27	X	X	X	X	X	Lowland Riparian	Mountain Shrub	Migrant	A
Le Conte's Thrasher	37			X			Low Desert Scrub	Low Desert Scrub	Low Desert Scrub	P
Least Flycatcher	24	X			X		Mountain Riparian	Aspen	Migrant	A
Lesser Goldfinch	24		X	X		X	Lowland Riparian	Urban	Lowland Riparian	B
Lesser Nighthawk	20	X	X	X		X	Low Desert Scrub	Lowland Riparian	Migrant	A
Lewis's Woodpecker[8]	40	X	X		X	X	Ponderosa Pine	Lowland Riparian	Northern Oak	B
Lincoln's Sparrow	22	X	X		X	X	Mountain Riparian	Wet Meadow	Lowland Riparian	A
Loggerhead Shrike	28	X	X	X	X	X	High Desert Scrub	Pinyon-Juniper	High Desert Scrub	B
Long-billed Curlew[8]	34		X		X	X	Grassland	Agriculture	Migrant	A
Long-eared Owl	22	X	X	X	X	X	Lowland Riparian	Mountain Riparian	Lowland Riparian	B
Lucy's Warbler	36			X		X	Lowland Riparian	Low Desert Scrub	Migrant	C
MacGillivray's Warbler	25	X	X		X	X	Lowland Riparian	Mountain Shrub	Migrant	A
Marsh Wren	26	X	X		X	X	Wetland	Wetland	Wetland	B
Merlin	24		X		X		Lowland Riparian	Mixed Conifer	Agriculture	B
Mountain Bluebird	28	X	X		X	X	Mountain Riparian	High Desert Scrub	Shrubsteppe	B
Mountain Chickadee	29	X	X		X	X	Mixed Conifer	Pinyon-Juniper	Mountain Riparian	P
Mountain Plover[8]	36					X	High Desert Scrub	High Desert Scrub	Migrant	M
Mourning Dove	14	X	X	X	X	X	Lowland Riparian	Agriculture	Agriculture	B
N. Rough-winged Swallow	22	X	X	X	X	X	Lowland Riparian	Lowland Riparian	Migrant	A
Northern Flicker (Red-shafted)	19	X	X	X	X	X	Lowland Riparian	Mountain Riparian	Lowland Riparian	B
Northern Goshawk[8]	30	X	X			X	Lodgepole Pine	Aspen	Lowland Riparian	B
Northern Harrier	27	X	X	X	X	X	Wet Meadow	High Desert Scrub	Agriculture	B
Northern Mockingbird	19	X	X	X		X	High Desert Scrub	Low Desert Scrub	Urban	B
Northern Pygmy-Owl	30	X	X		X	X	Mountain Riparian	Mixed Conifer	Lowland Riparian	P
Northern Saw-whet Owl	24	X	X		X		Mountain Riparian	Aspen	Mountain Riparian	P
Olive-sided Flycatcher	31	X	X		X	X	Sub-Alpine Conifer	Ponderosa Pine	Migrant	A

Common Name[1]	Score[2]	UM[3]	BR[3]	MD[3]	WB[3]	CP[3]	1E Breeding[4]	2E Breeding[5]	Winter Habitat[6]	Status[7]
Orange-crowned Warbler	25	X	X		X	X	Mountain Riparian	Mountain Shrub	Migrant	A
Osprey[8]	23	X	X		X		Water	Water	Migrant	B
Peregrine Falcon[10]	29	X	X	X		X	Cliff	Lowland Riparian	Wetland	A
Phainopepla	27		X	X		X	Lowland Riparian	Low Desert Scrub	Lowland Riparian	A
Pied-billed Grebe	26		X		X	X	Wetland	Water	Wetland	P
Pine Grosbeak	25	X					Sub-Alpine Conifer	Sub-Alpine Conifer	Mixed Conifer	P
Pine Siskin	18	X	X		X	X	Sub-Alpine Conifer	Mixed Conifer	Lowland Riparian	B
Pinyon Jay	31	X	X	X	X	X	Pinyon-Juniper	Ponderosa Pine	Pinyon-Juniper	P
Plumbeous Vireo	30	X	X	X	X	X	Mixed Conifer	Mountain Riparian	Migrant	A
Prairie Falcon	30	X	X	X	X	X	Cliff	High Desert Scrub	Agriculture	B
Purple Martin	26	X		X		X	Aspen	Mixed Conifer	Migrant	A
Pygmy Nuthatch	30	X				X	Ponderosa Pine	Aspen	Ponderosa Pine	P
Red Crossbill	21	X	X	X	X	X	Ponderosa Pine	Mixed Conifer	Mixed Conifer	P
Red-breasted Nuthatch	17	X	X		X	X	Ponderosa Pine	Ponderosa Pine	Mixed Conifer	P
Red-naped Sapsucker	29	X	X	X	X	X	Aspen	Mixed Conifer	Mountain Riparian	B
Red-tailed Hawk	20	X	X	X	X	X	Lowland Riparian	Aspen	Agriculture	B
Red-winged Blackbird	18	X	X	X	X	X	Wetland	Wet Meadow	Agriculture	B
Ring-billed Gull	21		X	X			Water	Water	Water	P
Ring-necked Pheasant	27	X	X	X	X	X	Agriculture	Grassland	Wetland	P
Rock Dove	17	X	X	X	X	X	Urban	Agriculture	Urban	P
Rock Wren	25	X	X	X	X	X	Rock	Playa	Rock	B
Ruby-crowned Kinglet	22	X	X		X	X	Sub-Alpine Conifer	Mixed Conifer	Mixed Conifer	B
Ruffed Grouse	28	X	X		X	X	Aspen	Mountain Riparian	Aspen	P
Rufous-crowned Sparrow	28	X		X			Grassland	Rock	Low Desert Scrub	P
Sage-grouse[8, 11]	36	X	X		X	X	Shrubsteppe	Shrubsteppe	Shrubsteppe	P
Sage Sparrow	32	X	X	X	X	X	Shrubsteppe	High Desert Scrub	Low Desert Scrub	B
Sage Thrasher	29	X	X	X	X	X	Shrubsteppe	High Desert Scrub	Migrant	B
Sandhill Crane	29	X	X		X		Wet Meadow	Agriculture	Migrant	M
Savannah Sparrow	22	X	X	X	X	X	Grassland	Wet Meadow	Grassland	B
Say's Phoebe	21	X	X	X	X	X	High Desert Scrub	Low Desert Scrub	Low Desert Scrub	B
Scaled Quail	27		X			X	High Desert Scrub	Low Desert Scrub	Low Desert Scrub	P
Scott's Oriole	29	X	X	X		X	Low Desert Scrub	Pinyon-Juniper	Migrant	A
Sharp-shinned Hawk	22	X	X	X	X	X	Mixed Conifer	Mountain Shrub	Urban	B
Sharp-tailed Grouse[8]	34	X	X				Shrubsteppe	Grassland	Shrubsteppe	P
Short-eared Owl[8]	29	X	X		X	X	Wetland	Grassland	Agriculture	B
Snowy Egret	19		X		X	X	Wetland	Agriculture	Migrant	M
Snowy Plover	31	X	X			X	Playa	Playa	Migrant	M
Song Sparrow	21	X	X	X	X	X	Lowland Riparian	Mountain Riparian	Lowland Riparian	B
Sora	24	X	X	X	X	X	Wetland	Wetland	Wetland	P
Spotted Owl (Mexican)[9]	32	X				X	Cliff	Lowland Riparian	Cliff	P
Spotted Sandpiper	22	X	X	X	X	X	Wetland	Lowland Riparian	Migrant	M
Spotted Towhee (Rufous-sided)	24	X	X	X	X	X	Mountain Shrub	Lowland Riparian	Mountain Shrub	B
Steller's Jay	24	X	X	X	X	X	Mountain Shrub	Northern Oak	Mountain Shrub	P
Summer Tanager	31			X			Lowland Riparian	Lowland Riparian	Migrant	A
Swainson's Hawk[8]	23	X	X		X	X	Agriculture	Aspen	Migrant	A
Swainson's Thrush	25	X	X		X	X	Mountain Riparian	Aspen	Migrant	A
Three-toed Woodpecker[8]	32	X					Sub-Alpine Conifer	Lodgepole Pine	Sub-Alpine Conifer	P
Townsend's Solitaire	30	X	X		X	X	Sub-Alpine Conifer	Mountain Riparian	Lowland Riparian	B
Tree Swallow	23	X	X		X	X	Aspen	Mountain Riparian	Migrant	B
Turkey Vulture	18	X	X	X	X	X	Cliff	Cliff	Migrant	B

Common Name[1]	Score[2]	UM[3]	BR[3]	MD[3]	WB[3]	CP[3]	1E Breeding[4]	2E Breeding[5]	Winter Habitat[6]	Status[7]
Veery	29	X			X		Lowland Riparian	Lowland Riparian	Migrant	A
Verdin	27			X			Low Desert Scrub	Lowland Riparian	Low Desert Scrub	P
Vermilion Flycatcher	28			X			Low Desert Scrub	Lowland Riparian	Migrant	A
Vesper Sparrow	19	X	X		X	X	High Desert Scrub	Shrubsteppe	Migrant	B
Violet-green Swallow	26	X	X	X	X	X	Mountain Riparian	Aspen	Migrant	A
Virginia Rail	26		X	X		X	Wetland	Wetland	Wetland	P
Virginia's Warbler	36	X	X	X		X	Northern Oak	Pinyon-Juniper	Migrant	A
Warbling Vireo	23	X	X	X	X	X	Lowland Riparian	Mountain Riparian	Migrant	A
Western Bluebird	27	X	X	X	X	X	Ponderosa Pine	Pinyon-Juniper	Pinyon-Juniper	B
Western Grebe	30	X	X		X	X	Wetland	Water	Water	P
Western Kingbird	25	X	X	X	X	X	Lowland Riparian	Agriculture	Migrant	A
Western Meadowlark	24	X	X	X	X	X	High Desert Scrub	Grassland	Agriculture	B
Western Screech-Owl	31	X	X	X	X	X	Mountain Riparian	Lowland Riparian	Lowland Riparian	P
Western Scrub-Jay	26	X	X	X		X	Mountain Shrub	Pinyon-Juniper	Mountain Shrub	P
Western Tanager	22	X	X	X	X	X	Mountain Riparian	Ponderosa Pine	Migrant	A
Western Wood-Pewee	28	X	X	X	X	X	Lowland Riparian	Mountain Riparian	Migrant	A
White-breasted Nuthatch	21	X	X	X	X	X	Ponderosa Pine	Mixed Conifer	Mixed Conifer	P
White-crowned Sparrow	20	X	X		X	X	Alpine	Mountain Riparian	Lowland Riparian	B
White-faced Ibis	27	X	X		X		Wetland	Agriculture	Migrant	M
White-tailed Ptarmigan	28	X					Alpine	Mountain Riparian	Mountain Riparian	P
White-throated Swift	28	X	X	X	X	X	Cliff	Cliff	Migrant	A
White-winged Dove	20			X			Lowland Riparian	Low Desert Scrub	Low Desert Scrub	C
Wild Turkey (Merriam's)	27	X	X			X	Ponderosa Pine	Mountain Shrub	Mountain Shrub	P
Wild Turkey (Rio Grande)	27	X	X			X	Lowland Riparian	Northern Oak	Lowland Riparian	P
Willet	29		X		X		Wetland	Wet Meadow	Migrant	M
Williamson's Sapsucker[8]	31	X	X			X	Sub-Alpine Conifer	Aspen	Migrant	B
Willow Flycatcher[10]	28	X	X	X	X	X	Lowland Riparian	Mountain Riparian	Migrant	A
Wilson's Phalarope	31		X		X		Wetland	Water	Migrant	M
Wilson's Warbler	25	X	X		X	X	Mountain Riparian	Alpine	Migrant	A
Yellow Warbler	20	X	X	X	X	X	Lowland Riparian	Mountain Riparian	Migrant	A
Yellow-billed Cuckoo[9]	32	X	X	X		X	Lowland Riparian	Agriculture	Migrant	A
Yellow-breasted Chat	26	X	X	X	X	X	Lowland Riparian	Mountain Riparian	Migrant	A
Yellow-headed Blackbird	27	X	X	X	X	X	Wetland	Wet Meadow	Agriculture	A
Yellow-rumped Warbler	26	X	X		X	X	Mixed Conifer	Sub-Alpine Conifer	Lowland Riparian	P

1 Priority Species are listed in bold type; See Appendix C for Scientific Names
2 See text for explanation of Utah PIF conservation scores (possible range 10-50)
3 UM = Utah Mountains, BR = Basin & Range, MD = Mojave Desert, WB = Wyoming Basin, CP = Colorado Plateau; X indicates that species breeds within the physiographic region
4 1E Breeding Habitat: Primary habitat used during the breeding season in Utah (nesting habitat).
5 2E Breeding Habitat: Secondary habitat used during the breeding season in Utah (nesting or foraging habitat; habitat specialists may have identical 1E and 2E habitats)
6 Winter Habitat: Primary Winter Habitat in Utah.
7 Neotropical Migratory Status: A = species breeds North of US/Mexican border, winters south of border; B = species breeds North of US/Mexican border, some winter south of border; C = some breed South of US/Mexican border, winters south of border; M = Non-Neotropical migratory species (e.g., waterfowl); P = Permanent Resident species; for remaining status codes see Finch and Martin 1991, Gauthreaux 1992, and Hunter and Pashley 1999)
8 State Species of Special Concern; 1998 Utah Sensitive Species List (UDWR 1998)
9 State Threatened Species; 1998 Utah Sensitive Species List (UDWR 1998)
10 State Endangered Species; 1998 Utah Sensitive Species List (UDWR 1998)
11 Sage-grouse includes Greater and Gunnison species

ECOLOGICAL SUMMARY OF UTAH

PHYSIOGRAPHIC REGIONS OF UTAH

Aldrich (1963) and Robbins et al. (1986) contain detailed descriptions of how Physiographic Strata were determined within Utah and throughout North America. These Physiographic Strata (also called Ecoregions) have historically formed the basis for comparison of Breeding Bird Survey (BBS) results and are continually used for comparing BBS data today.

The BBS delineations were modified by PIF for most portions of North America, including Utah, to better reflect the distribution of birds and bird habitats in the U.S. and Canada. The PIF Physiographic Strata are used both by the national PIF and by UPIF for planning purposes. A total of five Physiographic Strata occur within Utah; these have been used to facilitate interaction with adjacent states which share strata. The 5 physiographic strata occurring in Utah are as follows: Great Basin, Wyoming Plateau, Utah Mountains, Colorado Plateau, and Mojave Desert (Figure 1). Ecoregional delineations are based on Pitelka (1941), Kuchler (1964), Peterson (1975), Bailey (1976), and the BBS Strata presented in (Sauer et al. 1997). The BBS Strata have been slightly modified to reflect avian distribution in Utah, but BBS ecoregion names and number codings have been retained.

GREAT BASIN

The Great Basin Ecoregion (often referred to as Basin and Range) covers most of the western half of Utah and extends across most of Nevada. In Utah, it occupies 12,025 mi^2 (31,144 km^2 - 37% of the state) and ranges in elevation from less than 1270 m (4200 ft) on the basin floor near the Great Salt Lake to over 3640 m (12,000 ft) in the Deep Creek mountain range. None of this region's watercourses escapes the Great Basin. Major watercourses include the Bear, Ogden, Weber, Jordan, and Sevier Rivers and several streams that flow into the basin from the adjacent Utah Mountains ecoregion.

Shrubsteppe and High Desert Scrub are the most common habitat types in the lower elevations. Big sagebrush (*Artemisia tridentata*) dominates much of the landscape though other scrubs such as rabbitbrush (*Chrysothamnus* spp), saltbush (*Atriplex* spp.) and greasewood (*Sarcobatus vermiculatus*) may dominate some areas. Open water (primarily the Great Salt Lake), and alkali barrens also make up a large portion of the ecoregion. Wetlands, Lowland Riparian, and Grassland are relatively rare and sparsely distributed. Urban and Agricultural habitats also occur at the lower elevations, primarily along the Wasatch front on the eastern side of the ecoregion. Other habitats tend to occur in bands of vegetation corresponding to elevation. Pinyon-Juniper, and Juniper alone in drier areas, is widespread and common in the middle elevations. Mountain Shrub habitats also occur at this and higher elevations. Above the Pinyon-Juniper belt, Mixed Conifer and Sub-Alpine Conifer, occasionally mixed with Aspen, is found in scattered locations. Mountain Riparian also occurs infrequently at higher elevations. The Ponderosa Pine belt that often occurs above Pinyon-Juniper in other Utah ecoregions, is frequently absent from Utah's Great Basin ranges. The highest peaks are usually barren rock mixed with widely scattered grasses and forbs (Bailey 1976, Edwards et al. 1995).

While there are a large variety of birds that occupy the Great Basin, there are no species endemic to this ecoregion (Ryser 1985). Typical bird species include Sage-grouse, Horned Larks, Sage Thrashers, Brewer's Sparrows, Sage Sparrows, Black-throated Sparrows, Lark Sparrows, and House Finches. A variety of breeding and wintering raptors occur in the Great Basin including Burrowing Owls, Ferruginous Hawk, Swainson's Hawk, Red-tailed Hawk, Rough-legged Hawk, Prairie Falcon, Golden Eagle, and Bald Eagle. Corvids, such as, Common Raven, Black-billed Magpie, and Pinyon Jay, are also common. The Great Salt Lake and Great Basin Wetlands feature 35 species of shorebirds, such as,

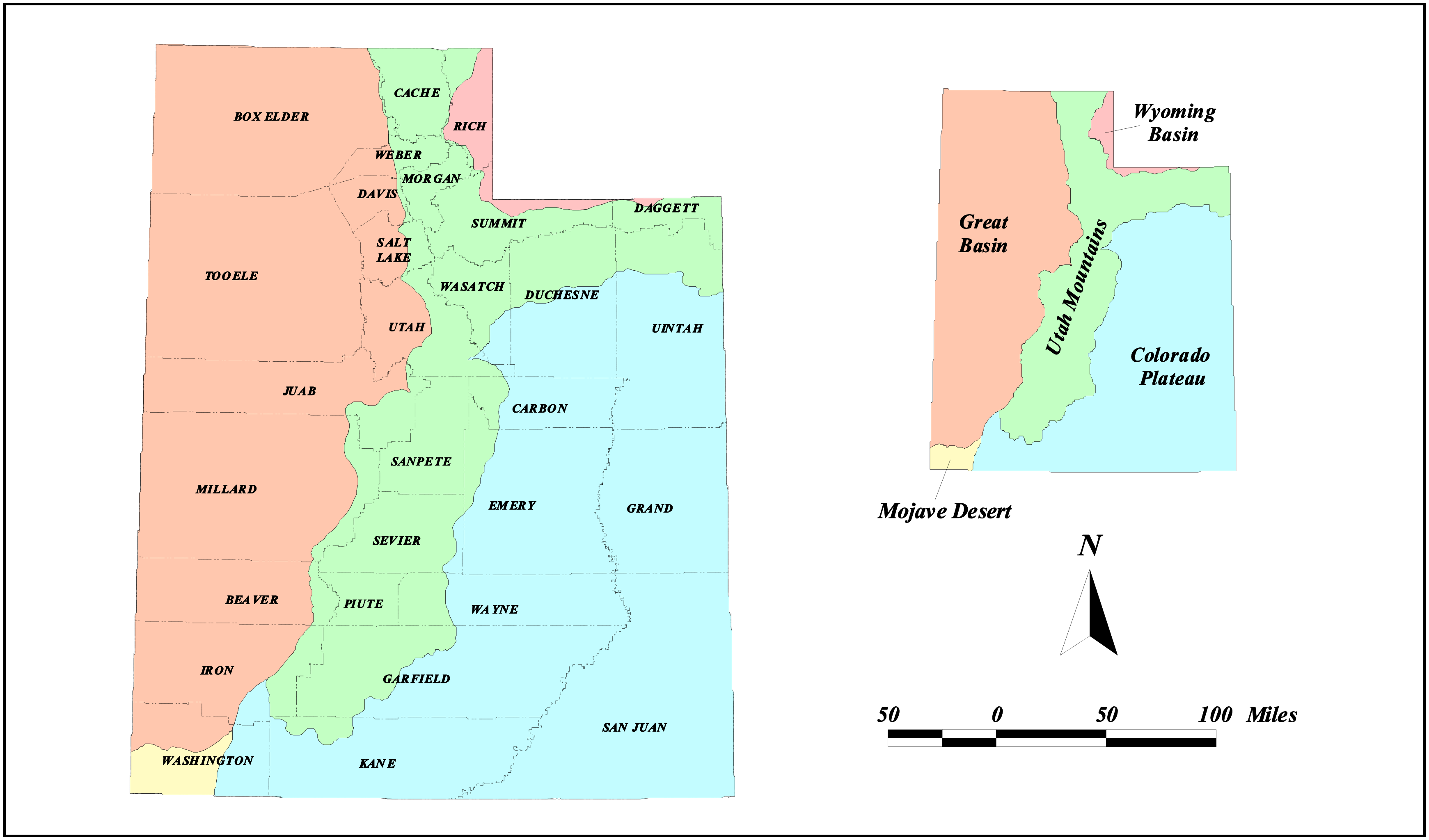


Figure 1. Physiographic Regions and Counties of Utah.

American Avocets, Black-necked Stilts, Wilson's Phalaropes, Long-billed Curlews, and Snowy Plovers and a variety of other water-associated birds like American White Pelicans, Clark's Grebes, California Gulls, Ring-billed Gulls, Black Terns, White-faced Ibises, Tundra Swans, Canada Geese and Redheads. The diversity of birds found around the Great Salt Lake contributes greatly to the diversity of this ecoregion. Of the 231 UPIF bird species, 192 (83%) occur within the Great Basin, more than any other Utah ecoregion (Table 1).

MOJAVE DESERT

The Mojave Desert Ecoregion occurs in the southwestern corner of the state and only covers about 1% (348 mi^2/901 km^2) of state's land area. It extends into eastern Arizona, southern Nevada and southern California. In Utah, elevation ranges from less than 760 m (2,500 ft) in the Virgin River gorge to 2270 m (7,500 ft) in the Beaver Dam mountains. The Virgin River is this region's primary watercourse.

The most common habitat type is Low Desert Scrub; this habitat is usually dominated by blackbrush (*Coleogyne ramosissima*), creosote (*Larrea tridentata*) or joshua tree (*Yucca brevifolia*); various cactus species are also common. Lowland Riparian also occurs along watercourses at the lower elevations, and Desert Oak and Pinyon-Juniper habitats dominate the mountain ranges (Kuchler 1964, Bailey 1976, Edwards et al. 1995).

This ecoregion's 123 bird species (53% of UPIF species) is the fewest of any Utah ecoregion (Table 1); however, many of the species that occur in the Mojave Desert region are not usually found elsewhere in the state (Behle et al. 1985). Examples of such birds include Abert's Towhee, Bell's Vireo, Black-tailed Gnatcatcher, Brown-crested Flycatcher, Cactus Wren, Common Black Hawk, Costa's Hummingbird, Crissal Thrasher, Green Heron, Hooded Oriole, Inca Dove, LeConte's Thrasher, Verdin, and Vermilion Flycatcher.

COLORADO PLATEAU

The Colorado Plateau ecoregion covers most of southern and eastern Utah; it occupies 38% (12,525 mi^2/32,441 km^2) of the state. The area is ultimately drained by the Colorado River; other major watercourses include the Green, Duchesne, Strawberry, White, Price, San Rafael, Dirty Devil, Escalante, San Juan, and Paria Rivers. Elevations range from 1120 m (3,700 ft) at Lake Powell to over 3,790 m (12,500 ft) in the La Sal Mountains.

High Desert Scrub and Shrubsteppe habitats, i.e., sagebrush and a variety of grasses, dominate the lower elevations on the plateau. Pinyon-Juniper woodlands are also extensive in this region. Northern Oak, Mountain Shrub, Ponderosa Pine, Mixed Conifer, Sub-Alpine Conifer, and Alpine habitats occur at increasing elevations in the mountains with Aspen habitats mixed throughout the middle and high elevations. Lowland Riparian, Mountain Riparian, and Wetlands occur in scattered areas primarily along watercourses. Most of the Agricultural habitats occur in the northern and eastern portions of the plateau. Spectacular geologic formations produce Barren habitats of Rock and Cliff throughout the Colorado Plateau.

Seventy-seven percent (n=179) of the UPIF bird species occur in the Colorado Plateau ecoregion (Table 1). Ash-throated Flycatcher, Black-throated Gray Warbler, Blue Grosbeak, Blue-gray Gnatcatcher, Brewer's Sparrow, Canyon Wren, Clark's Nutcracker, Common Poorwill, Common Raven, Dusky Flycatcher, Ferruginous Hawk, Cooper's Hawk, Gray Vireo, Green-tailed Towhee, Hermit Thrush, Horned Lark, Juniper Titmouse, Lesser Goldfinch, MacGillivray's Warbler, Mountain Bluebird, Mourning Dove, Pinyon Jay, Sage-grouse, Sage Sparrow, Sage Thrasher, Western Bluebird, Western Meadowlark, White-throated Swift are typical Colorado Plateau species. A small population of Mountain Plovers occurs in the northern portion of the plateau and Mexican Spotted Owls inhabit several of the canyonland areas. The Colorado Plateau also hosts one of the largest populations of Peregrine Falcons in the country.

UTAH MOUNTAINS

The Utah Mountain ecoregion occupies 23% (7,416 mi^2/19,208 km^2) of Utah's land area. This ecoregion is made up primarily of the Wasatch and Uinta mountain ranges and their associated valleys. Elevations range from 1360 m (4500 ft) in the Salt Lake Valley at the edge of the ecoregion to 4,090 m (13,500 ft) on King's Peak. Numerous streams of various size are formed in these mountains. From the north slope of the Uinta Mountains, the Bear River flows in a circuitous western route into the Great Basin (Great Salt Lake) and the Green River flows through the eastern end of the Uintas into the Colorado Plateau where it meets the Colorado River. All of the streams and rivers flowing out of the Wasatch Range to the west terminate in the Great Basin; these include the Logan, Ogden, Weber, Provo, and Sevier Rivers, and Beaver Creek.

Streams draining the south Uinta and eastern Wasatch Ranges flow into the Colorado and Green Rivers; examples include the Duchesne, Price, and Fremont Rivers and Huntington and Ferron Creek. The Virgin River flows from the southwest corner of the Utah Mountains into the Mojave Desert ecoregion.

Most of the state's forested habitats occur within this ecoregion. Urban and Agricultural habitats are frequent in the lower elevation valleys; Shrubsteppe, High Desert Shrub, and Grasslands persist in low elevation areas that have not been converted to Urban or Agriculture. Northern Oak, Mountain Shrub, and Pinyon-Juniper are dominant on the low to middle elevation hillsides and often mix with other forested habitats. Deciduous forests such as Aspen are distributed throughout the Utah Mountains and are more extensive in the northern half of the state. Higher elevation forests include Ponderosa Pine, Lodgepole Pine (primarily in the Uintas), Mixed Conifer, Spruce-fir, and Sub-Alpine Conifer. Barren peaks and Alpine meadows occur at the highest elevations. Wetlands, Lowland and Mountain Riparian areas are sparsely scattered throughout the ecoregion.

Several forest birds are most common in this ecoregion. In Utah, American Redstart, American Pipit, Black Rosy-finch, Pine Grosbeak, Three-toed Woodpecker, and White-tailed Ptarmigan occur primarily in the Utah Mountains. Active colonies of Black Swift in Utah are known from this ecoregion in the Provo River Canyon and adjacent areas. Typical Utah Mountain species include Osprey, Northern Goshawk, Ruffed Grouse, Northern Pygmy-Owl, Broad-tailed Hummingbird, most Utah woodpeckers, Olive-sided Flycatcher, Hammond's Flycatcher, Warbling Vireo, Gray Jay, Violet-green Swallow, Gray Catbird, Yellow-rumped Warbler and several other warblers, Western Tanager, Chipping Sparrow, Vesper Sparrow, Lincoln's Sparrow, Black-headed Grosbeak, Bullock's Oriole, Cassin's Finch, Red-Crossbill, and Pine Siskin. A total of 168 (73%) UPIF species occur in the Utah Mountains ecoregion (Table 1).

WYOMING BASIN

The Wyoming Basin ecoregion covers only 1% (458 mi^2/1,186 km^2) of the state. Most of the ecoregion is located in Wyoming where it covers nearly half the state. This basin is relatively high compared to other Utah ecoregions; elevation ranges from 1,970 m (6,500 ft) in the valleys to 3,030 m (10,000 ft) at the transition to Utah Mountains. The Bear and Green Rivers are the major watercourses.

High Desert Scrub is the most common habitat type in the Wyoming Basin. Shrubsteppe and Grasslands also occur in sparsely scattered locations. Agriculture is the primary habitat in the Bear River Valley though Mountain Riparian also occurs along the Bear River and other watercourses in the region. The Wyoming Basin has 144 species (62% of UPIF species), most of which also occur in other Utah ecoregions (Table 1). Typical species include Black-billed Magpie, Brewer's Blackbird, Brewer's Sparrow, Brown-headed Cowbird, California Gull, Golden Eagle, Grey Flycatcher, Green-tailed Towhee, Horned Lark, Lark Sparrow, Loggerhead Shrike, Mountain Bluebird, Northern Harrier, Sage Sparrow, Sage Thrasher, Say's Phoebe, Vesper Sparrow, and Western Meadowlark.

INFLUENCE OF LATITUDE AND ELEVATION ON UTAH BIRDS

Utah's avian communities are heavily influenced by habitat type and habitat type is strongly influenced by elevation and latitude. Many of Utah's habitat types occur within fairly distinct bands of elevation and the corresponding bird communities also occur within those elevation bands. Also, many birds reach their northern or southern range limits in Utah and thus occur only in the southern or northern parts of the state. Furthermore, the combination of latitude and elevation influences habitat and bird distributions.

While type of habitat in an area depends on several factors, the two most important factors are temperature and precipitation. These two factors are influenced primarily by latitude and elevation. In Utah, the effect of elevation is the most obvious and is clearly reflected by elevational bands of habitat. This effect is so obvious because elevations change over very short distances in many parts of the state. The effect of changing latitude is not as obvious because the change in latitude is more gradual than the change in elevation. Within elevational and latitudinal gradients, aspect (north-facing vs. south-facing slopes) also affects habitat type. North-facing slopes (which receive less direct sunlight) are cooler and retain moisture longer than south-facing slopes; thus north-facing slopes often support different habitat types and birds than adjacent south-facing slopes. These differences are most evident on mountains ridges and in canyons.

In general, a change of 300 m (1000 ft) in elevation is roughly equivalent to a change of 4.5E of latitude or about 300 miles (480 km). And thus, a trip from St. George (760 m/2500 ft, 37EN) to King's Peak (4090 m/13,500 ft, 41EN) is ecologically equivalent to a trip from northern Mexico to the Arctic Circle. Both precipitation and temperature are influenced by elevation. An increase of 300 m (1000 ft) in elevation corresponds to a decrease of about 3EF (1.5EC) and an increase of about 12.5 cm (5 in) of precipitation (Behle and Perry 1975).

Since many birds are closely associated with only one or two breeding habitats, their elevational distributions correspond closely with the distribution of those habitat types. For example, American Pipits breed exclusively in Alpine meadows which occur only above 3180 m (10,500 ft), Pine Grosbeaks breed primarily in the Sub-Alpine Conifer habitats at elevations of 2575-3180 m (8500-10,500 ft), and Sage-grouse breed in Shrub-steppe and Grassland habitats in the 1210-1515 m (4000-5000 ft) elevation range. Species that are associated with a wider variety of habitat types have wider elevational distributions. For example, Common Ravens, which occur in virtually all of Utah's habitats can be found at all elevations. Because of the wide range of elevations and associated habitat types, Utah's avian diversity is relatively high.

Many species reach their northern or southern range limits in Utah. As with elevation, habitats are often associated with certain latitudes. Bendire's Thrasher breeds almost exclusively in Low Desert Scrub habitats and is limited to the southern portion of the state from about 37E to 38EN latitude. However, many species' ranges are limited by factors other than habitat type that appear to correspond with latitude. For example, Eastern Kingbirds only breed in the northern third of the state, though their breeding habitats (Lowland Riparian and Agriculture) occur throughout the state. Which factors limit latitudinal distribution of birds in Utah has not been well studied and thus why some birds only occur in northern or southern Utah is not always clear. Potential limiting factors may include prey distribution, competition with similar species, exclusion by predators, etc. and likely vary by species. Whatever the cause, because Utah includes the limits of many species' ranges, the state's avian diversity is increased.

In Utah's southwestern corner, the combined influence of latitude and elevation is clearly reflected in the avifauna. Several species such as Abert's Towhee, Bell's Vireo, Black-tailed Gnatcatcher, Brown-crested Flycatcher, Cactus Wren, Common Black Hawk, Costa's Hummingbird, Crissal Thrasher, Green Heron, Hooded Warbler, Inca Dove, LeConte's Thrasher, Verdin, and Vermilion Flycatcher occur only in this corner of the state near 37EN latitude and below 1060 m (3500 ft). This is the only area in the state that supports a warm desert biome which is dominated by low desert shrubs such as creosote and yucca.

Another combined effect of latitude and elevation is that elevational bands of habitats occur at lower elevations farther south in the state. For example, a habitat (and associated bird species) that occurs from 2425-2725 m (8000-9000 ft) in northern Utah may occur from 2120 - 2425 m (7000-8000 ft) in the southern part of the state.

Many bird species which are resident in Utah exhibit altitudinal migrations, seasonal movements usually from high elevations (breeding) to low elevations (wintering). For example, Black Rosy-Finches nest above timberline in Utah's Alpine habitats. They then migrate to lower elevation habitats such as Grasslands for the winter--an elevational change of up to 2725 m (9000 ft). Many species exhibit less dramatic altitudinal migrations and may only migrate if conditions at higher elevations become too harsh.

While elevations vary with latitude, aspect, and local factors, a general picture of Utah's habitat types from lowest to highest is illustrated in Figure 5. Details of elevational ranges for each habitat type are given in Table 2 and the Habitats in Utah Most in Need of Conservation Section.

AVIAN GUILDS

Avian communities can be divided into groups of species that use environmental resources in a similar way, i.e., guilds (Root 1967). There has been much discussion on the appropriate use of guilds in management (Croonquist and Brooks 1991, Jaksic 1981, Knopf et al. 1988, Landres 1983, Mannan et al. 1984, Paige 1990, Severinghaus 1981, Short and Burnham 1982, Verner 1984, Szaro 1986). Certainly assigning a species to a guild is not an exact science, and many species may fit into several guilds. However, it is often a useful management tool to group species according to their resource needs.

FORAGING GUILDS

DeGraaf et al. (1985) proposed a foraging guild classification of North American birds. Their classification was based on major food type, substrate, and foraging technique. Under this system, Utah birds fit into 37 foraging guilds (Tables 3 and 4). Some bird species use more than one foraging strategy or feed on more than one type of food and thus belong to more than one guild. For example, Black Phoebes, a type of flycatcher, typically feed on flying insects which they catch on the wing (Insectivore: air sallier); however, they also eat fruits from shrubs and small trees (Frugivore: lower-canopy gleaner). Some birds use multiple foraging strategies throughout the year, and many species use different techniques or prey bases during the breeding and nonbreeding seasons. Most birds are insectivorous during the breeding season, but many birds switch to different food sources in the nonbreeding season. Some very specialized species, such as the American Dipper (Insectivore: riparian bottom gleaner), use the same foraging strategy and prey throughout the year. Each foraging guild has two components. The first component focuses on the type of food used and the second looks at specific foraging techniques. For example, an Insectivore: lower-canopy gleaner feeds on insects which is picks (or gleans) from branches and leaves of shrubs and the lower portions of trees; an Omnivore: ground forager feeds on seeds, plant parts, and animals it finds on the ground. Detailed guild definitions can be found in Table 3.

Most Utah birds feed on insects (Insectivores--44%) and/or a variety of different foods (Omnivores--37%). Granivores (seed eaters) and carnivores (meat eaters) each comprise 13% of Utah species. Other birds feed on crustaceans (Crustaceovores–10%), plant parts other than seeds (Herbivores--7%), fishes (Piscivores–7%), snails (Muscovores–5%), fruit (Frugivores–4%) and worms (Vermivores–3%).

NESTING GUILDS

Nesting is another important factor in avian ecology and management. The availability of suitable nesting habitat, i.e., nest locations, is frequently a limiting factor in bird populations (Martin 1993). Nest type, location, and parasitism by cowbirds are all important management factors when dealing with bird populations. We do not specifically define nesting guilds, but we do provide groupings of birds that share similar nesting characteristics (e.g., canopy level cavity nesters) (Tables 5 and 6). These groupings are based on Ehrlich et al. (1988).

Nest groupings have three components: height of nest (canopy, subcanopy or shrub, and ground level), type of nest substrate (e.g., coniferous tree, shrub, snag), and nest structure (e.g., cavity, open cup). In addition to nest groupings, information on frequency of cowbird parasitism is also noted in Table 5.

While nesting is not as flexible as foraging for most species, some species may belong to more than one nesting group. For example, Cordilleran Flycatcher typically build their nests in cavities of trees, but the may also nest on cliff ledges, stream banks, or on the ground in upturned root crowns. Nesting substrate varies greatly among Utah birds; most species are tree nesters (38%) and these are further divided into those that nest primarily in deciduous trees (17%), and coniferous trees (6%) or those that nest in either (15%). Many birds are primarily ground nesters (36%) and many species are shrub nesters (27%). Other nesting substrates include snags (12%), cliffs (9%), cactus, banks, reeds, vines, buildings (2% each), caves, yuccas (1% each). Cup nests are the most common nest type for Utah birds (38%); several species use cavities (16%), build platforms (14%), or make simple scrapes (17%). Utah birds also build saucers (3%), pendant nests (3%), spherical nests (2%), oven-like nests (1%) and mud gourds (1%). Other birds nest in crevices (2%), burrows (1%), abandoned nests (2%) or simply lay eggs on the ground (2%). Species that nest at or near ground level (< 0.6 m /2 ft) and those that nest in the subcanopy (shrub) layer (0.9-6.1 m/3-20 ft) are nearly equally divided, 54 and 58% respectively. Thirty-three percent of Utah's birds nest in the canopy level (above 6.1 m/20 ft).

Brown-headed Cowbirds are known to parasitize about 98 species of Utah birds (Table 5). These are usually species that are similar in size or somewhat smaller than the cowbirds. Nest parasitism also occurs more frequently in small or fragmented habitats than in large, contiguous blocks of habitat. Of the 98 known host species, only 3% have been known to reject the cowbird eggs. Most of the host species are only rarely parasitized (46%) and another 3% are only occasionally parasitized. Twenty-eight percent are uncommon hosts, 9% are common hosts and 10% are frequently parasitized.

Of course both nesting and foraging are closely related to habitat type. While not discussed here, habitat types for Utah birds are discussed in detail in the Habitats in Utah Most in Need of Conservation Section.

Figure 2. General Distribution of Habitats in Utah by Elevation. Mountain Riparian occurs from Alpine to Pinyon-Juniper, Lowland Riparian occurs from Pinyon-Juniper through Low Desert Scrub. Agriculture and Urban occurs at several elevations but generally at or below Northern Oak. Cliff, Rock, Wetland, Wet Meadow, and Water occur across a large range of elevations.

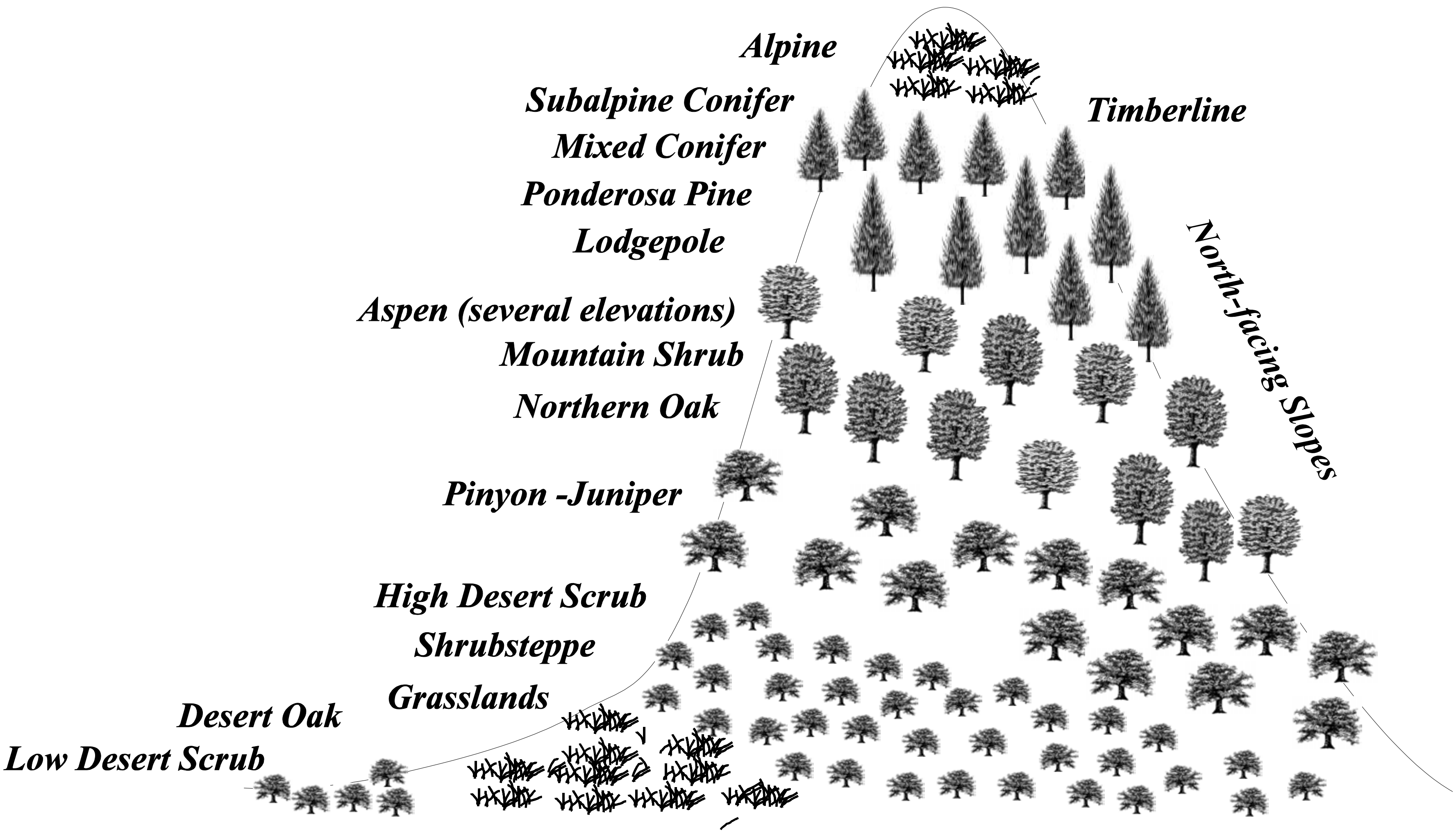


Table 2. Elevation Ranges and General Distribution of Habitats in Utah.

HABITAT	AREA OF STATE	GENERAL ELEVATION RANGE (M [FT])
Low Desert Scrub	Southern	682-1060 [2250-3500]
Desert Oak	Southern	< 1060 [3500]
Grassland	Statewide	1060-1667 [3500-5500]
Agriculture	Statewide	several, primarily < 1820 [6000]
Urban	Statewide	several, primarily < 1820 [6000]
Shrubsteppe	Statewide	1060-1667 [3500-5500]
High Desert Scrub	Statewide	1060-1667 [3500-5500]
Pinyon-Juniper	Statewide	1060-2121 [3500 - 7000]
Lowland Riparian	Statewide	# 1667 [5500]
Mountain Shrub	Statewide	1364-1820 [4500-6000]
Northern Oak	Statewide	1364-1820 [4500-6000]
Aspen	Statewide	1820-3182 [6000-10500]
Ponderosa Pine	Eastern and Southern	2182-2727 [7200-9000]
Lodgepole Pine	Northern	2182-2727 [7200-9000]
Mixed Conifer	Statewide	2182-3182 [7000-10500]
SubAlpine Conifer	Statewide	2575-3182 [8500-10500]
Mountain Riparian	Statewide	$ 1667 [5500]
Alpine	Statewide	3182-4090 [10500-13500]

Table 3. Breeding/Nonbreeding Foraging Guilds of Utah Birds.

SPECIES	BREEDING PERIOD	NONBREEDING PERIOD
Abert's Towhee	Omnivore: ground forager	Omnivore: ground forager
Acorn Woodpecker	Frugivore: upper-canopy gleaner; Insectivore: bark gleaner	Frugivore: upper-canopy gleaner; Insectivore: bark gleaner
American Avocet	Omnivore: marsh forager	Omnivore: marsh forager
American Bittern	Carnivore/Insectivore/Crustaceovore: water ambusher	Carnivore/Insectivore/Crustaceovore: water ambusher
American Coot	Omnivore: freshwater dabbler, freshwater diver	Herbivore: water dabbler, water diver
American Crow	Omnivore: ground forager, ground scavenger	Omnivore: ground forager, ground scavenger
American Dipper	Insectivore: riparian bottom gleaner	Insectivore: riparian bottom gleaner
American Goldfinch	Omnivore: lower-canopy forager, ground forager	Granivore: lower-canopy gleaner, ground gleaner
American Kestrel	Insectivore: air hawker; Carnivore: ground hawker	Carnivore: ground hawker
American Pipit	Insectivore: ground gleaner	Omnivore: ground forager
American Redstart	Insectivore: lower-canopy gleaner, air sallier	
American Robin	Vermivore: ground gleaner; Omnivore: lower-canopy forager	Omnivore: ground forager, lower-canopy forager
American White Pelican	Piscivore: freshwater surface gleaner	Piscivore: coastal surface gleaner
Ash-throated Flycatcher	Insectivore: lower-canopy gleaner, air sallier	Insectivore: lower-canopy gleaner, air sallier
Bald Eagle	Piscivore: water foot-plunger; Carnivore: ground scavenger	Piscivore: water foot-plunger; Carnivore: ground scavenger
Band-tailed Pigeon	Frugivore: lower-canopy gleaner; Granivore: ground forager	Frugivore: upper-canopy gleaner; Granivore: ground forager
Bank Swallow	Insectivore: air screener	
Barn Owl	Carnivore: ground hawker	Carnivore: ground hawker
Barn Swallow	Insectivore: air screener	

SPECIES	BREEDING PERIOD	NONBREEDING PERIOD
Bell's Vireo	Insectivore: lower-canopy gleaner	
Belted Kingfisher	Piscivore: water plunger	Piscivore: water plunger
Bendire's Thrasher	Omnivore: ground forager, lower-canopy forager	Omnivore: ground forager, lower-canopy forager
Bewick's Wren	Insectivore: ground gleaner, foliage gleaner	Insectivore: ground gleaner, foliage gleaner
Black Phoebe	Insectivore: air sallier	Frugivore: lower-canopy gleaner; Insectivore: air sallier
Black Rosy-Finch	Omnivore: ground forager; Insectivore: air sallier	Granivore: ground gleaner
Black Swift	Insectivore: air screener	
Black Tern	Insectivore: freshwater surface gleaner, air hawker, water plunger	
Black-billed Magpie	Insectivore: ground gleaner; Omnivore: ground scavenger	Omnivore: ground forager; Omnivore: ground scavenger
Black-capped Chickadee	Insectivore: lower-canopy gleaner	Omnivore: lower-canopy forager
Black-chinned Hummingbird	Omnivore: floral hover-gleaner, air salliers	Omnivore: floral hover-gleaner, air salliers
Black-chinned Sparrow	Omnivore: ground forager	Granivore: ground gleaner
Black-crowned Night Heron	Crustaceovore/Piscivore: water ambusher	Crustaceovore/Piscivore: water ambusher
Black-headed Grosbeak	Omnivore: upper- and lower-canopy forager	
Black-necked Stilt	Insectivore: freshwater gleaner	Insectivore: freshwater gleaner
Black-tailed Gnatcatcher	Insectivore: lower-canopy gleaner	Insectivore: lower-canopy gleaner
Black-throated Gray Warbler	Insectivore: lower-canopy gleaner	Insectivore: lower-canopy gleaner
Black-throated Sparrow	Insectivore: lower-canopy gleaner, ground forager	Granivore: ground gleaner

SPECIES	BREEDING PERIOD	NONBREEDING PERIOD
Blue Grosbeak	Omnivore: ground forager, foliage gleaner	
Blue Grouse	Omnivore: ground forager	Herbivore: upper-canopy forager
Blue-gray Gnatcatcher	Insectivore: upper- and lower-canopy gleaner	Insectivore: upper- and lower-canopy gleaner
Bobolink	Omnivore: ground forager	
Brewer's Blackbird	Omnivore: ground forager	Omnivore: ground forager
Brewer's Sparrow	Insectivore: ground and lower-canopy gleaner	Omnivore: ground and lower-canopy forager
Broad-tailed Hummingbird	Omnivore: floral hover-gleaner, air salliers	
Brown Creeper	Insectivore: bark gleaner	Insectivore: bark gleaner
Brown-crested Flycatcher	Insectivore: air sallier	
Brown-headed Cowbird	Omnivore: ground forager	Granivore: ground gleaner
Bullock's Oriole,	Omnivore: upper-canopy forager	
Burrowing Owl	Carnivore: ground hawker; Insectivore: air hawker	Carnivore: ground hawker; Insectivore: air hawker
Common Bushtit	Insectivore: lower-canopy gleaner	Omnivore: lower-canopy forager
Cactus Wren	Omnivore: ground and lower-canopy forager	Omnivore: ground and lower-canopy forager
California Gull	Insectivore: ground gleaner; Carnivore: ground hawker Omnivore: shoreline scavenger	Carnivore: coastal beach scavenger Omnivore: shoreline scavenger
California Quail	Granivore: ground gleaner	Herbivore: ground forager
Calliope Hummingbird	Omnivore: floral hover-gleaner, air salliers	
Canyon Wren	Insectivore: ground gleaner	Insectivore: ground gleaner
Caspian Tern	Piscivore: water plunger	Piscivore: coastal plunger
Cassin's Finch	Omnivore: ground forager	Granivore: ground and upper-canopy gleaner

SPECIES	BREEDING PERIOD	NONBREEDING PERIOD
Cassin's Kingbird	Insectivore: air sallier	Frugivore: lower-canopy gleaner; Insectivore: air sallier
Cattle Egret	Insectivore: ground gleaner	Insectivore: ground gleaner
Cedar Waxwing	Insectivore: air sallier; Frugivore: upper-canopy gleaner	Insectivore: air sallier; Frugivore: upper-canopy gleaner
Chipping Sparrow	Omnivore: ground forager	Granivore: ground gleaner
Chukar	Herbivore: ground forager	Herbivore: ground forager
Clark's Grebe	Piscivore: freshwater diver	Piscivore: water diver
Clark's Nutcracker	Omnivore: upper-canopy forager	Omnivore: upper-canopy forager
Cliff Swallow	Insectivore: air screener	
Common Black Hawk	Carnivore: ground hawker	Carnivore: ground hawker
Common Grackle	Omnivore: ground forager	Omnivore: ground forager
Common Moorhen	Omnivore: fresh-marsh forager	Omnivore: fresh-marsh forager
Common Nighthawk	Insectivore: air screener	
Common Poorwill	Insectivore: air screener	Insectivore: air screener
Common Raven	Omnivore: ground scavenger	Omnivore: ground scavenger
Common Snipe	Vermivore: ground prober; Omnivore: mud forager	Omnivore: mud forager
Common Yellowthroat	Insectivore: marsh and lower-canopy gleaner	Insectivore: marsh and lower-canopy gleaner
Cooper's Hawk	Carnivore: air and ground hawker	Carnivore: air and ground hawker
Cordilleran Flycatcher,	Insectivore: air sallier	
Costa's Hummingbird	Omnivore: floral hover-gleaner	Omnivore: floral hover-gleaner
Crissal Thrasher	Omnivore: ground and lower-canopy forager	Omnivore: ground and lower-canopy forager
Dark-eyed Junco	Omnivore: ground forager	Granivore: ground gleaner

SPECIES	BREEDING PERIOD	NONBREEDING PERIOD
Double-crested Cormorant	Piscivore: water diver	Piscivore: water diver
Downy Woodpecker	Insectivore: bark and lower-canopy gleaner Frugivore: lower-canopy gleaner	Insectivore: bark and lower-canopy gleaner Frugivore: lower-canopy gleaner
Dusky Flycatcher	Insectivore: air sallier	
Eared Grebe	Insectivore: freshwater diver	Crustaceovore: coastal diver; Insectivore:freshwater diver
Eastern Kingbird	Insectivore: air sallier	
European Starling	Omnivore: ground forager	Omnivore: ground forager
Evening Grosbeak	Omnivore: upper-canopy forager	Granivore: ground and upper-canopy gleaner
Ferruginous Hawk	Carnivore: ground hawker	Carnivore: ground hawker
Flammulated Owl	Insectivore: ground hawker	Insectivore: ground hawker
Forster's Tern	Insectivore: water surface gleaner; Piscivore: water plunger	Insectivore: water surface gleaner; Piscivore: water plunger
Fox Sparrow	Omnivore: ground forager	Granivore: ground gleaner
Franklin's Gull	Insectivore: air hawker	
Gambel's Quail	Herbivore: ground forager	Herbivore: ground forager
Golden Eagle	Carnivore: ground hawker	Carnivore: ground scavenger, ground hawker
Golden-crowned Kinglet	Insectivore: upper and lower-canopy gleaner	Insectivore: upper and lower-canopy gleaner
Grace's Warbler	Insectivore: upper-canopy gleaner	
Grasshopper Sparrow	Omnivore: ground forager	Omnivore: ground forager
Gray Catbird	Omnivore: ground and lower-canopy forager	Omnivore: ground and lower-canopy forager
Gray Flycatcher	Insectivore: air sallier	Insectivore: air sallier
Gray Jay	Omnivore: upper-canopy forager	Omnivore: upper-canopy forager
Gray Partridge	Omnivore: ground forager	Granivore: ground gleaner

SPECIES	BREEDING PERIOD	NONBREEDING PERIOD
Gray Vireo	Insectivore: lower-canopy gleaner	
Great Blue Heron	Piscivore/Carniovore: water ambusher	Piscivore/Carnivore: water ambusher
Great Horned Owl	Carnivore: ground hawker	Carnivore: ground hawker
Greater Roadrunner	Carnivore: ground chaser; Insectivore: ground gleaner	Carnivore: ground chaser; Insectivore: ground gleaner
Great-tailed Grackle	Omnivore: ground forager	Omnivore: ground forager
Green Heron	Crustaceovore/Piscivore: water ambusher	Crustaceovore/Piscivore: water ambusher
Green-tailed Towhee	Omnivore: ground forager	Omnivore: ground forager
Hairy Woodpecker	Insectivore: bark gleaner; Frugivore: lower-canopy gleaner	Insectivore: bark gleaner; Frugivore: lower-canopy gleaner
Hammond’s Flycatcher	Insectivore: air sallier	Insectivore: air sallier
Hermit Thrush	Insectivore: ground gleaner	Omnivore: ground and lower-canopy forager
Hooded Oriole	Omnivore: lower-canopy forager	
Horned Lark	Omnivore: ground gleaner	Granivore: ground gleaner
House Finch	Frugivore/Granivore: ground gleaner	Granivore: ground gleaner
House Sparrow	Granivore: ground gleaner	Granivore: ground gleaner
House Wren	Insectivore: lower-canopy gleaner	Insectivore: lower-canopy gleaner
Inca Dove	Granivore: ground gleaner	Granivore: ground gleaner
Indigo Bunting	Omnivore: lower-canopy forager	Omnivore: lower-canopy forager
Juniper Titmouse	Omnivore: lower-canopy forager	Omnivore: lower-canopy forager
Killdeer	Insectivore: ground gleaner	Insectivore: shoreline gleaner
Ladder-backed Woodpecker	Insectivore: bark gleaner; Frugivore: lower-canopy gleaner Omnivore: ground gleaner	Insectivore: bark gleaner; Frugivore: lower-canopy gleaner Omnivore: ground gleaner
Lark Bunting	Omnivore: ground forager	Omnivore: ground forager
Lark Sparrow	Omnivore: ground forager	Granivore: ground gleaner

SPECIES	BREEDING PERIOD	NONBREEDING PERIOD
Lazuli Bunting	Omnivore: lower-canopy forager	Omnivore: lower-canopy forager
Le Conte's Thrasher	Insectivore: ground gleaner	Insectivore: ground gleaner
Least Flycatcher	Insectivore: air sallier	
Lesser Goldfinch	Granivore: ground and lower-canopy gleaner	Granivore: ground and lower-canopy gleaner
Lesser Nighthawk	Insectivore: air screener	
Lewis Woodpecker	Insectivore: air sallier; Granivore: upper-canopy gleaner	
Lincoln's Sparrow	Omnivore: ground forager	Granivore: ground gleaner
Loggerhead Shrike	Carnivore: ground hawker	Carnivore: ground hawker
Long-billed Curlew	Omnivore: ground forager	Insectivore/Crustaceovore: shoreline gleaner/prober
Long-eared Owl	Carnivore: ground hawker	Carnivore: ground hawker
Lucy's Warbler	Insectivore: lower-canopy gleaner	
MacGillivray's Warbler	Insectivore: lower-canopy gleaner	
Marsh Wren	Insectivore: marsh gleaner	Insectivore: marsh gleaner
Merlin	Carnivore: air hawker	Carnivore: air hawker
Mountain Bluebird	Insectivore: ground gleaner	Omnivore: lower-canopy forager; Insectivore: ground gleaner
Mountain Chickadee	Insectivore: lower-canopy gleaner	Omnivore: lower-canopy forager
Mountain Plover	Insectivore: ground gleaner	Insectivore: ground gleaner
Mourning Dove	Granivore: ground gleaner	Granivore: ground gleaner
Northern Flicker	Insectivore: ground gleaner	Omnivore: ground and lower-canopy forager
Northern Goshawk	Carnivore: air and ground hawker	Carnivore: air hawker and ground hawker
Northern Harrier	Carnivore: ground hawker	Carnivore: ground hawker

SPECIES	BREEDING PERIOD	NONBREEDING PERIOD
Northern Mockingbird	Omnivore: ground forager	Frugivore: lower-canopy gleaner
Northern Pygmy-Owl	Insectivore/Carnivore: ground hawker	Carnivore: ground hawker
Northern Rough-winged Swallow	Insectivore: air screener	Insectivore: air screener
Northern Saw-whet Owl	Carnivore: ground hawker	Carnivore: ground hawker
Olive-sided Flycatcher	Insectivore: air sallier	
Orange-crowned Warbler	Insectivore: upper- and lower-canopy gleaner	Omnivore: lower-canopy forager
Osprey	Piscivore: water foot-plunger	Piscivore: water foot-plunger
Peregrine Falcon	Carnivore: air hawker	Carnivore: air hawker
Phainopepla	Frugivore: lower-canopy gleaner	Frugivore: lower-canopy gleaner
Pied-billed Grebe	Crustaceovore/Insectivore: freshwater diver	Crustaceovore/: water diver
Pine Grosbeak	Omnivore: upper-canopy forager	Granivore: ground and upper-canopy gleaner
Pine Siskin	Omnivore: ground and upper-canopy forager	Granivore: ground and upper-canopy gleaner
Pinyon Jay	Omnivore: ground and upper-canopy forager	Omnivore: ground and upper-canopy forager
Plumbeous Vireo	Insectivore: lower-canopy gleaner	Omnivore: lower-canopy forager
Prairie Falcon	Carnivore: air and ground hawker	Carnivore: air and ground hawker
Purple Martin	Insectivore: air screener	
Pygmy Nuthatch	Insectivore: bark gleaner; Omnivore: upper-canopy forager	Insectivore: bark gleaner; Omnivore: upper-canopy forager
Red Crossbill	Omnivore: upper-canopy forager	Granivore: upper-canopy gleaner
Red-breasted Nuthatch	Insectivore: bark gleaner	Granivore: upper-canopy gleaner; Insectivore: bark gleaner

SPECIES	BREEDING PERIOD	NONBREEDING PERIOD
Red-naped Sapsucker	Omnivore: bark excavator	Insectivore: bark gleaner; Omnivore: bark excavator
Red-tailed Hawk	Carnivore: ground hawker	Carnivore: ground hawker
Red-winged Blackbird	Omnivore: ground and freshwater marsh forager	Granivore: ground gleaner
Ring-billed Gull	Insectivore: ground gleaner; Carnivore: ground hawker	Carnivore: coastal beach scavenger
Ring-necked Pheasant	Omnivore: ground forager	Herbivore: ground forager
Rock Dove	Omnivore: ground forager	Omnivore: ground forager
Rock Wren	Insectivore: ground gleaner	Insectivore: ground gleaner
Ruby-crowned Kinglet	Insectivore: upper- and lower-canopy gleaner	Insectivore: upper and lower-canopy gleaner
Ruffed Grouse	Omnivore: ground forager	Herbivore: upper-canopy forager
Rufous-crowned Sparrow	Omnivore: ground forager	Granivore: ground gleaner
Sage-grouse	Herbivore: ground forager	Herbivore: ground forager
Sage Sparrow	Insectivore: ground and lower-canopy forager	Insectivore: ground and lower-canopy forager
Sage Thrasher	Insectivore: ground gleaner	Omnivore: ground and lower-canopy forager
Sandhill Crane	Omnivore: ground and fresh-marsh forager	Omnivore: ground and fresh-marsh forager
Savannah Sparrow	Omnivore: ground forager	Granivore: ground gleaner
Say’s Phoebe	Insectivore: air sallier	Insectivore: air sallier
Scaled Quail	Granivore: ground gleaner; Omnivore: ground forager	Granivore: ground gleaner; Omnivore: ground forager
Scott’s Oriole	Omnivore: lower-canopy forager	
Sharp-shinned Hawk	Carnivore: air and ground hawker	Carnivore: air and ground hawker
Sharp-tailed Grouse	Omnivore: ground forager	Herbivore: ground forager

SPECIES	BREEDING PERIOD	NONBREEDING PERIOD
Short-eared Owl	Carnivore: ground hawker	Carnivore: ground hawker
Snowy Egret	Crustaceovore/Carnivore: water ambusher	Crustaceovore/Carnivore: water ambusher
Snowy Plover	Crustaceovore/Insectivore: shoreline gleaner	Crustaceovore/Vermivore: coastal beach gleaner
Song Sparrow	Omnivore: lower-canopy and ground forager	Granivore: ground gleaner
Sora	Omnivore: fresh-marsh forager	Omnivore: marsh forager
Spotted Owl	Carnivore: ground hawker	Carnivore: ground hawker
Spotted Sandpiper	Insectivore: shoreline gleaner	Insectivore: shoreline gleaner
Spotted Towhee	Omnivore: ground forager	Omnivore: ground forager
Steller's Jay	Omnivore: ground forager	Omnivore: ground forager
Summer Tanager	Insectivore: upper-canopy gleaner	
Swainson's Hawk	Carnivore/Insectivore: ground/air hawker	Carnivore/Insectivore: ground/air hawker
Swainson's Thrush	Omnivore: ground and lower-canopy forager	
Three-toed Woodpecker	Insectivore: bark scaler	Insectivore: bark scaler
Townsend's Solitaire	Insectivore: air sallier; Omnivore: ground forager	Insectivore: air sallier; Omnivore: ground forager
Tree Swallow	Insectivore: air screener	Frugivore: lower-canopy gleaner; Insectivore: air screener
Turkey Vulture	Carnivore: ground scavenger	Carnivore: ground scavenger
Veery	Omnivore: ground and lower-canopy forager	
Verdin	Insectivore: lower-canopy gleaner	Omnivore: lower-canopy forager
Vermilion Flycatcher	Insectivore: air sallier	Insectivore: air sallier
Vesper Sparrow	Omnivore: ground forager	Granivore: ground gleaner
Violet-green Swallow	Insectivore: air screener	Insectivore: air screener

SPECIES	BREEDING PERIOD	NONBREEDING PERIOD
Virginia Rail	Insectivore/Molluscovore: marsh prober	Omnivore: marsh forager
Virginia’s Warbler	Insectivore: lower-canopy gleaner	
Warbling Vireo	Insectivore: upper-canopy gleaner	
Western Bluebird	Insectivore: ground gleaner	Omnivore: lower-canopy forager
Western Grebe	Piscivore: freshwater diver	Piscivore: water diver
Western Kingbird	Insectivore: air sallier	Insectivore: air sallier
Western Meadowlark	Insectivore: ground gleaner	Omnivore: ground forager
Western Screech Owl	Insectivore/Carnivore: ground hawker	Carnivore: ground hawker
Western Scrub-Jay	Omnivore: ground forager	Omnivore: ground forager
Western Tanager	Omnivore: upper-canopy forager; Insectivore: air sallier	
Western Wood-pewee	Insectivore: air sallier	
White-breasted Nuthatch	Insectivore: bark gleaner	Granivore: upper-canopy gleaner; Insectivore: bark gleaner
White-crowned Sparrow	Omnivore: ground forager	Granivore: ground gleaner
White-faced Ibis	Insectivore: mud gleaner; Crustaceovore: mud prober	Insectivore: mud gleaner; Crustaceovore: mud prober
White-tailed Ptarmigan	Herbivore: ground forager	Herbivore: lower-canopy forager
White-throated Swift	Insectivore: air screener	Insectivore: air screener
White-winged Dove	Granivore: ground gleaner	Granivore: ground gleaner
Wild Turkey	Omnivore: ground forager	Herbivore: ground forager
Willet	Insectivore/Crustaceovore: shoreline prober	Insectivore/Crustaceovore: coastal beach prober

SPECIES	BREEDING PERIOD	NONBREEDING PERIOD
Williamson's Sapsucker	Omnivore: bark excavator	Insectivore: bark gleaner
Willow Flycatcher	Insectivore: air sallier	
Wilson's Phalarope	Insectivore: freshwater shoreline/surface gleaner	
Wilson's Warbler	Insectivore: lower-canopy gleaner; air sallier	
Yellow Warbler	Insectivore: lower-canopy gleaner	
Yellow-billed Cuckoo	Insectivore: lower-canopy gleaner	
Yellow-breasted Chat	Omnivore: lower-canopy forager	
Yellow-headed Blackbird	Omnivore: ground forager	Omnivore: ground forager
Yellow-rumped Warbler	Insectivore: upper- and lower-canopy gleaner	Omnivore: lower-canopy forager

Definitions of terms used in Table 3 (from DeGraaf et al. 1985).

Food types

For *food types* the authors "did not necessarily include all foods taken by each species, only the major food items" (20% of diet during a given period).

Carnivore: vertebrates
Crustaceovore: crustaceans
Frugivore: fruits
Granivore: nuts
Herbivore: plants (leaves, stems, roots)
Insectivore: insects
Molluscovore: mollusks
Omnivore: a variety of foods including both animal and plant foods (the less common food group makes up 10% of diet)
Piscivore: fish
Vermivore: sandworms, earthworms, etc.

Substrates

Substrate refers to the place where the food item is found or taken.

air: caught in the air
bark: on, in, or under bark of trees
coastal: waters along coast (can include brackish as well as salt water)
coastal beach: beaches and/or tidal flats along coast
coastal bottom: floor of continental shelf along coast
coastal rock: rocks along the coast
coastal surface: surface of coastal waters
floral: on or in flowers
fresh marsh: freshwater marshes (on mud, in shallow water, or on marsh plants.
freshwater: freshwater habitats (ponds, lakes, rivers, streams)
freshwater bottom: bottoms of freshwater ponds and lakes
freshwater shoreline: shores of freshwater ponds. lakes, rivers, or streams
freshwater surface: surface of freshwater habitats
ground: on the ground or on very low, weedy vegetation
lower canopy/shrub: on leaves, twigs, and branches of shrubs, saplings, and lower crowns of trees
marsh: fresh, brackish, or saltwater marshes (on mud, in shallow water, or on marsh plants)
mud: inland on mud flats (wet fields, meadows, tundra, or associated with freshwater habitats)
pelagic: ocean water away from coastlines
pelagic surface: surface of ocean waters
riparian bottom: bottoms of rivers and streams
salt marsh: brackish or salt marshes (on mud, in shallow water, or on marsh plants)
shoreline: along shoreline of both freshwater and saltwater (coastal) habitats
upper canopy: on leaves, twigs, and branches of trees in main canopy
water: brackish, fresh and saltwater habitats
water bottom: on bottoms of fresh, brackish, or saltwater habitats
water surface: on surface of fresh, brackish, or saltwater habitats

Technique

Technique refers to the manner in which food is obtained. Note: some techniques are associated with particular food types and/or substrates.

ambusher: slowly stalks or waits for prey to come within reach
chaser: pursues prey on ground
dabbler: submerges head and neck or tips up (various water substrates)
diver: dives from surface for underwater food
excavator: locates food in bark by drilling holes
food pirate: steals food from other species, usually other birds
foot plunger: catches prey by plunging from air to water surface (or ground) and seizing prey in talons
forager: takes almost any food items encountered upon the substrate (includes all herbivores and omnivores feeding on terrestrial habitats or vegetation, except grazers and grubbers)
gleaner: selects particular food items from the substrate
grazer: feeds on grasses, sedges, or grains in fields or meadows
grubber: digs up roots and tubers of either terrestrial or aquatic plants
hawker: flies after prey and captures it either in air or on ground
hover gleaner: hovers in air while selecting prey (from vegetation or ground)
plunger: dives from air into water to capture prey in bill or gular pouch
prober: inserts bill into substrate (beach, mud, ground) and locates prey by touch
sallier: perches on exposed branch or twig, waits for insect to fly by, and then pursues and catches insect in air
scaler: exposes prey under bark by scaling off loose bark
scavenger: takes a variety of items, including refuse or carrion
screener: flies with bill open and screens prey from air
skimmer: flies low over water and skims food from water surface with lower mandible in water
strainer: strains food items from water or mud through lamellae along edge of bill

Table 4. Foraging Guilds of Utah Birds Listed by Guild.[1,2]

FORAGING GUILD	BREEDING PERIOD	NONBREEDING PERIOD
Carnivore: air hawker	Sharp-shinned Hawk Cooper's Hawk Northern Goshawk Merlin Peregrine Falcon Prairie Falcon	Sharp-shinned Hawk Cooper's Hawk Northern Goshawk Merlin Peregrine Falcon Prairie Falcon
Carnivore: ground chaser	Greater Roadrunner	Greater Roadrunner
Carnivore: ground hawker	Ring-billed Gull California Gull Northern Harrier Sharp-shinned Hawk Swainson's Hawk Red-tailed Hawk Ferruginous Hawk Golden Eagle American Kestrel Prairie Falcon Barn Owl Western Screech Owl Great Horned Owl Northern Pygmy Owl Burrowing Owl Spotted Owl Long-eared Owl Short-eared Owl Northern Saw-whet Owl Loggerhead Shrike	Ring-billed Gull California Gull Northern Harrier Sharp-shinned Hawk Swainson's Hawk Red-tailed Hawk Ferruginous Hawk Golden Eagle American Kestrel Prairie Falcon Barn Owl Western Screech Owl Great Horned Owl Northern Pygmy Owl Burrowing Owl Spotted Owl Long-eared Owl Short-eared Owl Northern Saw-whet Owl Loggerhead Shrike
Carnivore: ground scavenger	Turkey Vulture Bald Eagle	Turkey Vulture Bald Eagle Golden Eagle
Carnivore: water ambusher	American Bittern Snowy Egret	American Bittern Snowy Egret
Crustaceovore: coastal beach gleaner		Snowy Plover
Crustaceovore: coastal beach prober		Willet
Crustaceovore: coastal diver		Eared Grebe
Crustaceovore: mud prober	White-faced Ibis	White-faced Ibis
Crustaceovore: shoreline gleaner	Snowy Plover	
Crustaceovore: shoreline prober		Long-billed Curlew

FORAGING GUILD	BREEDING PERIOD	NONBREEDING PERIOD
Crustaceovore: water ambusher	American Bittern Snowy Egret Green Heron Black-crowned Night Heron	American Bittern Snowy Egret Green Heron Black-crowned Night Heron
Frugivore: ground gleaner	House Finch	
Frugivore: upper canopy gleaner	Acorn Woodpecker Cedar Waxwing	Acorn Woodpecker Cedar Waxwing Band-tailed Pigeon
Granivore: ground gleaner	Inca Dove Mourning Dove House Finch Lesser Goldfinch House Sparrow California Quail	Inca Dove Mourning Dove House Finch Lesser Goldfinch House Sparrow Gray Partridge Horned Lark Rufous-crowned Sparrow Chipping Sparrow Black-chinned Sparrow Vesper Sparrow Lark Sparrow Black-throated Sparrow Sage Sparrow Savannah Sparrow Fox Sparrow Song Sparrow Lincoln's Sparrow White-throated Sparrow White-crowned Sparrow Dark-eyed Junco Red-winged Blackbird Brown-headed Cowbird Black Rosy Finch Pine Grosbeak Cassin's Finch Pine Siskin American Goldfinch Evening Grosbeak
Granivore: lower-canopy/shrub gleaner	Lesser Goldfinch	Lesser Goldfinch American Goldfinch
Granivore: upper-canopy gleaner	Pine Siskin Evening Grosbeak	Pine Siskin Evening Grosbeak Red-breasted Nuthatch White-breasted Nuthatch Pine Grosbeak Cassin's Finch Red Crossbill Lewis's Woodpecker

FORAGING GUILD	BREEDING PERIOD	NONBREEDING PERIOD
Herbivore: ground forager	Chukar Sage-grouse Gambel's Quail White-tailed Ptarmigan	Chukar Sage-grouse Gambel's Quail Ring-necked Pheasant Wild Turkey California Quail
Herbivore: lower-canopy/shrub forager		White-tailed Ptarmigan
Herbivore: upper-canopy forager		Blue Grouse Ruffed Grouse Sharp-tailed Grouse
Herbivore: water dabbler		American Coot
Herbivore: water diver		American Coot
Insectivore: air sallier	Lewis Woodpecker Hammond's Flycatcher Gray Flycatcher Black Phoebe Say's Phoebe Vermillion Flycatcher Ash-throated Flycatcher Cassin's Kingbird Western Kingbird Townsend's Solitaire Cedar Waxwing Red-headed Woodpecker Olive-sided Flycatcher Western Wood-Pewee Willow Flycatcher Least Flycatcher Dusky Flycatcher Cordilleran Flycatcher* Brown-crested Flycatcher Eastern Kingbird American Redstart Wilson's Warbler Western Tanager Black-throated Sparrow Black Rosy-Finch*	Lewis Woodpecker Hammond's Flycatcher Gray Flycatcher Black Phoebe Say's Phoebe Vermillion Flycatcher Ash-throated Flycatcher Cassin's Kingbird Western Kingbird Townsend's Solitaire Cedar Waxwing
Insectivore: air screener	Common Poorwill White-throated Swift Tree Swallow Violet-green Swallow N. Rough-winged Swallow Lesser Nighthawk Common Nighthawk Black Swift Purple Martin Bank Swallow Cliff Swallow Barn Swallow	Common Poorwill White-throated Swift Tree Swallow Violet-green Swallow N. Rough-winged Swallow

FORAGING GUILD	BREEDING PERIOD	NONBREEDING PERIOD
Insectivore: bark gleaner	Acorn Woodpecker Ladder-backed Woodpecker Downy Woodpecker Hairy Woodpecker Red-breasted Nuthatch White-breasted Nuthatch Pygmy Nuthatch Brown Creeper	Acorn Woodpecker Ladder-backed Woodpecker Downy Woodpecker Hairy Woodpecker Red-breasted Nuthatch White-breasted Nuthatch Pygmy Nuthatch Brown Creeper Red-naped Sapsucker Williamson's Sapsucker
Insectivore: bark scaler	Three-toed Woodpecker	Three-toed Woodpecker
Insectivore: freshwater diver	Eared Grebe Pied-billed Grebe	Eared Grebe
Insectivore: freshwater gleaner	Black-necked Stilt	Black-necked Stilt
Insectivore: freshwater shoreline gleaner	Wilson's Phalarope	
Insectivore: freshwater surface gleaner	Black Tern	
Insectivore: ground hawker	Flammulated Owl Western Screech Owl Northern Pygmy Owl	Flammulated Owl
Insectivore: lower-canopy/shrub gleaner	Ash-throated Flycatcher House Wren Golden-crowned Kinglet Ruby-crowned Kinglet Black-tailed Gnatcatcher Black-throated Gray Warbler Common Yellowthroat Yellow-billed Cuckoo Black-capped Chickadee Verdin Bushtit Bell's Vireo Gray Vireo Plumbeous Vireo Orange-crowned Warbler Virginia's Warbler Lucy's Warbler Yellow Warbler Yellow-rumped Warbler American Redstart MacGillvray's Warbler Wilson's Warbler Black-throated Sparrow	Ash-throated Flycatcher House Wren Golden-crowned Kinglet Ruby-crowned Kinglet Black-tailed Gnatcatcher Black-throated Gray Warbler Common Yellowthroat
Insectivore: marsh gleaner	Marsh Wren	Marsh Wren
Insectivore: marsh prober	Virginia's Rail	
Insectivore: mud gleaner	White-faced Ibis	White-faced Ibis
Insectivore: riparian bottom gleaner	American Dipper	American Dipper
Insectivore: shoreline gleaner	Spotted Sandpiper	Spotted Sandpiper Killdeer Long-billed Curlew

FORAGING GUILD	BREEDING PERIOD	NONBREEDING PERIOD
Insectivore: shoreline prober	Willet	
Insectivore: upper-canopy gleaner	Blue-gray Gnatcatcher Warbling Vireo Grace's Warbler Summer Tanager	Blue-gray Gnatcatcher
Insectivore: water ambusher	American Bittern	American Bittern
Insectivore: water diver		Pied-billed Grebe
Insectivore: water surface gleaner	Forster's Tern	Forster's Tern
Molluscovore: marsh prober	Virginia Rail	
Omnivore: bark gleaner	Red-naped Sapsucker* Williamson's Sapsucker	Red-naped Sapsucker*
Omnivore: floral hover-gleaner	Black-chinned Hummingbird Costa's Hummingbird Calliope Hummingbird Broad-tailed Hummingbird	Black-chinned Hummingbird Costa's Hummingbird
Omnivore: freshwater diver	American Coot	
Omnivore: ground forager	Sandhill Crane Rock Dove Steller's Jay Scrub Jay Pinyon Jay Clark's Nutcracker American Crow Cactus Wren Townsend's Solitaire Gray Catbird Bendire's Thrasher Crissal Thrasher European Starling Green-tailed Towhee Spotted Towhee* Lark Bunting Grasshopper Sparrow Gray Partridge Ring-necked Pheasant Blue Grouse Ruffed Grouse Sharp-tailed Grouse Wild Turkey Long-billed Curlew Horned Lark Veery Swainson's Thrush Northern Mockingbird Blue Grosbeak Rufous-crowned Sparrow	Sandhill Crane Rock Dove Steller's Jay Scrub Jay Pinyon Jay Clark's Nutcracker American Crow Cactus Wren Townsend's Solitaire Gray Catbird Bendire's Thrasher Crissal Thrasher European Starling Green-tailed Towhee Spotted Towhee* Lark Bunting Grasshopper Sparrow Northern Flicker Black-billed Magpie Western Bluebird Hermit Thrush American Robin Sage Thrasher American Pipit* Brewer's Sparrow Western Meadowlark

FORAGING GUILD	BREEDING PERIOD	NONBREEDING PERIOD
Omnivore: ground forager (cont.)	Chipping Sparrow Black-chinned Sparrow Vesper Sparrow Lark Sparrow Sage Sparrow Savannah Sparrow Fox Sparrow Song Sparrow Lincoln's Sparrow White-throated Sparrow White-crowned Sparrow Dark-eyed Junco Bobolink Red-winged Blackbird Brown-headed Cowbird Black Rosy-Finch* Cassin's Finch Pine Siskin American Goldfinch	
Omnivore: ground scavenger	Common Raven	Common Raven
Omnivore: marsh forager		Virginia Rail Sora
Omnivore: mud forager	Common Snipe	Common Snipe
Omnivore: upper-canopy forager	Gray Jay Pinyon Jay Clark's Nutcracker Pygmy Nuthatch Western Tanager Black-headed Grosbeak Bullock's Oriole* Pine Grosbeak Red Crossbill Pine Siskin Evening Grosbeak	Gray Jay Pinyon Jay Clark's Nutcracker Pygmy Nuthatch
Piscivore: coastal plunger		Caspian Tern
Piscivore: coastal surface gleaner		American White Pelican
Piscivore: freshwater diver	Western Grebe	
Piscivore: freshwater surface gleaner	American White Pelican	
Piscivore: water ambusher	Great Blue Heron Black-crowned Night Heron	Great Blue Heron Black-crowned Night Heron
Piscivore: water diver	Double-crested Cormorant	Double-crested Cormorant Western Grebe
Piscivore: water foot-plunger	Osprey Bald Eagle	Osprey Bald Eagle
Piscivore: water plunger	Forster's Tern Belted Kingfisher	Forster's Tern Belted Kingfisher
Vermivore: coastal beach gleaner		Snowy Plover
Vermivore: ground gleaner	American Robin	

FORAGING GUILD	BREEDING PERIOD	NONBREEDING PERIOD
Vermivore: ground prober	Common Snipe	

1 Guilds are defined at the end of Table 3.
2 Recently changed species as published in the American Ornithologists' Union (1998) Checklist of North American Birds, 7th edition or species which were omitted from foraging guilds listed by DeGraaf et al. (1985). Guilds for these species have been extrapolated from information on other species.

Table 5. Nest Characteristics of Utah Birds.

SPECIES[1]	NEST LOCATION[2]	NEST	NEST TYPE[4]	COWBIRD HOST [5]
Abert's Towhee	Shrub, tree	(To 30)	Cup	Common
Acorn Woodpecker	Snag	20-25 (6-60)	Cavity	No
American Avocet	Ground	0	Scrape	No
American Bittern	Ground	0	Platform	No
American Coot	Floating, shrub	0-2	Platform	No
American Crow	Deciduous tree, shrub	0-70	Cup	Rare
American Dipper	Cliff, bridge	0+	Oven	No
American Goldfinch	Shrub, tree	1-30 (T0 60)	Cup	Common
American Kestrel	Snag, cliff	12-80	Cavity	No
American Pipit	Ground	0	Cup	No
America Redstart	Deciduous tree, shrub	10-20 (4-7)	Cup	Frequent
American Robin	Deciduous tree, conifer	10-20 (0-75)	Cup	Rare
American White Pelican	Ground	0	Scrape	No
Ash-throated Flycatcher	Deciduous tree	3-20	Cavity	No
Bald Eagle	Conifer, cliff	30-60 (10-180)	Platform	No
Band-tailed Pigeon	Conifer, deciduous tree	6-30	Platform	No
Bank Swallow	Bank	4+	Burrow	Rare
Barn Owl	Snag, building, cave		Cavity	No
Barn Swallow	Building	6-40	Cup	Rare
Bell's Vireo	Shrub	1-5 (To 25)	Cup	Common
Belted Kingfisher	Bank, snag		Burrow, cavity	No
Bendire's Thrasher	Shrub	2-4 (to 8)	Cup	Rare
Bewick's Wren	Deciduous tree, snag	0-20+?	Cavity	Uncommon
Black Phoebe	Cliff, wall		Cup	Rare
Black Rosy-Finch	Ground, cliff	0-25	Cup, crevice	No
Black Swift	Cliff		Saucer	No
Black Tern	Floating, ground	0	Platform, scrape	No
Black-billed Magpie	Deciduous tree, shrub	20-30 (5-50)	Spherical	No
Black-capped Chickadee	Deciduous tree, snag	4-8 (To 40)	Cavity	Rare
Black-chinned Hummingbird	Deciduous tree	4-8 (To 30)	Cup	No
Black-chinned Sparrow	Shrub	1.5-3	Cup	Uncommon
Black-crowned Night Heron	Deciduous tree, shrub	15 - 30 (0-60)	Platform	No
Black-headed Grosbeak	Deciduous tree, shrub	4-12	Cup	Uncommon
Black-necked Stilt	Ground	0	Scrape	No
Black-tailed Gnatcatcher	Shrub	1-4	Cup	Uncommon

SPECIES[1]	NEST LOCATION[2]	NEST	NEST TYPE[4]	COWBIRD HOST [5]
Black-throated Gray Warbler	Conifer, deciduous tree	5-50 (1-50)	Cup	Rare
Black-throated Sparrow	Shrub, cactus	0-2	Cup	Uncommon
Blue Grosbeak	Shrub, tree	3-12 (0.5-15)	Cup	Frequent
Blue Grouse	Ground	0	Scrape	No
Blue-gray Gnatcatcher	Deciduous tree	2-25 (To 80)	Cup	Common
Bobolink	Ground	0	Cup	Uncommon
Brewer's Blackbird	Conifer, ground, shrub	0-150	Cup	Common
Brewer's Sparrow	Shrub	0-4	Cup	Uncommon
Broad-tailed Hummingbird	Deciduous tree, conifer	3-15 (To 30)	Cup	No
Brown Creeper	Conifer, deciduous tree	3-50	Under bark	Rare
Brown-crested Flycatcher	Deciduous tree, cactus	5-30	Cavity	No
Brown-headed Cowbird	Tree, shrub, ground		Parasite	No
Bullock's Oriole	Deciduous tree	15-30 (6-60)	Pendant	Uncommon
Burrowing Owl	Ground	0	Burrow	No
Bushtit	Deciduous tree, shrub	4-25 (To 50)	Pendant	Rare
Cactus Wren	Cactus	2-6 (To 30)	Spherical	No
California Gull	Ground	0	Scrape	No
California Quail	Ground	0	Scrape	No
Calliope Hummingbird	Conifer,deciduous tree, shrub	1.8-70	Cup	No
Canyon Wren	Cliff		Crevice	No
Caspian Tern	Ground	0	Scrape	No
Cassin's Finch	Conifer	10-80	Cup	No
Cassin's Kingbird	Deciduous tree	20-55 (8-55)	Cup	No
Cattle Egret	Deciduous tree, shrub	3-30 (0.5-65)	Platform	No
Cedar Waxwing	Deciduous tree, conifer	6-50	Cup	Uncommon
Chipping Sparrow	Conifer, deciduous tree	0-11 (To 60)	Cup	Frequent
Chukar	Ground	0	Scrape	No
Clark's Grebe	Floating	0	Platform	No
Clark's Nutcracker	Conifer	8-50	Cup	No
Cliff Swallow	Bridge, cliff, building	3+	Mud gourd	Rare
Common Black-hawk	Deciduous tree	20-30 (15-100)	Platform	No
Common Grackle	Deciduous tree, conifer	2-12 (To 100)	Cup	Rare
Common Moorhen	Floating, ground, shrub	0	Platform	No
Common Nighthawk	Ground	0	No nest	No
Common Poorwill	Ground	0	No nest, scrape	No
Common Raven	Cliff, conifer		Cup	No

SPECIES[1]	NEST LOCATION[2]	NEST	NEST TYPE[4]	COWBIRD HOST [5]
Common Snipe	Ground	0	Scrape	No
Common Yellowthroat	Shrub	0-3	Cup	Frequent
Cooper's Hawk	Deciduous tree, conifer	35-45 (10-60)	Platform	No
Cordilleran Flycatcher	Deciduous tree, cliff, ground	0-30	Cavity	Rare
Costa's Hummingbird	Shrub, deciduous tree	3-5 (1-30)	Cup	No
Crissal's Thrasher	Shrub	3-8	Cup	Rejects eggs
Dark-eyed Junco	Ground, bank	(To 20)	Cup, cavity	Uncommon
Double-crested Cormorant	Ground, tree	6-150 (0-150)	Platform	No
Downy Woodpecker	Snag	3-50	Cavity	No
Dusky Flycatcher	Shrub, tree	3-7 (2-15)	Cup	Rare
Eared Grebe	Floating	0	Platform	No
Eastern Kingbird	Deciduous tree, shrub	8-25 (2-60)	Cup	Common
European Starling	Deciduous tree, building	10-25 (2-60)	Cavity	No
Evening Grosbeak	Conifer, deciduous tree	20-100	Cup	Rare
Ferruginous Hawk	Conifer, cliff	20-40 (6-55)	Platform	No
Flammulated Owl	Snag		Cavity	No
Forster's Tern	Floating, ground	0	Platform, saucer	No
Fox Sparrow	Ground, shrub	0-3 (To 20)	Cup	Uncommon
Franklin's Gull	Floating	0	Platform	No
Gambel's Quail	Ground	0	Scrape	No
Golden Eagle	Cliff, tree	10-100+	Platform	No
Golden-crowned Kinglet	Conifer	4-60	Pendant	Rare
Grace's Warbler	Conifer	20-60	Cup	Rare
Grasshopper Sparrow	Ground	0	Cup	Uncommon
Gray Catbird	Shrub	2-10 (1-50)	Cup	Uncommon
Gray Flycatcher	Shrub, tree	2-9	Cup	No
Gray Jay	Conifer	4-30 (To 85)	Cup	No
Gray Partridge	Ground	0	Scrape	No
Gray Vireo	Shrub	2-6	Cup	Frequent
Great Blue Heron	Deciduous tree	30-70 (10-130)	Platform	No
Great Horned Owl	Deciduous tree, cliff	30-50 (15-70)	Abandoned nest	No
Greater Roadrunner	Deciduous tree, shrub, cactus	3-15	Platform	No
Great-tailed Grackle	Deciduous tree, shrub, reeds	2-30	Cup	Rejects eggs*
Green Heron	Deciduous tree, shrub	10-20 (0-30)	Platform	No
Green-tailed Towhee	Shrub, ground	0-2.5	Cup	Uncommon
Hairy Woodpecker	Deciduous tree, snag	4-60	Cavity	No

SPECIES[1]	NEST LOCATION[2]	NEST	NEST TYPE[4]	COWBIRD HOST [5]
Hammond's Flycatcher	Conifer, deciduous tree	10-40 (6-60)	Cup	No
Hermit Thrush	Ground, tree	0-8	Cup	Rare
Hooded Oriole	Deciduous tree, yucca	12-45	Pendant	Frequent*
Horned Lark	Ground	0	Saucer	Uncommon
House Finch	Deciduous tree, shrub, building	5-35	Cup, cavity	Uncommon
House Sparrow	Building, tree	To 40	Cavity, spherical	No
House Wren	Deciduous tree, snag	0-20	Cavity	Rare
Inca Dove	Shrub	10-12 (0-25)	Saucer	No
Indigo Bunting	Shrub, tree, vine tangle	1-15	Cup	Frequent
Juniper Titmouse	Deciduous tree, snag	3-10 (To 32)	Cavity	No
Killdeer	Ground	0	Scrape	No
Ladder-backed Woodpecker	Deciduous tree, agave	6-14 (3-30)	Cavity	No
Lark Bunting	Ground	0	Cup	Uncommon
Lark Sparrow	Ground, shrub	0-7 (To 25)	Cup	Occasional
Lazuli Bunting	Shrub, vine tangle	1.5-4 (To 10)	Cup	Uncommon
Le Conte's Thrasher	Shrub	2-4 (1-6)	Cup	Rare
Least Flycatcher	Deciduous tree, shrub	10-40 (2-60)	Cup	Uncommon
Lesser Goldfinch	Deciduous tree, shrub, forb	2-30	Cup	Rare
Lesser Nighthawk	Ground	0	No nest	No
Lewis Woodpecker	Deciduous tree, snag	5-100 (To 170)	Cavity	No
Lincoln's Sparrow	Ground	0-5	Cup	Rare
Loggerhead Shrike	Deciduous tree, shrub	3-30 (To 50)	Cup	No
Long-billed Curlew	Ground	0	Scrape	No
Long-eared Owl	Deciduous tree, ground	25-35 (0-40)	Abandoned	No
Lucy's Warbler	Snag	3-11 (0-11)	Cavity	Occasional
MacGillivray's Warbler	Shrub, ground	2-3 (1-5)	Cup	Uncommon
Marsh Wren	Reeds	1-9 (To 15)	Spherical	No
Merlin	Deciduous tree, cliff	15-35 (8-60)	Platform	No
Mountain Bluebird	Snag	2-50	Cavity	Rare
Mountain Chickadee	Conifer, snag	4-8 (0.5-80)	Cavity	No
Mountain Plover	Ground	0	Scrape	No
Mourning Dove	Deciduous tree, conifer, ground	0-40	Saucer	Rare
Northern Flicker	Snag	6-15 (To 100)	Cavity	No
Northern Goshawk	Conifer, deciduous tree	20-60 (18-75)	Platform	No
Northern Harrier	Ground, shrub	<5	Platform	No
Northern Mockingbird	Shrub, tree	3-10 (0.5-20)	Cup	Rare

SPECIES[1]	NEST LOCATION[2]	NEST	NEST TYPE[4]	COWBIRD HOST [5]
Northern Pygmy Owl	Snag	8-20	Cavity	No
Northern Rough-winged Swallow	Bank, cliff, culvert	4+	Burrow, crevice	No
Northern Saw-whet Owl	Snag	14-60	Cavity	No
Olive-sided Flycatcher	Conifer	5 - 75	Cup	Rare
Orange-crowned Warbler	Ground, shrub	0-3	Cup	Rare
Osprey	Deciduous tree, cliff	10-60 (0-200)	Platform	No
Peregrine Falcon	Cliff, tree	50-200+	Scrape	No
Phainopepla	Deciduous tree, shrub	4-50	Cup	Rare
Pied-billed Grebe	Floating	0	Platform	No
Pine Grosbeak	Conifer, shrub	2-25	Cup	No
Pine Siskin	Conifer, deciduous tree	8-50 (3-50)	Saucer	Uncommon
Pinyon Jay	Conifer	3-26 (To 85)	Cup	No
Plumbeous Vireo	Conifer, deciduous tree	4-30	Cup	Common
Prairie Falcon	Cliff	30-40 (20-400)	Scrape, crevice	No
Purple Martin	Snag	5+	Cavity	No
Pygmy Nuthatch	Conifer, snag	6-60	Cavity	No
Red Crossbill	Conifer	6-40	Cup	No
Red-breasted Nuthatch	Conifer	5-40 (To 120)	Cavity	No
Red-naped Sapsucker	Deciduous tree	10-20 (3-35)	Cavity	No
Red-tailed Hawk	Deciduous tree, cliff	15-70 (0-120)	Platform	No
Red-winged Blackbird	Reeds	1-8 (0.5-20)	Cup	Frequent
Ring-billed Gull	Ground	0	Saucer	No
Ring-necked Pheasant	Ground	0	Scrape	No
Rock Dove	Man-made structures, cliff		Saucer	No
Rock Wren	Ground	0	Crevice	Occasional
Ruby-crowned Kinglet	Conifer	15-30 (2-100)	Pendant	Rare
Ruffed Grouse	Ground	0	Scrape	No
Rufous-crowned Sparrow	Ground, shrub	0-2.5 (To 25)	Cup	No
Sage-grouse	Ground	0	Scrape	No
Sage Sparrow	Shrub, ground	0-3.3	Cup	Uncommon
Sage Thrasher	Shrub, ground	0-3 (To 5)`	Cup	Rejects eggs
Sandhill Crane	Ground	0	Saucer	No
Savannah Sparrow	Ground	0-0.5	Cup	Uncommon
Say’s Phoebe	Cliff, wall		Cup	Rare
Scaled Quail	Ground	0	Scrape	No
Scott’s Oriole	Deciduous tree, yucca	4-18	Pendant	Rare[*]

SPECIES[1]	NEST LOCATION[2]	NEST	NEST TYPE[4]	COWBIRD HOST [5]
Sharp-shinned Hawk	Conifer, deciduous tree	10-60 (10-90)	Platform	No
Sharp-tailed Grouse	Ground	0	Scrape	No
Short-eared Owl	Ground	0	Scrape	No
Snowy Egret	Deciduous tree, shrub	5-10 (0-30)	Platform	No
Snowy Plover	Ground	0	Scrape	No
Song Sparrow	Ground, shrub	0-3 (To 12)	Cup	Frequent
Sora	Floating, ground	0	Saucer	No
Spotted Owl	Coniferous tree, cliff	80 (30-160)	Cavity, platform,	No
Spotted Sandpiper	Ground	0	Scrape	No
Spotted Towhee	Ground, shrub	0-5 (To 18)	Cup	Frequent
Steller's Jay	Conifer	8-25 (To 100)	Cup	No
Summer Tanager	Deciduous tree, conifer	10-35	Cup	Uncommon
Swainson's Hawk	Deciduous tree, cliff	20-30 (6-70)	Platform	No
Swainson's Thrush	Shrub, conifer	4-20 (0-40)	Cup	Rare
Three-toed Woodpecker	Snag	3-15 (1-45)	Cavity	No
Townsend's Solitaire	Ground, snag	0-10	Cup, cavity	No
Tree Swallow	Snag	5+	Cavity	Rare
Turkey Vulture	Cliff, snag	0 - 20+	No nest	No
Veery	Ground, shrub	0-6 (To 25)	Cup	Common
Verdin	Shrub, cactus	2-20	Spherical	No
Vermilion Flycatcher	Deciduous tree	8-20 (4-60)	Cup	Rare
Vesper Sparrow	Ground	0	Cup	Common
Violet-green Swallow	Snag	5+	Cavity	No
Virginia Rail	Ground	0	Saucer	No
Virginia's Warbler	Ground	0	Cup	Rare
Warbling Vireo	Deciduous tree, shrub	30-90 (4-90)	Cup	Common
Western Bluebird	Snag	2-50?	Cavity	Rare
Western Grebe	Floating	0	Platform	No
Western Kingbird	Deciduous tree, shrub	15-30 (5-40)	Cup	Rare
Western Meadowlark	Ground	0	Cup	Uncommon
Western Screech Owl	Snag, cactus	5-30	Cavity	No
Western Scrub-Jay	Deciduous tree, shrub	3-30	Cup	No
Western Tanager	Conifer	6-65	Cup	Rare
Western Wood-Pewee	Conifer	15-35 (2-75)	Cup	Rare
White-breasted Nuthatch	Deciduous tree	10-60 (3-60)	Cavity	Rare
White-crowned Sparrow	Shrub, ground	1-5 (0-35)	Cup	Uncommon

SPECIES[1]	NEST LOCATION[2]	NEST	NEST TYPE[4]	COWBIRD HOST [5]
White-faced Ibis	Ground, shrub, tree	0 - 6	Platform	No
White-tailed Ptarmigan	Ground	0	Scrape	No
White-throated Swift	Cliff		Crevice	No
White-winged Dove	Deciduous tree	4-25	Saucer	No
Wild Turkey	Ground	0	Scrape	No
Willet	Ground	0	Scrape	No
Williamson's Sapsucker	Deciduous tree, conifer	3-60	Cavity	No
Willow Flycatcher	Shrub, deciduous tree	2-10 (1-18)	Cup	Common
Wilson's Phalarope	Ground	0	Scrape	No
Wilson's Warbler	Ground, vine tangle	0-3	Cup	Uncommon
Yellow Warbler	Shrub, tree	1-14 (To 60)	Cup	Frequent
Yellow-billed Cuckoo	Deciduous tree, shrub	4-8 (3-20)	Platform	No
Yellow-breasted Chat	Shrub	1-5 (To 8)	Cup	Frequent
Yellow-headed Blackbird	Reeds	0.5-3	Cup	Rare
Yellow-rumped Warbler	Conifer	4-50	Cup	Rare

1 Nesting information in this table was primarily extracted from Ehrlich et al. (1988). Baicich and Harrison (1997), Harrison (1979) were also used as sources of information on nesting. Species in this table are limited to summer residents of Utah.
2 Nest locations: agave, bank, bridge, building, cactus, cave, cliff, conifer, culvert, deciduous tree, floating, ground, reeds, shrub, snag, tree, vine tangle. Each of these is from Ehrlich et al. (1988) and is self-explanatory.
3 Nest height is given in feet. Numbers outside of parentheses are usual heights. Numbers in parentheses are ranges.
4 Nest types: burrow, cavity, crevice, cup, no nest, pendant, platform, saucer, scrape, sphere.
5 Cowbird host categories: no, rare, occasional, uncommon, common, frequent. The Brown-headed Cowbird is the most common species found in Utah. Bronzed Cowbirds occur only occasionally in the state. Host species for Bronzed Cowbirds are marked with * as a superscript.

Table 6. Nesting Groups of Utah Birds.[1]

CANOPY LEVEL[2] - TREE/SNAG - OPEN NEST[4,5]		
American Crow	**Common Black-Hawk**	**Mourning Dove**
American Goldfinch	Common Grackle	**Northern Goshawk**
American Redstart	Common Raven	**Olive-sided Flycatcher**
American Robin	**Cooper's Hawk**	**Osprey**
Bald Eagle	**Double-crested Cormorant**	**Phainopepla**
Barn Swallow	Eastern Kingbird	**Pine Siskin**
Black-billed Magpie[5]	**Evening Grosbeak**	Pinyon Jay
Black-crowned Night Heron	**Ferruginous Hawk**	**Red Crossbill**
Black-throated Gray Warbler	Golden Eagle	**Red-tailed Hawk**
Blue-gray Gnatcatcher	**Golden-crowned Kinglet**[4]	Ruby-crowned Kinglet[4]
Brewer's Blackbird	**Grace's Warbler**	**Sharp-shinned Hawk**
Brown-headed Cowbird[8]	Gray Catbird	Spotted Owl
Bullock's Oriole[4]	Gray Jay	Steller's Jay
Bushtit[4]	**Great Blue Heron**	Swainson's Hawk
Calliope Hummingbird	**Great Horned Owl**	Swainson's Thrush
Cattle Egret	**Hammond's Flycatcher**	Vermillion Flycatcher
Cassin's Finch	**House Sparrow**[5]	**Warbling Vireo**
Cassin's Kingbird	**Hooded Oriole**[4]	Western Kingbird
Cedar Waxwing	Least Flycatcher	**Western Tanager**
Chipping Sparrow	Loggerhead Shrike	Western Wood-Pewee
Clark's Nutcracker	Long-eared Owl	**Yellow-rumped Warbler**

CANOPY LEVEL - TREE/SNAG - CAVITY NEST[9]		
Acorn Woodpecker	**Hairy Woodpecker**	**Pygmy Nuthatch**
American Kestrel	**House Sparrow**	**Red-breasted Nuthatch**
Barn Owl	**Lewis Woodpecker**	Three-toed Woodpecker
Belted Kingfisher	**Mountain Bluebird**	**Tree Swallow**
Black-capped Chickadee	Mountain Chickadee	**Violet-green Swallow**
Brown Creeper[6]	Northern Flicker	**Western Bluebird**
Downy Woodpecker	**Northern Saw-whet Owl**	**White-breasted Nuthatch**
European Starling	Peregrine Falcon	**Williamson's Sapsucker**
Flammulated Owl	Purple Martin	

SUBCANOPY LEVEL[10] - TREE/SNAG/SHRUB - OPEN NEST		
Abert's Towhee	**Cassin's Finch**	**Gray Flycatcher**
American Crow	**Cassin's Kingbird**	**Gray Jay**
American Goldfinch	**Cattle Egret**	**Gray Vireo**
American Redstart	**Cedar Waxwing**	Great Blue Heron
American Robin	**Chipping Sparrow**	Great Horned Owl
Band-tailed Pigeon	**Clark's Nutcracker**	**Great-tailed Grackle**
Barn Swallow	**Common Black-Hawk**	**Greater Roadrunner**
Bell's Vireo	**Common Grackle**	**Green Heron**
Bendire's Thrasher	Common Raven	**Hammond's Flycatcher**
Black-billed Magpie[5]	Cooper's Hawk	**Hermit Thrush**
Black-chinned Hummingbird	**Costa's Hummingbird**	**Hooded Oriole**[4]
Black-crowned Night Heron	**Crissal Thrasher**	**House Finch**
Black-headed Grosbeak	Dark-eyed Junco	**House Sparrow**[5]
Black-throated Gray Warbler	Double-crested Cormorant	**Inca Dove**
Blue-gray Gnatcatcher	**Dusky Flycatcher**	**Indigo Bunting**
Blue Grosbeak	**Eastern Kingbird**	**Lark Sparrow**
Brewer's Blackbird	**Evening Grosbeak**	Lazuli Bunting
Broad-tailed Hummingbird	**Ferruginous Hawk**	**Least Flycatcher**
Brown-headed Cowbird[8]	Fox Sparrow	LeConte's Thrasher
Bullock's Oriole[4]	**Golden Eagle**	**Lesser Goldfinch**
Bushtit[4]	**Golden-crowned Kinglet**[4]	**Lincoln's Sparrow**
Cactus Wren[5]	**Grace's Warbler**	**Loggerhead Shrike**
Calliope Hummingbird	**Gray Catbird**	**Long-eared Owl**

SUBCANOPY LEVEL[10] - TREE/SNAG/SHRUB - OPEN NEST (Cont'd)		
MacGillivray's Warbler	**Ruby-crowned Kinglet**[4]	**Verdin**[5]
Marsh Wren[5]	Rufous-crowned Sparrow	**Vermillion Flycatcher**
Merlin	Sage Sparrow	Warbling Vireo
Mourning Dove	Sage Thrasher	**Western Kingbird**
Northern Goshawk	**Scott's Oriole**[4]	**Western Scrub-Jay**
Northern Mockingbird	**Sharp-shinned Hawk**	**Western Tanager**
Olive-sided Flycatcher	**Snowy Egret**	**Western Wood-Pewee**
Osprey	Song Sparrow	**White-crowned Sparrow**
Phainopepla	**Spotted Towhee**	**White-winged Dove**
Pine Grosbeak	**Steller's Jay**	White-faced Ibis
Pine Siskin	**Summer Tanager**	**Willow Flycatcher**
Pinyon Jay	**Swainson's Hawk**	**Yellow-billed Cuckoo**
Plumbeous (Solitary) Vireo	**Swainson's Thrush**	**Yellow-breasted Chat**
Red Crossbill	**Townsend's Solitaire**	**Yellow-rumped Warbler**
Red-tailed Hawk	**Turkey Vulture**	**Yellow Warbler**
Red-winged Blackbird	**Veery**	

SUBCANOPY LEVEL[11]- TREE/SNAG/SHRUB - CAVITY NEST		
Acorn Woodpecker	**Flammulated Owl**	**Northern Saw-whet Owl**
American Kestrel	**Hairy Woodpecker**	**Purple Martin**
Ash-throated Flycatcher	**House Finch**	**Pygmy Nuthatch**
Barn Owl	**House Sparrow**[5]	**Red-breasted Nuthatch**
Belted Kingfisher	**House Wren**	**Red-naped Sapsucker**
Bewick's Wren	**Juniper Titmouse**	**Three-toed Woodpecker**
Black-capped Chickadee	**Ladder-backed Woodpecker**	Townsend's Solitaire
Brown Creeper[6]	**Lewis Woodpecker**	**Tree Swallow**
Brown-crested Flycatcher	**Lucy's Warbler**	**Violet-green Swallow**
Cordilleran Flycatcher	**Mountain Bluebird**	**Western Bluebird**
Dark-eyed Junco	**Mountain Chickadee**	**Western Screech Owl**
Downy Woodpecker	**Northern Flicker**	**White-breasted Nuthatch**
European Starling	**Northern Pygmy Owl**	**Williamson's Sapsucker**

GROUND LEVEL[11]		
Abert's Towhee	**Bobolink**	**Dark-eyed Junco**
American Avocet	Brewer's Blackbird	Double-crested Cormorant
American Bittern	**Brewer's Sparrow**	Dusky Flycatcher
American Coot[7]	Broad-tailed Hummingbird	**Eared Grebe**[7]
American Crow	Brown-headed Cowbird[8]	Eastern Kingbird
American Goldfinch	**Burrowing Owl**	European Starling
American Pipit	Cactus Wren[5]	Ferruginous Hawk
American Robin	**California Gull**	**Forster's Tern**[7]
American White Pelican	**California Quail**	**Fox Sparrow**
Bell's Vireo	**Calliope Hummingbird**	**Franklin's Gull**[7]
Bendire's Thrasher	**Caspian Tern**	**Gambel's Quail**
Bewick's Wren	Cattle Egret	**Grasshopper Sparrow**
Black Rosy-Finch	**Chipping Sparrow**	**Gray Catbird**
Black Tern[7]	**Chukar**	Gray Flycatcher
Black-chinned Sparrow	**Clark's Grebe**[7]	**Gray Partridge**
Black-crowned Night Heron	**Common Grackle**	**Gray Vireo**
Black-necked Stilt	**Common Moorhen**[7]	Great Blue Heron
Black-tailed Gnatcatcher	**Common Nighthawk**	**Great-tailed Grackle**
Black-throated Gray Warbler	**Common Poorwill**	Green Heron
Black-throated Sparrow	**Common Snipe**	**Green-tailed Towhee**
Blue-gray Gnatcatcher	**Common Yellowthroat**	**Hermit Thrush**
Blue Grosbeak	**Cordilleran Flycatcher**	**Horned Lark**
Blue Grouse	Costa's Hummingbird	House Sparrow[5]

GROUND LEVEL[11] (Cont'd)		
Indigo Bunting	**Pied-billed Grebe**[7]	Swainson's Thrush
Killdeer	Red-tailed Hawk	**Townsend's Solitaire**
Lark Bunting	**Red-winged Blackbird**	**Turkey Vulture**
Lark Sparrow	**Ring-billed Gull**	**Veery**
Lazuli Bunting	**Ring-necked Pheasant**	Verdin[5]
Least Flycatcher	**Rock Wren**	**Vesper Sparrow**
LeConte's Thrasher	**Ruffed Grouse**	**Virginia Rail**
Lesser Goldfinch	**Rufous-crowned Sparrow**	**Virginia's Warbler**
Lesser Nighthawk	**Sage-grouse**	**Western Grebe**[7]
Lincoln's Sparrow	**Sage Sparrow**	**Western Meadowlark**
Long-eared Owl	**Sage Thrasher**	Western Wood-Pewee
Long-billed Curlew	**Sandhill Crane**	**White-crowned Sparrow**
Lucy's Warbler	**Savannah Sparrow**	**White-faced Ibis**
MacGillivray's Warbler	**Scaled Quail**	**White-tailed Ptarmigan**
Marsh Wren[5]	**Sharp-tailed Grouse**	**Wild Turkey**
Mountain Bluebird	**Short-eared Owl**	**Willet**
Mountain Chickadee	Snowy Egret	Willow Flycatcher
Mountain Plover	**Snowy Plover**	**Wilson's Phalarope**
Mourning Dove	**Song Sparrow**	**Wilson's Warbler**
Northern Harrier	**Sora**[7]	**Yellow-breasted Chat**
Northern Mockingbird	**Spotted Sandpiper**	**Yellow Warbler**
Orange-crowned Warbler	**Spotted Towhee**	**Yellow-headed Blackbird**
CLIFF/BANK[12]		
American Dipper	**Common Raven**	**Prairie Falcon**
American Kestrel	Cordilleran Flycatcher	Red-tailed Hawk
Bald Eagle	Dark-eyed Junco	**Rock Dove**
Bank Swallow	Ferruginous Hawk	**Say's Phoebe**
Belted Kingfisher	**Golden Eagle**	**Spotted Owl**
Black Phoebe	Great-horned Owl	Swainson's Hawk
Black Rosy-Finch	**Merlin**	**Turkey Vulture**
Black Swift	N. Rough-winged Swallow	**White-throated Swift**
Canyon Wren	Osprey	
Cliff Swallow	**Peregrine Falcon**	

1. Bolded species indicate typical nesting group(s); groupings and nest type definitions follow Ehrlich et al. 1988.
2. Canopy level may vary by site but is defined for this table as >30 feet.
3. Open nest includes platform, saucer, and cup unless otherwise indicated
4. p = pedant-shaped nest
5. s = spherical-shaped nest
6. b = nest under bark
7. f = floating nest
8. Brown-headed Cowbirds are nest parasites and do not build their own nests.
9. Cavity nest includes nests in tree cavities, burrows, and caves
10. Subcanopy level may vary by site but is defined for this table as > 3 and $\leq$ 30 feet.
11. Ground level is 0 - 3 feet; species in this group include those that nest directly on the ground and those that nest low in trees, shrubs, etc.
12. Cliff/Bank nests may be at any height; see Table 4 for species-specific nest types

BIRDS IN UTAH MOST IN NEED OF CONSERVATION

SPECIES IDENTIFICATION PROCESS

Effective and efficient management of avian communities means knowing the species and habitats most in need of our conservation efforts. The Utah Partners in Flight (UPIF) Ranking Committee used a multi-faceted approach to identifying priority species for conservation action, a more practical method of evaluation than attempting to write and implement conservation actions for every bird species in Utah. The ecological tenet underlying this process, that conservation actions focused on priority species will benefit other avian species (as well as other forms of wildlife), extends the benefits to most birds in Utah.

More formally, the Utah Avian Conservation Strategy (UTACS) priority species identification process was designed as a tool for distinguishing those species to be used in development and implementation of initial conservation actions. Priority species were selected by assigning a numerical score to each species known to occur within Utah based on several measures of conservation "vulnerability." Species with relatively high overall scores are considered most in need of conservation action, or at least need to be carefully monitored throughout their range within Utah.

Nationally, Partners in Flight initially focused only on Neotropical migratory birds. As the national program progressed, emphasis expanded to include all breeding, wintering, and resident birds except waterfowl. Following the expanded national Partners in Flight emphasis, UPIF has focused on the birds that will be most positively influenced by management as well as those species with the greatest immediate threats. In many cases, management of habitat groups will provide protection for suites of species and allow land managers to participate in necessary conservation actions. This approach often results in less of the financial burden than single-species management practices can incur.

SPECIES RANKING SYSTEM

The UPIF Rankings Committee employed 8 criteria in prioritizing Utah bird species (detailed below). The criteria are based upon national PIF Planning Process criteria first developed in 1993 (see Carter et al. 2000) with modifications made to provide a more specific approach overall for Utah. Criteria include four 'global' measures (i.e., they do not change from region to region), three 'local' measures (i.e., measures specific to Utah and physiographic strata), and one measure assessing the uncertainty associated with the'local' measures. Each species is given a score of 1-5 in each category, with 1 indicating the least amount of vulnerability with regard to that parameter and 5 the greatest amount of vulnerability (Appendix A).

The exception to this scoring scheme is the population trend uncertainty measure (PU) which combines the scaled uncertainty associated with the three 'local' measures: population trend (PT), threats to non-breeding populations (TN), and threats to breeding populations (TB). Uncertainty associated with each of the three is estimated on a 1-5 scale, and then summed for a total range of 3-15. This final category was not added to the final scores, but was included in process to indicate species with a high degree of uncertainty or lack of sufficient information. In one further divergence from the national process, the UPIF Rankings Committee considered the three 'local' measures more important than the others and subsequently weighted these by doubling their scores. Scores for each species were then summed (Utah PIF SUM) to produce a possible composite score ranging from 10 -50.

The priority species identified in the current version of UTACS should be be viewed as a statewide list that may have limited application within a given physiographic area. The next step in the species ranking process is to further evaluate these species for each physiographic region of Utah.

The 8 criteria used for Utah's ranking process were:

1. **Relative Abundance (RA)**
   Relative abundance is the abundance of a bird, in appropriate habitat within its entire range, relative to other bird species. This area-independent (global) criterion gives an indication of a species' vulnerability to catastrophic environmental changes. A low score indicates a higher relative abundance, and therefore a reduced risk of complete extirpation from losses in one or more regions. Higher scores indicate a lower relative abundance, and thus a greater vulnerability to drastic losses or population changes. This criteria was used for both wintering and breeding bird ranks.
2. **Breeding Distribution (BD)**
   High scores in this area-independent criterion indicate typically localized breeding, and thus a species with a greater vulnerability to drastic environmental changes; low scores indicate a wide breeding distribution with a correspondingly lesser likelihood of extirpation.
3. **Winter Distribution (WD)**
   This area-independent criterion is similar to the Breeding Distribution criterion definition, applied to a species' winter range.
4. **Threats in Breeding Range (TB)**
   Two factors are considered in the creation of this area-dependent criterion: historic habitat loss/disruption and future threats. The magnitude of these threats are modulated by a species' degree of ecological specialization. TB is a combination of the amount of habitat (or conditions necessary for survival and reproductive success) that has been lost in the past (here defined as since 1945) and the amount that is anticipated will be lost in the future (with an estimated 50 year look ahead). High scores indicate either that a large loss of habitat has or is likely to occur and/or that a species that is an extreme ecological specialist. Low scores indicate a stable or increasing habitat and/or that a species that is an ecological generalist.
5. **Threats - Non-breeding (TN)**
   Similar to the TB criterion, but TN is an area independent score (global score) that is used to assess non-localized treats that have occurred or may occur outside the breeding area and season. Like TB, threats may include such population limiting factors as habitat loss, pesticides, predation, human recreation (or any combination).
6. **Importance of Area (IA)**
   High scores in this area-dependent criterion indicate that a large proportion of a breeding range occurs within Utah and/or that a species is using a habitat only available in Utah. It comprises both breeding and wintering area.
7. **Population Trend (PT)**
   Population trend values were almost always assigned based on the BBS data for this area-dependent criterion. In cases where the BBS data were nonexistent or uncertain, the UPIF Rankings Committee used additional data and expert opinion.
8. **Population Trend Uncertainty (PU)**
   Population trend uncertainty values are linked to the IA, TB, and PT scores (scale: 1-5 each). The PU scores for Utah were taken as an overall measure (sum) of uncertainty for these three criteria (combined range 3-15). Uncertainty values associated with these criteria were calculated in order to separate species with modest, but certain declines from those with potentially significant declines for which reliable information is not available.

Table 7. Utah Partners in Flight Priority Species.[1]

PRIORITY SPECIES	IA[2]	RA	BD	WD	TB[2]	TN	PT[2]	PU	UTPIF SUM[1]	1^0 BREEDING HABITAT	2^0 BREEDING HABITAT	WINTERING HABITAT
Lewis's Woodpecker	3	4	4	4	4	4	5	8	40	Ponderosa Pine	Lowland Riparian	Oak
Abert's Towhee	2	3	5	5	5	5	4	8	40	Lowland Riparian	Lowland Riparian	Lowland Riparian
American Avocet	5	2	3	4	4	4	3	6	37	Wetland	Playa	Migrant
Le Conte's Thrasher[3]	2	5	5	5	4	4	3	8	37	Low Desert Scrub	Low Desert Scrub	Low Desert Scrub
Mountain Plover	2	5	5	4	4	4	3	7	36	High Desert Scrub	High Desert Scrub	Migrant
Lucy's Warbler	2	2	5	5	5	4	3	8	36	Lowland Riparian	Low Desert Scrub	Migrant
Sage-grouse[4]	3	4	3	3	4	4	4	8	36	Shrubsteppe	Shrubsteppe	Shrubsteppe
American White Pelican	5	3	3	3	4	3	3	7	36	Water	Wetland	Migrant
Bobolink	2	4	3	4	5	3	4	8	36	Wet Meadow	Agriculture	Migrant
Virginia's Warbler	4	4	4	5	3	3	3	3	36	Oak	Pinyon-Juniper	Migrant
Gray Vireo	4	4	4	5	3	3	3	6	36	Pinyon-Juniper	Oak	Migrant
Bell's Vireo	2	4	3	4	5	4	3	8	35	Lowland Riparian	Lowland Riparian	Migrant
Black Rosy-Finch	5	3	5	5	2	2	3	8	35	Alpine	Alpine	Grassland
Long-billed Curlew	2	3	4	4	4	3	4	6	34	Grassland	Agriculture	Migrant
Sharp-tailed Grouse	2	4	3	3	4	4	4	8	34	Shrubsteppe	Grassland	Shrubsteppe
Brewer's Sparrow	3	2	4	3	4	3	4	4	34	Shrubsteppe	High Desert Scrub	Migrant
Black Swift	2	5	5	4	3	4	3	??	34	Lowland Riparian	Cliff	Migrant
Black-necked Stilt	3	3	4	3	4	4	3	6	34	Wetland	Playa	Migrant
Broad-tailed Hummingbird	3	2	4	4	3	3	4	5	33	Lowland Riparian	Mountain Riparian	Migrant
Ferruginous Hawk	3	4	3	3	4	3	3	6	33	Pinyon-Juniper	Shrubsteppe	Grassland
Brown-crested Flycatcher[3]	2	5	5	2	4	3	3	8	33	Lowland Riparian	Low Desert Scrub	Migrant
Bendire's Thrasher[3]	2	4	5	5	3	3	3	7	33	Low Desert Scrub	Low Desert Scrub	Migrant
Black-tailed Gnatcatcher[3]	2	4	5	5	3	3	3	3	33	Low Desert Scrub	Lowland Riparian	Low Desert Scrub
Common Black-Hawk[3]	2	5	3	3	4	3	3	8	32	Lowland Riparian	Lowland Riparian	Migrant
Yellow-billed Cuckoo	3	3	2	3	4	4	3	8	32	Lowland Riparian	Agriculture	Migrant
Black-throated Gray Warbler	3	3	4	4	3	3	3	3	32	Pinyon-Juniper	Mountain Shrub	Migrant
Grasshopper Sparrow[3]	2	4	2	3	4	3	4	8	32	Grassland	Grassland	Migrant
Three-toed Woodpecker	4	2	2	3	4	3	3	8	32	Sub-Alpine Conifer	Lodgepole Pine	Sub-Alpine Conifer
Sage Sparrow	3	3	4	4	3	3	3	2	32	Shrubsteppe	High Desert Scrub	Low Desert Scrub
Gambel's Quail	3	3	4	4	3	3	3	8	32	Low Desert Scrub	Lowland Riparian	Low Desert Scrub
Cordilleran Flycatcher[5]	3	3	4	4	3	3	3	6	32	Sub-Alpine Conifer	Mountain Riparian	Migrant
Gray Flycatcher[6]	4	3	4	4	3	3	2	7	32	Pinyon-Juniper	High Desert Scrub	Migrant
Spotted Owl (Mexican)[7]	2	5	4	4	3	3	3	8	32	Cliff	Lowland Riparian	Cliff

1 All species which had a ranking sum greater than 31 were considered for the final list. Utah Partners in Flight Priority species for conservation action appear in bold type. Removal of species from the final list are given below. Those species not considered as priority species were at least partially represented by priority species that require the same habitat type.
2 Importance of Area (IA), Threats to Breeding Habitat (TB), and Population Trend (PT) were considered to be more important ranking factors and were weighted more heavily than other factors in calculating final scores. The values of these three factors were therefore doubled in the revised final rankings (UTPIF SUM). Also, PU was not in included in scores, as it was used primarily as a qualifier for the other scores.
3 Species removed from the final list because of limited distribution or low abundance in Utah combined with relatively wide distribution or high abundance in the portion of its range outside of Utah (i.e., Utah is not particularly important to species as a whole).
4 Sage-grouse includes Greater and Gunnison species
5 Species removed from the final list because it is common in Utah and other portions of its range and does not have a significant declining population trend.
6 Species removed from the final list because it is common in Utah and other portions of its range and has a significant increasing population trend.
7 Species removed from the final list because it is federally listed as Threatened and has a Recovery Plan which is currently being implemented in Utah and across its range.

Based on the scoring process within each of the 8 prioritization criteria, a ranked list of all of Utah's native landbirds was developed (Table 7 and Appendix B). The list was developed using BBS data for Utah and the national Partners in Flight Prioritization Database as evaluated and refined by the Utah Partners in Flight Rankings Committee. The national Partners in Flight Prioritization Database is based primarily on the results of Breeding Bird Surveys (BBS) which does not always reflect a comprehensive assessment of local avifaunas. Further, BBS data are not habitat specific in all cases.

PRIORITY SPECIES AND HABITATS

Priority bird species in Utah were selected using first the prioritization scheme and second by a qualitative, informed decision. Species that scored 32 or higher were selected for the priority list (Table 7). Some species were removed from the list because of limited distribution or low abundance in Utah combined with relatively wide distribution or high abundance in the portion of its range outside of Utah (i.e., Utah is not particularly important to species as a whole); or because the species is common in Utah and other portions of its range and does not have a significant declining population trend; or because the species is common in Utah and other portions of its range and has a significant increasing population trend; or because the species is federally listed as Threatened and has a Recovery Plan which is currently being implemented in Utah and across its range.

The UPIF Rankings Committee also assigned a primary and secondary breeding habitat category to each species as well as a winter habitat category for those species that overwinter in the state. On this basis, a list of priority habitats were selected based on the habitat preferences of the priority species selected.

The UPIF priority species list is not intended to replace the State Sensitive Species List or Federal Endangered Species list. Rather, it is intended to be used as a tool by federal and state agencies to assist in the prioritization of bird species that should be considered for conservation action. Finally, we recognize that gaps remain in our knowledge and understanding of avian community dynamics in Utah. Thus, the current version of UTACS should be viewed as a non-static set of recommendations and assessments that will be sensitive to new information and refinement for future prioritization schemes and recommendations.

PRIORITY SPECIES ACCOUNTS

LEWIS'S WOODPECKER
(*Melanerpes lewis*)

Conservation Priority Score of 40

Mike Danzenbcaker www.avesphoto.com

Lewis's Woodpecker is generally considered a "specialty" for birders in Utah. It is a habitat specialist and is not always found. In winter it is particularly nomadic, and is sometimes found in small groups. Primary breeding habitat for Lewis's Woodpecker in Utah is Ponderosa Pine, with secondary breeding habitat being Lowland Riparian; it also breeds frequently in Mountain Shrub. It is found in woodland edges, streamside trees and recently burned forests. Wintering habitat is open woodland, including Lowland Riparian. It is an open country bird; most often found where trees are scattered.

The plumage of this woodpecker is unique in that no other woodpecker in the United States has wings that are entirely one color. It's dark appearance, and crow-like flapping wing beats make this woodpecker identifiable at long distances. The pinkish plumage on the belly, deep red face, and dark bronze green head is also unique for a North American woodpecker.

ASSOCIATED SPECIES: Other bird species that occur in these habitats and may respond similarly to habitat components used by the Lewis's Woodpecker include: Purple Martin, Pygmy Nuthatch, Band-tailed Pigeon, Flammulated Owl, Northern Flicker, Acorn Woodpecker, Olive-sided Flycatcher, Townsend's Solitaire, Western Bluebird, Grace's Warbler, Plumbeous Vireo, Chipping Sparrow, Cassin's Finch, and Red Crossbill.

DISTRIBUTION: Lewis's Woodpecker breeds from southern British Columbia to southwestern South Dakota and northwestern Nebraska to south-central California, central Utah, Southern New Mexico and Eastern Colorado (DeGraaf et al. 1991). It winters south to northwestern Mexico (Ehrlich et al. 1988) including northern Oregon, southern Idaho, central Colorado and south-central Nebraska, irregularly occurring in northern Baja California, northern Mexico, southern New Mexico and west Texas (DeGraaf et al. 1991). The northern part of the population moves to southern parts of its range in the non-breeding season (Stokes 1996).

In Utah, Breeding Bird Survey data show the distribution of Lewis's Woodpecker primarily in the northeastern and southeastern part of the state with small numbers in the northwestern corner as well (Sauer et al. 2001). Christmas Bird Count data show most occurrences in winter in the east half of Utah, with isolated occurrences in northwestern and southwestern Utah.

ECOLOGY: The Lewis's Woodpecker is a cavity nester, excavating a hole in tall trees, often dead or blackened by fire (DeGraaf et al. 1991; Stokes 1996; Ehrlich et al. 1988). It will also nest in utility poles, or stumps, but prefers Ponderosa Pine, cottonwood, or sycamore. In Utah, sycamores are used infrequently due to low availability. The male selects the site but both male and female excavate the cavity (Ehrlich et al. 1988). The male and female incubate 6-7 white eggs for 13-14 days; the male incubating at night, and both alternating during the day (Stokes 1996; Ehrlich et al. 1988). The young are altricial and fledge in 28-34 days after being attended by both parents (ibid.). One or possibly two broods are produced yearly (Stokes 1996).

The diet of this woodpecker consists of insects during the breeding season and nuts and berries during the winter (Ehrlich et al. 1988; Stokes 1996; DeGraaf et al. 1991). Insects are caught in the air by flying out from a perch site, sometimes with very acrobatic flights. It is the only woodpecker than perches on wires (Ehrlich et al. 1988). Insects are also picked off leaves or from the ground (Stokes 1996).

In the fall, the diet is mainly fruits and berries. Acorns or other nuts are stored (and used in winter) by removing the shell, breaking the nut into bits that will wedge into natural crevices of dead trees, power poles and oaks (Ehrlich et al. 1988; Stokes 1996; DeGraaf et al. 1991). This caching of food is not done communally, and the Lewis's Woodpecker will defend a winter store of food from other woodpeckers (primarily acorn woodpeckers). Seeds and fruit at feeders can be used. There are no apparent foraging differences between the sexes.

HABITAT REQUIREMENTS: The major breeding habitat consists of open park-like Ponderosa Pine forests (DeGraaf et al. 1991). The Lewis's Woodpecker is attracted to burned-over Douglas-fir, Mixed Conifer, pinyon-juniper, riparian and oak woodlands, but is also found in the fringes of pine and juniper stands, and deciduous forests, especially riparian cottonwoods (ibid.). Areas with a good under-story of grasses and shrubs to support insect prey populations are preferred. Dead trees or stumps are required for nesting. Wintering grounds are over a wide range of habitats, but oak woodlands are preferred.

HABITAT AND/OR POPULATION OBJECTIVES: Habitat or population objectives for Lewis's Woodpecker have been recommended for the Colorado Plateau, Utah Mountains, and Mojave Physiographic Regions as part of a multi-state Southern Rockies/Colorado Plateau planning effort for priority species and habitats. Current recommendations include managing, restoring and/or protecting 132 miles of deciduous riparian habitat. The minimum length of riparian or miles of stream within individual watershed has not yet been established. Estimates are that there are currently 110 miles of suitable or in-use deciduous riparian habitat and 22 miles that are restorable. In Utah, it is estimated that there are currently 20 miles of currently in-use or suitable habitat, and zero miles restorable (i.e., available areas presently in-use). The objective is to manage, restore and/or protect riparian habitat and associated uplands in 100 watersheds to total at least 20 miles of riparian in each watershed in one-mile reaches or greater by the year 2005. Utah's portion of the watersheds is identified as 25.

Objectives for Ponderosa Pine habitat are to protect and manage 4.3 million acres toward suitable habitat conditions. The Utah portion of this objective is to protect and manage 105,000 acres of Ponderosa Pine, of which 100,000 acres are managed for cavity nesting species, which includes Lewis's Woodpecker.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Densities of Ponderosa Pine and Mixed Conifer forests have increased due to fire prevention efforts over the last 75-100 years. Under-stories of true firs have increased decreasing areas with open habitats. Grazing has reduced ground cover vegetation such as shrubs, grasses and forbs which provide habitat for insect prey. Immediate harvest of trees in wildfire areas has reduced nesting sites. Oak woodlands have decreased from developments and encroaching pinyon-juniper woodlands.

Breeding Bird Survey data indicates that Lewis's Woodpeckers are declining (Sauer et al. 2001).

Because of its small range, it is particularly vulnerable to risk of extinction.

Woodpeckers tend to be habitat specialists. Densities of Ponderosa Pine and Mixed Conifer forests have increased due to fire prevention efforts over the last 75-100 years. Under-stories of true firs have increased, decreasing areas with open habitats. Grazing has reduced ground cover vegetation such as shrubs, grasses and forbs, which provide habitat for insect prey. Immediate harvest of trees in wildfire areas has reduced nesting sites. Oak woodlands have decreased from developments and encroaching pinyon-juniper woodlands. Deciduous and riparian habitats have also decreased over the last century.

Lewis's Woodpecker management issues are listed here in italics. Below each issue are Utah Partners in Flight Conservation Recommendations.

Habitat Loss

1. Encourage leaving tall trees in burned over areas.
2. Encourage prescribed burns to open the under-story of Ponderosa Pine and Mixed Conifer habitats.
3. Maintain oak woodland habitats.

Overgrazing by Livestock

1. Manage grazing practices to maintain under-story vegetation.
2. Manage grazing practices to maintain riparian habitats with all stages of plant development, with predominantly mature plants (cottonwoods).

Implementation Opportunities

1. Consider habitat needs in agency plans and projects, including stewardship projects.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

Identifying the reasons for Lewis's Woodpecker population declines would be a foremost objective for recommended research. To determine reasons for declines, studies are likely needed regarding reproductive ecology, wintering habitat needs, and current threats. Quality and quantity of habitat loss, distribution of suitable habitat, and locations of habitats that can be restored are also needed. Population size, population trends, the effects of management activities, dispersal, site fidelity, patch size needs, edge effects, size of ranges, and distribution trends are all areas where more data are needed.

OUTREACH NEEDS:

As with other priority species and habitats, outreach needs include increasing education efforts, public awareness, and agency participation to restore or maintain habitats.

ABERT'S TOWHEE
(*Pipilo abertii*)

Conservation Priority Score of 40

Earl A. Robinson

ASSOCIATED SPECIES: Other bird species that may respond similarly to habitat components used by Abert's Towhee are Gambel's Quail, Mourning Dove, Yellow-billed Cuckoo, Western Screech-Owl, Black-chinned Hummingbird, Ladder-backed Woodpecker, Willow Flycatcher, Black Phoebe, Bell's Vireo, Bewick's Wren, Crissal Thrasher, Lucy's Warbler, Yellow Warbler, Yellow-breasted Chat, Summer Tanager, Song Sparrow, Black-headed Grosbeak, Blue Grosbeak, Bullock's Oriole, and Lesser Goldfinch.

DISTRIBUTION: The Abert's Towhee breeds in southwestern North America from extreme southwestern Utah south along the Virgin and Colorado Rivers in Nevada, the lower Colorado River of California and Mexico, and the Gila River drainage of southern Utah and southwestern New Mexico (A.O.U. 1998). In Utah, Abert's Towhee occurs along the Virgin River drainage south of LaVerkin and the Santa Clara River drainage south of Gunlock (Tweit and Finch 1994).

ECOLOGY: Abert's Towhee is a permanent resident throughout its range. Its primary foods are insects, particularly beetles, ants, grasshoppers, and cicadas, and Chenopod seeds (Rosenberg et al. 1991). Abert's Towhee is primarily a ground forager and spends 50-60% of its time scratching on ground or loose litter (Marshall 1960). Territories are occupied year-round by permanent pairs. Nest building may begin as early as the first week of February in southern Utah, but the peak of nesting is early April through July (Finch 1984). Preferred nest sites are small trees and large shrubs. Nest height averages 155 cm early in the nesting season and 224 cm late in the season (Tweit and Finch 1994). Nesting territory size is 1.5 to 2 ha (Rosenberg et al. 1991).

Winter territories are much larger and birds tolerate adjacent pairs and floaters. Densities in well-developed cottonwood-willow habitat range from 55-107 birds/ 40 ha (Rosenberg et al. 1991), while densities in salt cedar-mesquite habitat are 30-49 birds/ 40 ha (Rosenberg 1987). Brown-headed Cowbird parasitism of Abert's Towhee nests has increased in recent years, due to a shortage of suitable sized hosts and an abundance of towhee nests (Finch 1983). Abert's Towhee nests are parasitized more frequently in mesquite than in riparian habitat (Conine 1982), and is highest during May (45%) and June (67%) (Finch 1983). Cowbird survival in parasitized Abert's Towhee nests is extremely low. Most young cowbirds cannot compete for food with the much larger towhee nestlings and starve (Finch 1983).

HABITAT REQUIREMENTS: Formerly a year-round resident of the brushy under-story of cottonwood-willow riparian habitat and mesquite bosques along stream sides below 1,220 m (4,000 ft) elevation (Rosenberg et al. 1991). Most of this habitat in Utah has been modified or eliminated, and Abert's Towhees are now found in cottonwood-willow remnants, exotic vegetation such as salt cedar, and mixed exotic/native habitat. In Utah, Abert's Towhees are found primarily in salt cedar/willow riparian habitats. Abert's Towhee populations disperse after the breeding season into more open habitats, then contract into preferred habitats for nesting.

HABITAT AND/OR POPULATION OBJECTIVES:
1. Maintain and increase multi-layered riparian habitats, with dense subcanopies (<10 m/ 33 ft) at low to middle elevations (750-1820 m/2500-6000 ft); habitats should consist mainly of native plant species identified in the lowland and/or Mountain Riparian habitat descriptions, particularly cottonwoods and willows. Conserve all suitable habitat in areas where towhees are found.
2. The habitat should be at least 250 linear miles (400 km) of the above described habitat in at least 0.8 km (0.5 mi) segments.
3. Increase populations to at least 50 pairs within 10 years, and 100 pairs within 25 years.

ASSUMPTIONS:
1. 100 pairs of Abert's Towhees distributed across Utah's riparian areas is a viable population.
2. Abert's Towhees can be reliably detected for inventory and monitoring purposes.
3. Riparian areas at low to middle elevations can be maintained or restored to provide suitable Abert's Towhee breeding habitats.
4. Abert's Towhee requirements for suitable breeding habitat are correctly identified.
5. Towhee populations will have long-term stability if 250 linear mi (400 km) of suitable habitat are provided in 0.8 km (0.5 mi) segments.
6. The population can be increased in 10 years; the population can reach 100 pairs in 25 years.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES:

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Year-round habitat loss and modification has occurred over much of its range through the removal of cottonwood-willow riparian habitat for agriculture, house and road construction and other urban developments, water enhancement, and livestock grazing. Groundwater pumping has lowered water tables, dried streams, and killed riparian habitat in some areas. Formerly contiguous riparian habitat is now fragmented, with only about 5-10% remaining in Utah (Alcock 1993). Nonnative salt cedar has replaced cottonwood-willow over much of the Abert's Towhee range (Rosenberg et al.1991). Relatively high rates of nest parasitism by Brown-headed Cowbirds is an increasing concern. In Utah, habitat loss includes removal of native and nonnative riparian vegetation for agriculture, house and road construction, and livestock grazing. The effects of cowbird parasitism on towhees in Utah is unknown.

Habitat Loss
1. Discourage the clearing of riparian (native and nonnative) habitat.
2. Encourage the replacement of salt cedar with native cottonwood-willow vegetation.

Livestock Grazing
1. Manage grazing practices to promote the growth of native riparian vegetation and reduce grazing impacts during the nesting season.

Brown-headed Cowbird Parasitism

1. Restrict livestock grazing in riparian habitats from April through July nesting season.

Implementation Opportunities

1. Consider habitat needs in agency plans and projects, including stewardship projects.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

1. Identify cowbird parasitism rates and their effect on productivity.
2. Quantify breeding habitat and how grazing and other impacts affect habitat.

OUTREACH NEEDS

1. Educate agency and public of the importance of riparian habitat to birds as well as the economic values.

AMERICAN AVOCET
(*Recurvirostra americana*)

Conservation Priority Score of 37

Ray Kirkland

ASSOCIATED SPECIES: Other bird species that may respond similarly to habitat components used by the American Avocet are Wilson's Phalarope, Black-necked Stilt, Long-billed Dowitcher, Marbled Godwit, Willet, Baird's, Least, and Western Sandpipers, and the Greater Yellowlegs.

DISTRIBUTION: Distribution of the American Avocet is highly dependent on suitable local habitat making the breeding range somewhat spotty and localized. The American Avocet breeds in North America in the western and west-central United States, the Gulf and Atlantic coasts, and in south-central Canada.

Breeding along the Pacific coast ranges from Sonoma County south to the Mexican border with rare instances further north and south along the coast. Inland, breeding ranges from the Central Valley of California south to Los Angeles County, east of the Sierra Nevada and Cascades, breeding occurs in central-southeast Washington, eastern Oregon, and southern Idaho. In California, east of the Sierra Nevada, the range extends from the Klamath Basin and Modoc Plateau southeast to Honey Lake and Lassen County and at Mono Lake south to Tinnemaha Reservoir, Inyo County. In Nevada, breeding occurs east to Humboldt and Carson Sinks, and also at Franklin and Ruby Lakes, and in impoundments near Wendover. Breeding distribution in the central inland area extends from the northern edge south of 54E in central Alberta, southeastern Alberta, southern Saskatchewan, and southwestern Manitoba south to the Wetlands associated with the Great Salt Lake, Utah and the Bear and Snake Rivers in southern Idaho.

The western boundary of the Great Plains breeding distribution runs generally through west-central Montana, central Colorado, and western New Mexico. The range extends east to eastern North Dakota and South Dakota, central Nebraska, eastern Colorado, locally in central and southwest Kansas, northwest Oklahoma, and throughout the Texas Panhandle south to Midland County, Texas. The avocet breeds locally and irregularly east to western Minnesota and central Iowa, south to western Oklahoma. Breeding also occurs in southeast Arizona. Resident breeding populations occur along the Gulf Coast of Texas and central Mexico. There have been recent reports of breeding along the Atlantic Coast in Virginia and North Carolina (American Ornithologists' Union 1998, Robinson et al. 1997).

Breeding in Utah occurs on mud flats in the Wetlands associated with the Great Salt Lake, Utah Lake, the Bear and Malad Rivers in northern Utah, the Logan and the Little Bear River in Cache Valley (Hayward et al. 1976); at Bear River Migratory Bird Refuge in Box Elder County (Roy 1998); and at Ouray National Wildlife Refuge and other reservoirs in Uinta County (Sjostrum 1998). Some breeding does occur in Rich County on the mud flats surrounding Bear Lake (Sjostrum 1998); at Fish Springs National Wildlife Refuge in Juab County (Banta 1998); in the Wetlands surrounding Clear Lake

Waterfowl Management Area (WMA) near Delta in Millard County (Zubeck 1998); at Blue Lake WMA south of Wendover in Tooele County; and at Desert Lake WMA south of Price in Grand County (McIvor 1998).

The avocet winters in the marshes of coastal California at Humboldt Bay, throughout the breeding range in the Central Valley south to the Mexican border, and the Salton Sea. In Mexico it winters throughout Baja California, along the Pacific slope from Sonora south to the Isthmus of Tehuantepec (especially the Sinaloa coast), and rarely to northeast Guatemala. In the interior of Mexico, avocets winter from central Chihuahua west of Sierra Madra Occidentale south to the central volcanic belt. Other wintering sites in the United States include along the Atlantic Coast at Craney Island, VA, North and South Carolina, Georgia, and both the Atlantic and Gulf Coasts of Florida. Wintering also occurs along the Gulf Coast in southwest Louisiana through Texas, and in Mexico along the Atlantic slope from Tamaulipas south to northern coast of the Yucatán Peninsula. A small number of avocets sometime winter within the northern breeding areas in Utah, Nevada, and Oregon (Robinson et al. 1997, Hayward et al. 1976).

ECOLOGY: The primary foods for American Avocet are invertebrates of the water column and sediment including water boatmen (Hemiptera, Corixidae), beetle larvae (Coleoptera), fly larvae (Diptera), and particularly midges (Chironomidae); terrestrial invertebrates include grasshoppers, caterpillars, and spiders. Other foods include small fish and seeds, especially sago pondweed and bulrushes. In the more saline Wetlands in Utah, avocets also feed on brine shrimp and brine flies. Avocets forage while wading in water depths up to 15 to 20 cm and while swimming in depths up to 25 cm. The characteristic of the substrate is an important factor in determining the foraging method (i.e., pecking or scything). Avocets have three visual feeding methods: pecking, plunging, and snatching; and six tactile feeding methods: bill pursuit, filtering, scraping, single scything (bill is held open slightly at the muddy substrate surface and moved from one side to the other), multiple scything, and dabble scything. Scything has been noted as the hallmark method. Avocets have also been observed foraging cooperatively in close groups using the multiple scything method, probably feeding on small fish (Robinson et al. 1997).

The birds arrive in Utah in late March. Pair formation seems to occur before and during migration, and is usually complete before arrival at a breeding site. The nesting site is selected jointly after nest-searching and scraping displays. Selected sites are usually in very sparse vegetation in an area affording an unobstructed view. Nests are located on islands when available, on dikes, or other areas associated with the water's edge. The nest is scraped into the substrate with the breast and feet by either sex, and small pieces of lining material are added throughout the incubation period. Nest diameter averages 146 mm, and depth 36 mm. Eggs are pyriform to long pyriform shaped, and average 5.0 cm in length and 3.4 cm in breadth. Three to four eggs are laid, and incubation onset is dependent on the local ambient temperature (in moderate temperatures incubation begins with the penultimate egg; in very warm weather, the eggs will begin to develop without incubation, and the birds may have to cool the eggs by wetting the breast and laying on the eggs). Incubation period is measured from date of first egg laid to date first egg hatched, and averages 26.4 days. Incubation period decreases over the season in response to increasing temperatures. Both sexes incubate the eggs alternating throughout the day and night. Eggs will usually hatch over 1-2 days. Chicks are hatched precocial, downy, and able to feed themselves. Young birds will remain in the nest for 24 hrs after last chick is hatched if undisturbed. The adults will then lead the chicks to a brood nursery area with shallow water and sufficient vegetation for cover. Downy chicks are attended by both parents, but as the young birds obtain their juvenile plumage, one or both parents may leave. After about 27 days, the young avocets are capable of sustained flight, and spend their days in flocks with other fledglings and adults. They will remain in these flocks for 1 to 3 weeks, and then fly south in small groups with other juveniles. American Avocets leave Utah for wintering grounds beginning in August and through September. Birds have been observed at Bear River Refuge as late as mid November (Roy 1998, Robinson et al. 1997, Sordahl 1996).

HABITAT REQUIREMENTS: American Avocets breed in fairly specific habitat regimes. Their somewhat spotty breeding range is indicative that breeding occurs in specific suitable areas. Nesting occurs in areas with salt ponds, potholes, or shallow alkaline Wetlands. It also occurs in some mud flats of inland lakes and impoundments and evaporation ponds. The alkaline Wetlands are characterized by the presence of common cattail (*Typha latifolia*), bulrushes (*Scirpus* spp.), and sedges (*Carex* spp.); however, most time is spent in more open areas with no vegetation or with sparse vegetation consisting of glasswort (*Salicornia* spp.), saltgrass (*Distichlis* spp.), or greasewood (*Sarcobatus* spp.). The birds feed in open water 0-20 cm and sometimes deeper. The nests are usually built on islands or dikes with sparse vegetation. In desert Wetlands, Utah in particular, avocets nest along the lake shoreline among scattered patches of vegetation, along barren mud flats, or up on small patches of vegetation over water. Wintering habitats include intertidal mud flats and brackish-water impoundments (Robinson et al. 1997).

HABITAT AND/OR POPULATION OBJECTIVES:

The Intermountain West region is the most important breeding area for American Avocets in North America. The current goal under the United States Shorebird Conservation Plan is to maintain American Avocet populations and to investigate suspected declines (Brown et al. 2001).

HABITAT OBJECTIVES:

1. Work to establish and maintain important habitats for American avocets and black-necked stilts within each of the managed Wetland habitat complexes that are found in association with Great Salt Lake, Utah Lake and Cutler Marsh.
2. Maintain situations where fresh water and saltwater complexes are in close proximity to one another.
3. Work to ensure no additional loss of existing natural Great Salt Lake shoreline habitats to anthropogenic activities.
4. Work with the Divisions of State Lands and Parks and Recreation to restrict off-road vehicle use in important foraging habitats, especially on the south shore of Great Salt Lake.
5. Insure that American Avocet habitat issues are addressed as conservation action is implemented through ongoing State Wildlife Management Area procedures.

POPULATION OBJECTIVES:

1. Strive to maintain a breeding population of American avocets of at least 50,000 pairs within the Great Salt Lake ecosystem. Fall staging numbers should be at least 130,000 birds.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES:

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS

American avocets and black-necked stilts are essentially sympatric in their habitat use when present at Great Salt Lake. It appears that the only difference of any consequence between the two species is the timing of their arrival to and departure from the area. Avocets tend to arrive in mid to late March and stilts arrive approximately 10 days to two weeks later. The majority of black-necked stilts migrate from the lake in mid-September, whereas avocets are present in October and some numbers persist into early November. The two species breed together in loose colonies that are often formed in association with sparse and short emergent vegetation complexes, or recently inundated vegetation that is dead or dying. Often these breeding complexes occur in channeled and braided drainage sites. Breeding also occurs in ponded management units within state and federal WMAs; here similar conditions exist as described above.

The young of both species are precocial and accompany adults shortly after hatching. At this time foraging habitat with water less than 4 inches is preferred. In managed areas fresh water invertebrates are an important food source for chicks. Exterior to management units around the lake, brine flies appear to be an essential protein resource. Adult stilts and avocets prefer foraging in water less than 9 inches. Both species have been observed to forage while swimming, but most foraging on the Great Salt Lake occurs in water shallow enough to wade. Management unit draw down appears to be a favorable condition for foraging avocets and stilts in post-breeding periods. Five years of Waterbird Survey data from the Great Salt Lake demonstrate the value of shorelines to American avocets and black-necked stilts where abundant numbers of brine flies persist. Other important Great Salt Lake habitats where these species occur are the major river and drainage discharge points into the lake. This is especially true for the Bear, Weber, and Jordan complexes. Late summer and fall Great Salt Lake habitat use is not limited to fresh water sites. Five-year survey information indicates that there is significant avocet use on the Stansbury spit and the west shore of the lake where xeric conditions exist. These late summer and fall populations occur in the tens of thousands.

Given these circumstances it is important for Wetland managers to provide for appropriate breeding, brooding and foraging habitats within ponded units. Draw down or impounding water timing in these units is also an important consideration. Managers should carefully consider not impounding units between the 1st of May and mid-July to avoid nest flooding. Conversely, draw down of units in August and early September might be advantageous for foraging populations of staging avocets and stilts.

Natural shoreline habitats of the Great Salt Lake have been significantly impacted through time due to diking, road construction and salt plant operations. There are some important and significant natural shoreline environments still intact that require careful management and protection to preserve their value as foraging sites for avocets and stilts. Lake managers should also carefully consider any anthropogenic activity that might negatively impact the relationship between fresh water emergent complexes and nearby Great Salt Lake shoreline habitats. Beyond the impacts of development important shoreline areas should be protected from intrusive human disturbance such as off-road vehicle use. Other than the vagaries of natural weather cycles lake managers should attempt to preserve the saline systems of the lake that are responsible for the production of brine flies and brine shrimp. This relationship between halophyles and the associated predatory waterbirds is one of the most unique in the Great Salt Lake ecosystem.

Wetland losses and deterioration across the Western United States have led to population declines of American Avocets. Breeding and staging areas have been lost or degraded due to development, agricultural diversions, and urban water storage and flood control projects. Increased sanitization from agricultural drain water, surface flow, and subsurface flow is a serious problem in many inland Wetlands. The increase in sanitization has wide-ranging impacts upon an ecosystem, and will have significant impacts on breeding avocets. Many Wetlands used by American Avocets have been contaminated as a result of irrigation and other human activities. Selenium pollution has been documented as a widespread problem associated with irrigated agriculture in many western states (Robinson et al. 1997). The ephemeral nature (both seasonally and multi-year) and patchy distribution of Wetland habitats in the Great Basin create challenges to breeding and migrating populations of avocets. One study was conducted to examine how avocets used these Wetlands (Plissner 1998). The American Avocet demonstrated wide-ranging and highly variable dispersal patterns; however, there is a lack of understanding and knowledge of migratory routes and wintering sites in Mexico. There is conflict among management priorities for various shorebird species, and there is no mechanism bringing all federal, state, and private interests together for the purpose of setting regional priorities (Haig and Oring 1998).

American Avocet management issues are listed here in italics. Below each issue are conservation recommendations.

Habitat Loss and Degradation

1. Develop local and regional Wetland conservation plans with the cooperation of local government, resource managers, and landowners.

Contaminants

1. Require contaminant discharges to provide mitigation habitat targeted for American Avocets and other shorebirds.

Habitat Distribution and Use by American Avocets

1. Consider large-scale habitat connectivity strategies for Great Basin Wetland ecosystems.
2. Conduct long-term monitoring of American Avocet breeding, migrating, and wintering populations.

Setting Management Priorities

1. Develop an organization dedicated to establishing regional and local priorities based upon the potential contribution of different areas to global biodiversity (Haig and Oring 1998).

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

1. Continue the assessment of American Avocet resources in Utah and the Great Basin.
2. Identify interactions among water quality and quantity, invertebrates, plants, and birds in Great Basin ecosystems.
3. Develop management techniques specifically aimed at increasing productivity.
4. Increase the knowledge and understanding of migratory routes and wintering sites.
5. Increase the knowledge and understanding of the energetics and nutrition of the American Avocet.
6. Continue and expand the impacts of irrigation drain water contamination on adults and juveniles.

OUTREACH NEEDS

1. Educate managers, local governments, and the community as to the importance of Wetlands to birds as well as the economic and cultural values.
2. Work with recreationists and land managers to restrict boat and vehicle use in important nesting and foraging areas during he breeding season.

MOUNTAIN PLOVER
(*Charadrius montanus*)

Conservation Priority Score of 36

Fritz Knopf

ASSOCIATED SPECIES: Other bird species which may respond similarly to habitat components used by the Mountain Plover would need to be similar in their degree of habitat specificity, degree of disturbance tolerance, social structure, or rareness. The Horned Lark, Loggerhead Shrike, Lark Bunting and Long-billed Curlew may be comparable to the Mountain Plover in some instances.

DISTRIBUTION: As cited in Knopf (1996): Breeds in eastern and-central and southwestern Montana (Bergeron et al. 1992), tablelands of Wyoming (Oakleaf et al. 1992), eastern Colorado (including Fremont and Park counties; Andrews and Righter 1992), northeast and locally to west-central New Mexico (south to Roswell area and west to Fence Lake area; Hubbard 1978), and in Oklahoma and Texas panhandles. Isolated breeding population occurs in Davis Mountains, TX. Breeding records defining the periphery of its range include Catron (Johnson and Spicer 1981), San Juan (Tolle 1976), and Valencia (Hubbard 1978) Counties, NM; Park County, NE (Clausen 1990, FLK), and in Lost River area of southern Alberta (Soper 1941, Wershler 1987). Three nests were found in 1993 in Duchesne County, UT (Day 1994), and additional nesting activity was found in 1994 and 1995.

In Utah it has been recorded as a casual migrant in Box Elder, Weber, Salt Lake and Daggett counties (Woodbury et al. 1949). There are six documented historical sightings in the Uinta Basin (White et al. 1983). In 1978, Dan Gardner of the Bureau of Land Management photographed one adult and a nearby nest with three eggs (UDWR 1994, unpublished report). A pair of plovers was observed on 11 April 1989 on a sagebrush bench about 1.6 k (1 mi) east of Pelican Lake, Uinta county (D. A. Boyce, USFS, pers. comm.). There were seven sightings of Mountain Plovers made during mapping surveys of whitetail prairie dog (*Cynomys leucurus*) colonies along Eightmile Flat, Uinta County in 1992 (UDWR 1992, unpublished report). Survey work in 1993 confirmed a Mountain Plover population of unknown size in the same area (Day 1994). Population information from survey work done from 1993-98 is reported in Table 8.

As cited in Knopf (1996): Winter range. Birds disperse widely across western and southern Great Plains in late summer and early fall. Most birds winter from north-central California to Mexico border, primarily in the Sacramento, San Joaquin, and Imperial valleys, with some birds on Pacific slopes in southern counties (Knopf and Rupert 1995).

ECOLOGY: Most birds wintering in California depart mid-March in flocks of <100 birds in a west-east spring migration, and seem to make a nonstop flight to the breeding grounds. Plovers regularly arrive on the Pawnee National Grassland around March 17 (Knopf and Rupert 1995), and have been observed in Duchesne County, Utah as early as April 9. It is likely that plovers arrive in Utah earlier than the date of observation reported here. Mountain Plover diet consists mainly of arthropods. Baldwin (1971, as cited in Knopf 1996) found ground-dwelling beetles to account for 60% of food mass eaten, grasshoppers and crickets 24.5% and ants 6.6%. A study done of the plover diet on the wintering ground indicated that birds may be more flexible in food selection than previously thought (Knopf 1998). This species is associated with disturbed prairie and semidesert habitats. It prefers areas with 30% bare ground (Knopf and Miller 1994).

Territories on the breeding ground are about 16 hectares each though some boundaries may overlap. Some birds will return to the same territory used the previous year (Graul 1973). In Utah nests of nearest neighbors in 1998 were located about 240-370 meters apart. The nest is a simple scrape on the ground (Graul 1973). Clutch size is typically 3 (Knopf 1996). Known predators to the Mountain Plover include thirteen-lined ground squirrel, swift fox, coyote, Swainson's Hawk, Prairie Falcon and Loggerhead Shrike (Knopf 1996). Most plovers breeding in Weld County, Colorado have departed by August 1 (Knopf and Rupert 1996); in Utah birds have been observed with young until August 14. Exact departure dates are not known.

HABITAT REQUIREMENTS: The Mountain Plover is typically associated with shortgrass prairie habitat, composed primarily of blue grama (*Bouteloua gracilis*) and buffalo grass (*Buchloe dactyloides*), (Graul 1975). Habitat characteristics in the Uinta Basin are notably different from shortgrass prairie breeding areas. Vegetation is sparse; sagebrush communities are dominated by *Artemisia* spp. with components of black sagebrush (*A. nova*) and grasses (Goodrich and Neese 1986). On the Pawnee National Grassland, Colorado, Mountain Plovers prefer to nest in areas of predominantly blue grama-buffalo grass with a mean height of less than 8 cm in April. Nest site selection is not random, but slightly colonial (Graul 1975). Graul (1973) reported nests to be clumped even in good habitat areas, especially in low population numbers. In north-central Montana on the Charles M. Russell National Wildlife Refuge, Mountain Plover nests are highly correlated with Black-tailed prairie dog (*Cynomys ludovicianus*) towns. Horizontal visibility on prairie dog towns is greater than visibility in adjacent areas (Knowles 1982). Studies in both Colorado and Montana described nest sites with a significant bare ground component at a minimum of 30%. Plovers also frequently raise broods near areas of excessive disturbance (Knopf and Miller 1994). In Utah, a small Mountain Plover population breeds in shrub-steppe habitat where White-tailed prairie dogs (*Cynomys leucurus*) are present, and oil and gas development have contributed surface disturbance to the landscape. On the wintering ground in California, plovers are found on plowed fields, heavily grazed annual Grasslands and burned fields (Knopf and Rupert 1995).

HABITAT AND/OR POPULATION OBJECTIVES:

The Intermountain West is the most important inland region within North America for maintaining the continent's shorebird populations. The current goal under the United States Shorebird Conservation Plan is to restore Mountain Plover populations to the 1970 Breeding Bird Survey (BBS) estimate of 20,000 individuals (Brown et al. 2001).

HABITAT OBJECTIVES:

1. Maintain habitat integrity as found during 1996-2002 studies. Major habitat altering disturbances should be avoided in known breeding concentration areas.

POPULATION OBJECTIVES:
1. Determine a more accurate population size of Mountain Plovers in the Uinta Basin.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES:

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Due to long-term declines, the Mountain Plover was listed as a Candidate Species under the U.S. Endangered Species Act on 3 May 1993. Breeding habitat loss is a result of the alteration of grasslands by removal of primary native grazers (Knopf 1994). In Utah the Mountain Plover breeds in an area where oil and gas development is extensive (1 well pad/16 ha). Plovers continued to nest in Utah with their population remaining around 30 birds until 1999. Since 1999, the population has dwindled and despite intensive survey efforts, no Mountain Plovers were observed during the breeding season in 2002 (Table 8). Additional wells have been proposed at 8 ha (20 ac) spacing in the plover concentration areas.

Habitat Loss
1. Create a buffer zone around the breeding concentration areas on the Myton Bench and restrict any further development. This restriction would involve an area of approximately two sections (518 ha [1280 ac]).
2. As cited in Knopf 1996: Grasslands have been burned to attract Mountain Plovers both on wintering grounds (Knopf and Rupert 1995) and breeding grounds (FLK). New construction for gas and oil exploration, wind-power development, and water well drilling is restricted 1 April to 30 June at key locales in Colorado, Utah, and Wyoming.

Implementation Opportunities
1. Consider habitat needs in agency plans and projects, including stewardship projects.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH
1. Continue to monitor population trends in concentration areas.
2. Identify other nesting areas in surrounding habitat.

OUTREACH NEEDS
1. Educate agency and oil companies on the cultural value of the species in Utah.

Table 8. Mountain Plover Information Summary 1992-2002. N/A indicates no information available.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
TOTAL OBSERVED	7	31	24-28	29	16	29	30	12-16	8-12	6	0
# CLUTCHES	N/A	3	2	2	3	N/A	5	1	1	0	0
# BROODS	N/A	8	6	4	2	7	6	1	1	0	0
# YOUNG	N/A	15	9	9	6	16	14	3	1?	0	0
YOUNG/ADULT	N/A	0.94	0.47	0.45	0.60	1.23	0.88	0.27	0.11	0	0
DATE OF 1ST OBS.	N/A	4/28	5/8	4/6	5/3	4/11	4/9	4/7	5/9	4/16	—
DATE OF LAST OBS.	N/A	7/26	8/15	8/1	8/13	8/13	8/14	7/14	7/11	5/25	—

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LUCY'S WARBLER
(Vermivora lucidae)

Conservation Priority Score of 36

In Utah, Lucy’s Warblers can only be found in the counties that border Arizona. It is a desert riparian species, using mesquite woodlands. As such, Utah birders trek to these areas in order to “check off” this species, and other southern Utah specialties, on their State bird lists.

The Lucy’s Warbler is small and drab with a tiny, thin bill. Its gray color is uniform above except for a rufous crown patch (which is usually concealed), and a rufous rump. Below it is white to grayish-white. It’s eye-ring is whitish and thin or indistinct. Immature birds are washed with light brownish or buff above and below, with varying amounts of rufous on the rump. Juveniles are generally more gray than immatures. Lucy’s Warbler is an early migrant and a very active bird. It flicks its tail often, and its wings less frequently. It flies with weak jerky wing beats.

ASSOCIATED SPECIES: Other bird species that are found in this habitat and may respond similarly to habitat components used by the Lucy's warbler include: Verdin, Gambel’s Quail, Mourning Dove, Yellow-billed Cuckoo, Costa’s Hummingbird, Black-chinned Hummingbird, Ladder-backed Woodpecker, Willow Flycatcher, Black Phoebe, Bell’s Vireo, Bewick’s Wren, Yellow-breasted Chat, Summer Tanager, Song Sparrow, Black-headed Grosbeak, Blue Grosbeak, Bullock’s Oriole, Lesser Goldfinch, and Abert’s Towhee.

DISTRIBUTION: The primary and secondary breeding habitats for Lucy’s Warbler are Lowland Riparian. Lucy’s Warblers winter in Central America. The Lucy's warbler breeds in northern Mexico and in the southwestern deserts of the United States; southern Nevada, southeastern California, southern Utah, and southwestern New Mexico). It winters in western Mexico, to Jalisco to Guerrero (Ehrlich et al. 1988). In Utah it occurs in the southern most portion of the state, associated with mesquite and desert habitats, but can also be found in foothills in stream side cottonwoods and willows.

ECOLOGY: Lucy's Warbler is one of only two warblers in North America (the other is the Prothonotary Warbler) that nest in cavities (Ehrlich et al. 1988; Stokes 1996; USDA 1991). R Natural cavities are used (usually in mesquite), under loose bark, in abandoned woodpecker holes, and in deserted Verdin nests (ibid.). Lucy’s Warbler nests are generally 1.5 - 1.8 m (5 - 6 ft) above the ground but can range from 0.3 to 4.5 m (1 - 15 ft) (USDA 1991). Occasionally the Lucy's warbler nests in holes in banks, in yuccas, willows, sycamores, and elderberry bushes (Ehrlich et al. 1988, USDA 1991). The nest is made of coarse materials such as weeds, bark strips, and mesquite leaf stems and is lined with finer materials (Ehrlich et al. 1988). In Utah, sycamores and elderberry bushes are used less frequently due to reduced availability.

Breeding ecology is largely unknown (Ehrlich et al. 1988, Stokes 1996). Egg number may be 3-7 (Stokes 1996) or 4-5 (Ehrlich et al. 1988) and are white to creamy with brown or red-brown spots usually at the large end. The pair is monogamous (ibid.). The Lucy's warbler is an early spring migrant that is active and flicks its tail frequently (Stokes 1996). It is occasionally a cowbird host (Ehrlich et al. 1988).

Diet of the Lucy's warbler consists of insects found on mesquite, shrubs and desert vegetation (Stokes 1996). It forages for insects at the middle heights in mesquite, seldom foraging in the treetops or near the ground (USDA 1991).

HABITAT REQUIREMENTS: Habitat requirements for the Lucy's warbler are trees with cavities in which to build nests. Mesquite, cottonwood, or willow trees are needed for cavities, and substrates for verdin nests, which are subsequently used by Lucy's warblers.

HABITAT AND/OR POPULATION OBJECTIVES: No population objectives have been identified. Habitat objectives can be considered with other lowland or desert riparian species such as Abert's Towhee. Because riparian habitats have decreased significantly over the last century, maintaining existing habitat should be foremost. Restoring habitats where feasible should also be a priority.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES:

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: In Utah, as in other western states, riparian areas with cottonwoods and willows have been reduced by grazing, water diversions and lowered water tables. Young cottonwoods and willows are lacking in many areas which will lead toward even fewer larger mature plants. Habitat loss in mesquite desert areas has also occurred from housing and shopping developments and golf courses.

Lucy's Warbler management issues are listed here in italics. Below each issue are Utah Partners in Flight Conservation Recommendations.

Habitat Loss

1. Discourage clearing of large tracts of habitat.
2. Encourage natural and xeric landscaping in developments.
3. Encourage plots of natural habitat within and surrounding golf courses.

Livestock Grazing

1. Manage grazing practices to maintain shrub habitat.
2. Manage grazing practices to maintain riparian habitats with all stages of plant development, with predominantly mature plants.

Implementation Opportunities

1. Consider habitat needs in agency plans and projects, including stewardship projects.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING:

RECOMMENDED RESEARCH

1. Identify breeding biology of Lucy's warblers to better understand habitat needs.
2. Identify cowbird parasitism rates and their effects on productivity.
3. Identify possible threats on wintering grounds.
4. Identify the effect and role of fire in relation to habitat needs

OUTREACH NEEDS

1. Educate agency and public of the importance of mesquite, desert habitats, riparian areas with cottonwood and willows.
2. Inform and work with land developers and encourage natural xeric landscaping codes, maintaining large blocks of habitat, and retaining riparian areas.

SAGE-GROUSE
(*Centrocercus urophasianus*)

Conservation Priority Score of 36

Howie Garber

Since the initial drafting of this species account in 1999, sage-grouse have been reclassified by the American Ornithologists Union into two species—the Greater Sage-Grouse (*Centrocercus urophasianus*) and the Gunnison Sage-Grouse (*Centrocercus minimus*).

ASSOCIATED SPECIES: According to Paige and Ritter (1999), other bird species that may respond similarly to various habitat components used by the Sage-grouse are as follows: sagebrush obligate species: Sage Thrasher, Sage Sparrow, Brewer's Sparrow; shrub land species: Black-throated Sparrow, Green-tailed Towhee, Lark Sparrow; shrub land and Grassland species: Swainson's Hawk, Ferruginous Hawk, Prairie Falcon, Sharp-tailed Grouse, Loggerhead Shrike; Grassland species: Long-billed Curlew, Burrowing Owl, Short-eared Owl, Vesper Sparrow; and dry woodland species: Gray Flycatcher.

DISTRIBUTION: Sage-grouse occur only in Western North America. At one time they were found in virtually all areas where sagebrush (especially *Artemisia tridentata*) occurred (Johnsgard 1983). Historically Sage-grouse were found in parts of 15 states (Arizona, California, Colorado, Idaho, Nebraska, Montana, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington and Wyoming) and 3 Canadian provinces (Alberta, British Columbia and Saskatchewan) (Johnsgard 1983). Sage-grouse have been extirpated from Arizona, Nebraska, New Mexico, Oklahoma and British Columbia. Extant Sage-grouse populations have declined in all states and provinces (Western States Sage and Columbian Sharp-tailed Grouse Technical Committee 1999).

It is hypothesized that the Sage-grouse breeding population in Western North America circa 1800 was 1.1 million birds. Today, the estimated range wide Sage-grouse breeding population is 200,000 birds—a decrease of nearly 82 percent (Western States Sage and Columbian Sharp-tailed Grouse Technical Committee 1999).

In Utah, Sage-grouse inhabit sagebrush habitat of the Colorado Plateau and Great Basin geographic regions from 1,830 to 2,440 m (6,000 - 9,000 ft) in elevation. The largest populations of Sage-grouse are found in Rich County, Park Valley area (Box Elder County), on Diamond and Blue Mountains (Uinta County) and on Parker Mountain (Wayne County) (Mitchell et al. 1998). Other smaller populations are found scattered in the central and southern parts of the state.

Historically, it is thought that segments of all of Utah's 29 counties provided adequate habitat for Sage-grouse. Early pioneer journals suggest that Sage-grouse were abundant in the early 1800s. However, large fragments of historical habitat have been lost in Utah. Loss and degradation of habitat where Gunnison Sage-grouse occur are primarily the result of agricultural and urban developments that eliminate sagebrush. Intensive domestic livestock grazing has also likely contributed to a decline in Sage-grouse numbers.

It is estimated that Sage-grouse in Utah occupy only 50 percent of the habitat they once did and are one-half as abundant as they were prior to 1850. Habitat loss, fragmentation and degradation are suspected as the cause.

TAXONOMY: There are currently two recognized species of Sage-grouse—the Greater Sage-Grouse (*Centrocercus urophasianus*) and the Gunnison Sage-Grouse (*Centrocercus minimus*). Research conducted in the Gunnison Basin of southwestern Colorado and San Juan County in southeastern Utah suggest that both species of sage-grouse inhabit both states.

Gunnison Sage-grouse—In Utah, sage-grouse populations that occur south and east of the Colorado River (Grand and San Juan Counties) constitute a newly described species known as the Gunnison Sage-grouse (Young et al. 1994, Young et al. 2000), with the exception of the population on Hatch Point, San Juan County. San Juan County is the only county in Utah currently known to support a breeding population of the Gunnison Sage-grouse. The species differs from all other sage-grouse by being significantly smaller in size, having different breeding behaviors, different specialized feathers and feather coloring and a narrow (one) range of genetic haplotypes.

Annual counts of sage-grouse on strutting grounds (e.g., lek sites) provide the best evidence of population status. Based on these lek counts, Gunnison Sage-grouse populations in San Juan County have declined in the last 30 years. In 1970 UDWR began monitoring 7 Gunnison Sage-grouse lek sites, and in 1972 the estimated spring breeding population was between 583-1,059 birds. By 1999 only 4 of these lek sites were still active, and the estimated spring breeding population was between 143-258 birds, which represents a 75% reduction from the 1972 population estimates. As a result, a Gunnison Sage-grouse Conservation Plan was completed in 2000 by the San Juan County Gunnison Sage-grouse Working Group (SWOG 2000) and is being implemented by state and federal natural resource agencies, private landowners, and local governments.

Greater Sage-grouse—Sage-grouse occurring in the remainder of the state are Greater Sage-grouse. Taxonomically, the Greater Sage-Grouse is further subdivided into two subspecies:

1. (*Centrocercus urophasianus urophasianus*—Bonaparte): Eastern Sage-grouse. Resident from southern Idaho, eastern Montana, southeastern Alberta, southern Saskatchewan, and western North Dakota south to eastern California, south-central Nevada, Utah, western Colorado, and southeastern Wyoming.
2. (*Centrocercus urophasianus phaios)*(Aldrich): Western Sage-grouse. Resident from central and eastern Washington south to southeastern Oregon; formerly north to southern British Columbia.

However, the validity of subspecies classification in this group is currently in question. Based on recent Sage-grouse genetic analysis studies (Unpublished Data; studies conducted at the University of Denver, Colorado) there is little justification for subspecies classification. All Sage-grouse found north and west of the Colorado River in Utah are classed as the eastern subspecies.

In 1998, a total of 137 Greater Sage-grouse strutting grounds were counted throughout Utah (Mitchell et al. in press). A total of 2,124 males were counted on these grounds, yielding an average of 16 males per ground. The long-term (1959-96) average number of males per ground statewide was 20. The 1997 average number of males per ground was 12. In 1998, the estimated Greater Sage-grouse breeding population in Utah was 12,744 birds. These estimates are based on the assumption that 50 percent of all male birds were counted at each strutting ground and that the male to female ratio in the population is 50:50.

The Utah Sage-Grouse Working Group has developed and begun to implement a detailed statewide conservation plan for sage-grouse [Strategic Management Plan for Sage-Grouse 2002 (UDWR Publ. No. 02-20)]. The working group consists of representatives from state and federal natural resource agencies concerned with the health and proper management of sage-grouse and the sagebrush-steppe ecosystem in Utah.

HARVEST: Based on wing data from harvested birds, sage-grouse production in 1997 was up 87 percent from 1996 and up 103 percent from the long-term average. Chicks per hen was 4.2 in 1997. Long-term average (1973-96) chicks per hen was 2.07. In 1998, Sage-grouse were observed and counted in 19 of Utah's 29 counties. Based on Franklin (1980) and Soule (1980), populations are considered to be secure (greater that 500 breeding birds) in only five counties: Box Elder, Garfield, Rich, Wayne and Uintah. In San Juan County where Gunnison Sage-grouse are found, the 1998 breeding population was estimated at 192 birds.

Sage-grouse are classed as an upland game bird in Utah and have been hunted since 1951. Harvest statistics for 1998 are shown in Table 9. In 1998, four areas of Utah were open to hunting of Sage-grouse: 1) western Box Elder County (9-day season) and 2) all Rich County (7-day season) in Northern Utah; 3) Blue and Diamond Mountains (9-day season) in Northeastern Utah and 4) Parker Mountain (7-day season) in South-Central Utah. Daily bag and possession limits were 1 and 2 respectively. Utah's 1998 Sage-grouse season opened on the third Saturday in September.

Table 9. 1998 Sage-grouse Harvest Statistics for Utah.

STATISTIC	NUMBER
Hunters Afield	3,559
Sage-grouse Harvested	4,676
Hunter-days Afield	8,003
Sage-grouse per Hunter-day	0.58
Sage-grouse per Hunter	1.31

Hunting is not believed to be a limiting factor on large Sage-grouse populations found in good habitat. The estimated annual harvest of Sage-grouse in Utah is less than 25% of the population. Approximate annual mortality of Sage-grouse is 60%. Therefore, Utah's annual Sage-grouse harvest is within the harvestable surplus. Utah Sage-grouse populations are not hunted in areas where there is at least a three-year running average of a minimum of 500 breeding birds.

BIOLOGY AND ECOLOGY: Sage-grouse have specialized digestive systems. They lack a muscular gizzard, which limits their diets to soft foods (Patterson 1952). Sage-grouse are large (2.0-7.0 lbs.) brown/gray chicken-like birds with conspicuous black (belly, under throat) and white markings (breast of males, undertail coverts). They are brown/gray above, barred with black, with rounded brown wings with some black barring. Males during the breeding season (March-May) have conspicuous neck filoplumes, white upper breast with yellow-green air sacs and prominent, long spiked tail feathers. Both sexes have yellow/green eye combs which are less prominent in females, and a fringe of pectinations along the toes which are most noticeable in winter and early spring. Males weigh from 3.0 to 7.0 lbs and are 19-23 inches in length, while females weigh from 2.0 to 4.0 lbs and are 26-30 inches in length.

The Gunnison Sage-grouse in San Juan County differs from all other Sage-grouse in that they are smaller (males weigh 3.0 to 5.0 lbs and females weigh 2.0 to 3.0 lbs.), have a different bill shape and size, have thicker ("pony tail") filoplumes, and longer and distinct white horizontal barring of tail feathers. Gunnison Sage-grouse males exhibit two more phases (total of 17 phases) in their spring strutting sequences, including a distinct "tail shake," versus other Sage-grouse males that strut in a sequence of 15 phases. Spring strutting sequences consist of a series of wing swishes, air sac pops and vocalizations.

Sage-grouse are dependent upon sagebrush (*Artemisia* spp.), primarily big sagebrush (*Artemisia tridentata*), and do not occur throughout the year in areas where an abundance of this shrub is absent (Johnsgard 1983). Breeding activities occur from mid-March to early June depending upon elevation. The earliest breeding activities occur in lower areas such as west Box Elder County and latest in higher (± 1980 m [> 6,500 ft]) mountain valleys and parks such as Rich County and Parker Mountain in Wayne County. Male Sage-grouse display on leks (strutting grounds) in early morning and late evening to attract females. The mating system is polygamous where only a few males actually breed. Hierarchy on the lek is comprised of a master cock, dominant cocks, guard cocks and outsider cocks. The master cock typically does most of the breeding.

Sites chosen as leks are usually openings with an abundance of sagebrush within 90 - 200 m (300-650 ft) for escape cover. These sites may be in broad valleys, ridges, benches and plateaus or mesas. Sites are generally close to or in large expanses of sagebrush and have good visibility (for predator detection) and acoustical qualities (so mating sounds will carry). After breeding in late March-early April (later for females unsuccessful in their first nesting attempt), females disperse from lek sites and choose nest sites from 250 - 300 m (650-980 ft) to over 8 k (5 mi) from the lek of mating. About 70-80 percent of all females nest within 2.7 k - 4 k (1.75-2.5 mi) of the lek of mating. Nest sites usually are located in taller (> 20 inches), more dense (> 25 % canopy cover), sagebrush areas that have an abundance of forbs (> 5-8 % canopy cover) and grasses (> 20 % canopy cover). Residual cover of grasses and forbs is important for nesting hens because few herbaceous plants are growing in mid- to late April when females initiate nesting activities.

Nests are typically placed at the base of a live sagebrush plant. Other shrubs, and even clumps of grass, have been used for nesting cover. Sagebrush cover has predominated in all nesting studies (Patterson 1952, Gill 1965, Gray 1967, Wallestad and Pyrah 1974). Clutch size ranges from 6-10 eggs with 7-9 being most common. Incubation occurs for 27-28 days and, unlike most grouse, Sage-grouse are not determined or persistent nesters and nest abandonment is common if the hen is disturbed during nesting. Extent of renesting, if the initial clutch is depredated or abandoned, varies with population and probably with moisture and vegetative conditions. If renesting occurs, most hens will renest within 0.6 miles of the original nest site. Clutch size of second nest attempts varies from 4 tp 7 eggs. Hatching of eggs in Utah can start by early May, but most eggs hatch in June. Clutches hatching after July 1 are usually the result of renesting attempts by hens unsuccessful in the initial attempt. Few clutches hatch in August.

Upon hatching their clutches, hens with chicks remain in sagebrush uplands as long as vegetative conditions are adequate. During this time, Sage-grouse feed on succulent forbs and insects. Ideal conditions are those where succulent green forbs and associated insects are abundant and grass cover is sufficiently tall to hide hens and chicks, with some live sagebrush plants for shade and cover. As chicks mature and vegetation in the sagebrush uplands becomes desiccated, hens with broods move towards Wet Meadow areas which may be irrigated alfalfa fields meadows or riparian areas. Preferred areas are those with an abundance of forbs, grasses for hiding cover, and with live sagebrush along the periphery for escape cover. The importance of Wet Meadow habitats for Sage-grouse has been repeatedly demonstrated throughout their range (Klebenow 1969, Wallestad 1971).

Groups of unsuccessfully nesting females and male flocks follow the same pattern but are less dependent on Wet Meadows and riparian areas than hens with broods. Summer rainfall decreases use of Wet Meadows and riparian areas as Sage-grouse disperse into sagebrush uplands for several days following significant (> 0.7 cm [0.2 in]) moisture events. Movements of Sage-grouse to and from areas with succulent green vegetation are common from July through September. Cohesion of broods and family units (hens with chicks) decreases in July and August depending upon age of the chicks. Intermixing of broods and flocks is common and becomes pronounced by mid-September. By mid-September, flocks typically include unsuccessful and successful hens, and chicks from several broods. Adult and yearling males are usually found in separate flocks on benches and along ridges some distance from Wet Meadows. Areas preferred by all Sage-grouse from mid-September into November are those with denser (>20 % canopy cover) sagebrush and some green forbs (especially buckwheat (*Eriogonum* spp.), clover *(Trifolium* spp) and dandelion (*Taraxacum* spp.)).

Movements of Sage-grouse in fall and early winter (September-December) can be extensive with some movements exceeding 23 k (15 mi). Sage-grouse in the Strawberry Valley area of Wasatch County move some 24 k (15 mi) to the east to winter (Welch et al. 1990). Areas used are extensive stands of sagebrush on north-facing slopes (early) to broad flat benches and valleys. Leaves of sagebrush are the primary winter food for Sage-grouse with preference shown for Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) and mountain big sagebrush (*Artemisia tridentata vaseyana*). As winter progresses, and if snow cover becomes extensive (> 80%) and deep (> 36 cm [12 in]), Sage-grouse forage in tall (> 52 cm [16 in]) Sagebrush in valleys and lower flat areas and roost in shorter sagebrush along ridge tops. In periods of extreme cold and deep snow, Sage-grouse will spend nights and portions of the day, when not foraging, in snow roosts or burrows which they dig by scratching with their feet or wing movements. Flock size in winter is variable (15-200 + birds) with flocks frequently being unisexual. Flocks of males are smaller than those of females but both sexes may make extensive movements (> 23 k [15 mi]) to locate suitable foraging and roosting areas. By early March, flocks of Sage-grouse are usually within 3-5 k (2-3 mi) of breeding areas used the previous year.

HABITAT REQUIREMENTS: Sage-grouse occur only in the sagebrush and sagebrush steppe ecosystems of western North America. Sagebrush and sagebrush habitats are essential for survival of Sage-grouse populations. Important areas of sagebrush rangeland that need to be protected and can be enhanced to provide optimal habitat for Sage-grouse include: strutting grounds, water sources (springs, seeps, creeks, and livestock water developments), Wet Meadows, forb-dominated meadows, and south and west-facing ridges and slopes where grouse are known to winter.

Food habits of adult Sage-grouse change on a seasonal basis; however, sagebrush leaves are eaten throughout the year. Dependence on sagebrush, primarily big sagebrush (*Artemisia tridentata*), reaches a peak from October through April when sagebrush leaves constitute the entire diet. In May, Sage-grouse diets change from being dominated by sagebrush to being dominated by forbs; in September diets switch back from forbs to sagebrush (Braun et al. 1977). Juvenile Sage-grouse feed on insects and succulent forbs after hatching and up until brood dispersal in the fall. Broods will relocate to forb-rich areas during the summer (Wallestad 1971). Peterson (1970) reported insects composed 60% of 1-week-old Sage-grouse chick diets and declined to 5% of the diet of 12-week-old chicks in central Montana. Insects commonly eaten by Sage-grouse chicks include grasshoppers, beetles, and ants (Johnson and Boyce 1990).

Sagebrush-dominated rangelands provide habitat for all life history requirements (i.e., cover, reproduction [strutting grounds], nesting, brood-rearing, and winter habitat) of Sage-grouse (Braun et al. 1977). Chemical and mechanical sagebrush treatments usually increase grass density and biomass. Grasses out-compete shrubs and perennial forbs used by Sage-grouse for food and cover. Thus, sagebrush reduction efforts often reduce or even eliminate Sage-grouse populations.

Strutting grounds or leks are considered to be the center of Sage-grouse activities. It is imperative that Sage-grouse leks be protected. Sage-grouse prefer open areas surrounded by sagebrush to strut on. The majority of nesting and brood-rearing activities occur within 2 miles of a lek (Braun et al. 1977). Sage-grouse have been known to establish new leks on recently disturbed sites (e.g., burns, gravel pits, and domestic sheep salting areas) (Connelly et al. 1981, Hulet 1983); however, Sage-grouse do not readily accept new strutting areas once existing leks are destroyed.

Braun et al. (1977) summarized results from several Sage-grouse nesting studies and concluded that hens most frequently selected nesting sites in sagebrush stands containing 20-40% canopy cover. According to Braun et al. (1977), Sage-grouse hens in several studies normally selected the tallest shrubs at a site to nest under. The height of sagebrush commonly used varied from 7 to 31 inches. Sage-grouse broods often feed in areas with lower sagebrush canopy cover and rest in areas with a higher canopy cover of sagebrush. Autenrieth (1976) reported that average canopy at brood feeding sites was 10.4% and 30% at loafing sites.

Sage-grouse prefer stands of sagebrush of at least 20% canopy cover for winter habitat (Hulet et al. 1984). Differences in topography, vegetative cover, and weather may limit Sage-grouse to inhabit less than 10% of sagebrush-dominated ranges in winter. Some Sage-grouse populations are sedentary where suitable habitat remains year-around. Other populations must migrate to areas where suitable sagebrush habitat exists above winter snow levels (Hupp and Braun 1989).

HABITAT AND/OR POPULATION OBJECTIVES: The reader is referred to the Strategic Plan for Sage-grouse (UDWR 2002) for information on Habitat and Population Objectives. The Plan has established 13 separate Sage-grouse Management Areas each with its own set of strategies and objectives designed to meet the statewide habitat and population objectives for the species.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES:

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Sage-grouse are not currently listed as a federal or state threatened or endangered species. However, the U. S. Fish and Wildlife Service (USFWS) has received separate petitions to list both the Greater Sage-grouse and Gunnison Sage-grouse under the Endangered Species Act (ESA). As of this writing, the Gunnison Sage-grouse is an ESA Step 5 Candidate species, and the petition to list the Greater Sage-grouse is still being reviewed. In addition to being a Utah Partners in Flight Priority Species, Sage-grouse are currently on the Utah Sensitive Species List as a Species of Special Concern (SP/SD: Due to declining populations and limited distribution). Factors contributing to the decline of Sage-grouse in Utah can be grouped into three broad categories:

1. Habitat Quality: Degradation of habitat has resulted from land treatments and other uses that have changed grass, forb and sagebrush cover, reduced organic material in the soil, and increased the loss/movement of soil resulting in changes in water table levels and basic soil productivity.
2. Habitat Loss and Fragmentation: Habitat has been lost through the conversion of land from sagebrush to roads, reservoirs, hay and other crops, town and ranch development, energy development, power lines, land treatments, etc., making areas unsuitable for Sage-grouse use. Habitat fragmentation has resulted from roads, power lines, reservoirs, land treatment and land conversions.
3. Physical Disturbance: Physical disturbance has been caused by hunting, predators, bird watchers, off-highway vehicle use, and harassment. Physical disturbance can result in Sage-grouse death or stress particularly if it occurs during biologically critical periods (i.e., nesting, mating, brood-rearing, wintering).

Sage-grouse management issues (in italics) and recommendations are listed below:

Habitat Quality

1. Enhance and protect existing riparian areas to benefit Sage-grouse production and chick survival.
2. Create, enhance and protect small ephemeral “wet areas” within nesting and brood-rearing habitats.
3. Manage growth of agricultural and urban development so as not to impact Sage-grouse habitats.
4. Manage existing and new overhead utility lines and other utility development and maintenance

activities to remove impacts to Sage-grouse.
5. Manage roads by removing, realigning and reseeding as opportunities arise in important Sage-grouse habitats.
6. Suppress wildfires occurring in Sage-grouse habitats.
7. Eliminate or modify habitat components that facilitate predation on Sage-grouse.
8. Manage motorized and mechanical travel to minimize impacts to Sage-grouse.
9. Improve Sage-grouse habitat quality by planting/reseeding with a high proportion of forbs.
10. Selectively brush beat stands of sagebrush to lower age classes to create an age mosaic to improve habitats.
11. Increase spring residual herbaceous cover and height.
12. Enforce USFS/BLM grazing allotment plans and regulations.
13. Adjust livestock management during drought to promote grass, forb and soil health in Sage-grouse habitats.
14. Prohibit land treatments known to be negative for Sage-grouse.
15. Manage big game populations so their grazing/browsing does not impact Sage-grouse habitats.
16. Manage the use of pesticides so as not to impact Sage-grouse or their habitats.

Habitat Loss and Fragmentation
1. Preserve Sage-grouse winter habitats--"no net loss."
2. Enhance existing riparian areas to benefit Sage-grouse production and chick survival by creating incentives for private landowners and developers so that riparian areas remain undeveloped.
3. Enhance existing riparian areas to benefit Sage-grouse reproduction and chick survival by restoring and rehabilitating riparian areas impacted or lost from water developments, recreation, power lines, utility corridors and roads.
4. Prevent habitat loss and fragmentation.
5. Mitigate habitat loss and fragmentation.
6. Many of the same recommendations made in the Habitat Quality section above apply here as well.

Physical Disturbance
1. Minimize research and data collection that negatively impacts Sage-grouse.
2. Remove unused overhead utility lines and fences.
3. Reduce speeds on roadways in high use Sage-grouse areas.
4. Manage impacts from motorcycles, mountain bikes, OHVs and other mechanical or motorized vehicles.
5. Manage recreational hunting opportunity.
6. Deter poaching.
7. Conduct predator control where necessary.
8. Manage recreational bird watching activities.
9. Avoid disturbance which impairs the "acoustical component" of breeding displays in the spring.

Sage-grouse management issues as they apply to important habitat types (including lek sites, nesting/early brood-rearing habitat, brood-rearing habitat, and winter habitat) are listed below. A desired future condition or conservation objective/recommendation is provided for each important habitat type as well.

Lek Sites—Lek sites are areas used by Sage-grouse during the mating season where males display to attract receptive females. These sites are characterized by low vegetation with sparse shrubs often surrounded by big sagebrush-dominated plant communities. The desired future condition of the low, open vegetation of the strutting ground is similar to present conditions (unless it is determined that such open areas need to be expanded or modified to enhance the value of these areas for Sage-grouse). The big sagebrush areas within 366 m (400 yd) from the edge of the lek site should have the following vegetative description big sagebrush canopy cover a minimum of 20% with an average height of at least 40 cm (12 in); grass canopy cover at least 25%. Grass leaf height should average 6 inches (previous years' residue or new growth) between March 20 and May 15. The vegetative description defined in the desired future condition should be evident on all lek sites.

Fragmentation/Permanent Loss of Habitat—Existing ground disturbances that fragment this habitat should be modified or reduced New ground disturbances resulting in fragmentation or permanent loss of lek habitat or adjacent habitat should be discouraged and should not occur without adequate mitigation.

Physical Disturbance—Physical disturbance from human activities or by predators to Sage-grouse while on leks from March 20 to May 15 or within Sage-grouse viewing or hearing distances should be minimal and not exceed a point where the breeding group of Sage-grouse at any lek are unable to contribute to new individuals to the population.

Nesting/Early Brood-rearing Habitat—This habitat is characterized by big sagebrush-dominated plant communities. Nesting can begin in mid-April and continue into July (some hens renest if the first nest is lost). The area in proximity to the nest is used by hens with broods up to several weeks after hatching. The desired future condition of nesting/early brood-rearing habitat is big sagebrush-dominated plant communities. Within 3 k (2 mi) of leks in big sagebrush-dominated plant communities, desired future conditions are: big sagebrush canopy cover a minimum of 20% with an average height of 16 inches, (canopy cover of big sagebrush can be up to 40% if the minimum canopy cover for grasses and forbs is met); grass 30% canopy cover minimum; forbs 10% canopy cover minimum Grass leaf height on these areas (previous years' residue or current growth) averages 6 inches during the period of April 15 to July 1. Fragmentation and/or permanent loss of nesting/early brood-rearing habitat within two miles of a lek that meets or exceeds the desired future condition or has the capability to meet the desired future condition should be discouraged and should not occur without adequate mitigation. Physical disturbance by human activities or by predators to Sage-grouse in nesting/early brood-rearing areas between April 15 and July 1 should not exceed the level where nest survival or brood survival is below that necessary to increase or maintain the population.

Brood-rearing Habitat—This habitat is typically comprised of riparian plant communities associated with intermittent and perennial streams, springs, seeps and meadows that are within upland vegetation communities or along the edge of alfalfa fields. These areas are used by hens with broods from early June through the summer and into fall. The desired future condition for brood-rearing habitat is: riparian areas within 3 km (2 mi) of leks in mid seral ecological status or higher as determined by existing NRCS vegetative classification. The stubble height of herbaceous vegetation should be a minimum of 13 cm (4 in) between June 15 and July 31 on all brood-rearing areas.

Existing surface disturbances that fragment or result in the permanent loss of this habitat should be modified, reduced or mitigated. New surface disturbing activities resulting in permanent loss and/or fragmentation of brood-rearing habitat within two miles of a lek should be discouraged and should not occur without adequate mitigation. Physical Disturbance: Physical disturbance by human activities or by predators to Sage-grouse in brooding habitat between June 15 and July 31 should not exceed the level where hen or brood survival is below that necessary to increase and maintain the population.

Winter Habitat—The areas available to Sage-grouse during the winter are largely determined by snow depth. Important areas during winters of deep snow are drainages because of tall, vigorous big sagebrush growth that is consistently available even during severe winters, southerly or westerly aspects (136E-315E) on slopes greater than 5E. Other areas used during the winter are plateaus, mesas and ridge tops (5 degrees or less slope) and flat, low sites (5E or less slope). The desired future condition for winter habitat is: big sagebrush on slopes with southerly or westerly aspects with a minimum canopy cover of 15% and an average height of 40 cm (12 in); big sagebrush in drainages should have a canopy cover of

30% minimum with an average height of 65 cm (20 in). Low, flat terrain used by Sage-grouse during the winter should have a big sagebrush canopy cover of 25% minimum with an average height of 53 cm (16 in). Scattered throughout the winter habitat should be small areas that are important feeding areas where big sagebrush should have greater canopy cover and height. In these areas on south and west aspects, big sagebrush should have a canopy cover of 30 - 40% with an average height of 53 cm (16 in); big sagebrush in drainages and on low, flat terrain should have a canopy cover of 30-40%.

Fragmentation and/or permanent loss of critical winter habitat should not occur. Permanent loss of other identified winter habitat that meets or exceeds the desired future condition or has the capability to meet the desired future condition should be discouraged and should not occur without adequate mitigation. Existing areas of disturbed surface that fragments this habitat should be modified, reduced or mitigated.

Physical disturbance by human activities to Sage-grouse on critical winter habitat should not occur. Physical disturbance to Sage-grouse on critical winter habitat, other than by human activities, should be minimized. On other identified winter habitat physical disturbance to Sage-grouse should be minimized and not exceed the level necessary to increase or maintain the population.

Implementation Opportunities

1. Increase cooperation between state and federal agencies and private organizations regarding sagebrush and sagebrush steppe inventory, conservation, and management.
2. Increase awareness of public regarding sagebrush and sagebrush steppe habitat importance to Sage-grouse.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

A more coordinated approach to inform the public about the importance of Sage-grouse habitat and methods to improve their habitat is needed. Collectively, information and education activities are considered to be highly effective in improving Sage-grouse conditions as it is believed that increasing the understanding of Sage-grouse needs will lead to a cooperative and coordinated effort to improve conditions.

RESEARCH AND MONITORING

Efforts to increase what is known about Sage-grouse need to continue. Research to identify impacts to Sage-grouse and methods of habitat improvement are needed. Research topics could include: genetic analysis of individuals and populations; how predators affect Sage-grouse populations; the manipulation of vegetation communities by herbicides, fire, or mechanical methods; the effects of hunting on Sage-grouse, and how to better manage other land uses in Sage-grouse habitat such as livestock grazing, big game herd management, and recreation. Existing monitoring of Sage-grouse and their habitat needs to be continued and in some cases intensified. Sage-grouse information will need to be developed and shared by all resource management agencies and made available to the public. All Sage-grouse habitat and related information will be identified and mapped, at a high level of accuracy, on a Geographic Information System. We are in this process in Utah. This should increase the understanding of Sage-grouse, their habitat needs and identify future improvement projects and activities. In some cases, inventory of important Sage-grouse habitat needs to occur before mapping.

OUTREACH NEEDS

The reader is referred to the Strategic Management Plan for Sage-Grouse 2002 (UDWR 2002) for a listing of Outreach Needs.

AMERICAN WHITE PELICAN
(*Pelecanus erythrorhynchos*)

Conservation Priority Score of 36

Jim Weis

ASSOCIATED SPECIES: Other bird species that may respond similarly to habitat components used by American White Pelicans are California Gull, Caspian Tern, and Double-crested Cormorant for nesting habitat. Other species besides the ones listed for nesting habitat that forage for food in similar habitat are Western and Clark's Grebes, Forster's Tern, Great Blue Heron, Black-crowned Night Heron, Snowy and Cattle Egrets.

DISTRIBUTION: In Utah, the only known breeding colonies are located in the northern portions of the state specifically within the Utah Lake/Great Salt Lake ecological complex. There is a record of pelicans nesting on Rock Island, Utah Lake in 1904 (Goodwin 1904) and two records of pelicans nesting in greasewood hummocks southwest of Farmington Bay WMA in 1973 and 1974 (C. Jensen, pers. comm.). Historically pelicans were identified as nesting on Egg Island in 1850 by Howard Stansbury and perhaps on Badger Island in the 1880's (Dr. H. A. Whytock). Beyond these records the substantial nesting has taken place on Hat Island and Gunnison Island. Pelicans have not nested on Hat Island for several decades. Gunnison Island persists as the only colonial nesting site for American White Pelicans in Utah and currently ranks as one of the largest breeding colonies in North America. During spring migration, breeding season and fall staging and migration periods American White Pelicans can be observed at many reservoirs throughout the state.

ECOLOGY: American White Pelicans migrate from northern breeding areas but are year round residents in Texas (Chapman 1988) and Mexico. Populations breeding west of the Rocky Mountains move southwest into California and due south to the west coast and central states of Mexico (Behle 1958). Spring returning occurs in late February in Nevada and early March in Utah (Behle 1959, Alcorn 1943). Further north in Yellowstone and Canada birds arrive in April and May (Diem 1967).

Autumnal departure seems to be drawn out from October through December. In Utah at least three factors seem to play a role when birds depart, the opening of the fall waterfowl hunting season, availability of fisheries, and ice up. Behle recorded banded birds from the Great Salt Lake being recovered north in Idaho (1958). Recent satellite telemetry studies of pelicans radio tagged at Pyramid Lake, Nevada also suggest that some birds fly north after the breeding season to the intermountain area. One bird made a flight from Pyramid Lake to Bear River Bay, Utah in the course of a day (Fuller et al. 1998).

The breeding range extends from the park lands and prairies of Canada into the mountain states to the

Gulf Coast of Texas and Mexico. Preferred nesting habitats are islands especially associated with fresh water lakes. Preferred foraging areas are shallow lakes, marshlands and rivers. Breeding colonies are often 50+ km from foraging areas. Low site fidelity and high mobility appear to be adaptations American White Pelicans have made to take advantage of temporarily rich food supplies (Evans 1972, Knopf 1976).

Primary food is fish. Fish are often sought in water < 2.5 m deep (Anderson 1991). American White Pelicans are diurnal and nocturnal foragers. Capture rates are higher during day and at the leading edge of foraging flocks, than at night (McMahon and Evans 1992a). Cooperative foraging is often employed in shallow water. Several to hundreds of pelicans can be observed not only to cooperate but also coordinate strategies to capture fish. They drive fish to shallows and often encircle and concentrate prey, then dip bill into water and scoop fish into their gular pouch (for details see Anderson 1991, McMahon and Evans 1992b). They forage mainly on “rough” fish often small, less than one-half bill length.

American White Pelicans are highly social. Nesting in colonies, using cooperative flight and foraging strategies, pelicans are among the most gregarious of avian species. These birds are often observed sleeping, roosting and sun bathing together. They are monogamous. Pair formation occurs after arrival in Utah the last week in March (Knopf 1979). Nest building occurs <5 days. There is synchrony in nest chronology within such colonies. For the colony as a whole, nest initiation extends over 3 months in Utah (Knopf 1979). A two egg clutch is produced within a week of nest completion with an incubation period of 30 days. Nestling attendance by a parent occurs to 3 weeks of age, after which young congregate into pods of young or creches that often are mobile. Young from various sub-colonies often combine to form larger pods.

Colonial nest sites are usually islands with flat or low gradient slopes so adults can access nest by flying in. Gravel or sandy, unconsolidated substrates are preferred for nesting. Breeding begins at three years of age. Fledging rates vary with type of cover near nest, range is from 0.89 to 0.34 young fledged/nest. Fledging success decreases as nesting dates become later (one chick/nest in early April to about 0.4/nest for eggs laid in June, Utah; Knopf 1979). Maximum reported lifespan is 26.4 years (Clapp et al. 1982). There is significant mortality of second eggs or second young. In Utah both young fledged at 9.7% and 9.4% of 195 and 374 nests (Knopf 1979).

Predation is rarely a problem for adults and young at undisturbed colonies. California Gulls are the main source of predation in Utah colonies, especially during episodic disturbance and where older chicks force younger nestlings out of the nest. Humans, including researchers, can increase vulnerability of eggs and nestling gull predation by bumping adult pelicans off nests.

Pelicans can be host to parasites, especially biting lice (*Piagetiella peralis*, mallopoya) (Price 1970), nematodes (*Contracaecum spiculigerum*), tapeworms (*Hymenolepis* spp.*, Dibothrium cordiceps, Oilgorchis longivaginatus*), and subcutaneous mites (*Pelecanectes apunctatus*) but there is no evidence of mortality to these parasites. In 1997 there was an outbreak of New Castel’s disease in Utah Double-crested Cormorants at the Bear River refuge, Utah but no known case of mortality for allied pelicans in the area.

In Utah the only known persisting long term nesting colony is on Gunnison Island. It lies in the north arm of the Great Salt Lake approximately ten miles to the northeast from Strong’s Knob, nine miles from the railroad causeway and 25 miles east from Promontory Point. Gunnison Island, named for John Gunnison of the Harvard Stansbury expedition of 1849 and 50 is located in township 9 west, range 7 north of box Elder County, Utah (Rawley 1976). Its long axis extends north and south. It occupies approximately 66 ha (163 ac) and has a relief of 233 ft (85 m) which forms a rock backbone that adds considerable relief and topographic variation including bays, slopes and sandy beaches. American White Pelicans and California Gulls are the primary colonist nesting species on Gunnison Island where over time they have nested mainly on the east and west sides of the island.

Non-breeding and early spring and late summer/early fall breeding age American White Pelicans are widely dispersed through Utah in small mobile numbers especially in the Great Basin. Utah has excellent information on post-nesting season dispersal of American White Pelicans thanks to two primary researchers in the 1940's and 50's. Dr. Jessop Low and Dr. William H. Behle banded 1,502 young pelicans at Gunnison Island over time. Up to 1958, as many as 82 returns provided a picture of pelican distribution. The principle wintering grounds are scattered throughout Mexico, but a few returns are from California (Behle 1958). The returns, as mentioned elsewhere in this report, reflect a northward movement for many birds that precedes the southward migration to winter habitats. Behle reported two instances of natal site fidelity for Gunnison Island (1958).

The Gunnison Island breeding population is somewhat unique in that the lake surrounding the nest colony is hyper saline and does not support a fishery, therefore, adults must make flights of at least 30 miles, one way, to fisheries. These fisheries have evolved over time from pre-Anglo native fisheries to post-Anglo non-indigenous fisheries dominated by carp (*Cyrinus carpio*) prior to the mid 1980's and now supplemented by Gizzard Shad (*Dorosoma cepedianam*) especially in the Willard Spur arm of Bear River Bay. Traditional foraging areas for Gunnison Island adults have occurred to the east of the colony at Bear River Bay including the National Refuge and east and southeast at state waterfowl management areas (WMA) and privately managed Wetlands. During these high lake years (1983-1987) primary foraging sites were restricted to fisheries occurring east of traditional lakeside sites. Some sites of foraging importance, directly south of Willard Reservoir, Rainbow and George East Clubs, the east portions of Ogden Bay WMA, Farmington Bay WMA and the Associated Duck Clubs were flooded during this time. Pelicans also flew to foraging areas north and south of Gunnison Island to American Falls Reservoir in southern Idaho and south to Utah Lake. Some birds flew east as far as Dingel Marsh on the north end of Bear Lake, Idaho (Flannery 1988). A study of flight paths and direction of American White Pelicans from Gunnison Island demonstrated that as the lake elevation changed in the 1980's and subsequent foraging habitat changed, the flight patterns of pelicans changed (every year) in response to these dynamic conditions (Flannery 1988).

Great Salt Lake foraging environments reflect many of the qualitative values identified for American Pelicans (Anderson 1991). Because of the low gradient bottom of the Great Salt Lake and its associated Wetlands pelicans have thousands of hectares of fisheries that are 0.5-2 m deep. These fisheries are high in nutrients, warm quickly, and provide excellent breeding, nursery, and foraging habitats for “rough” fish. Subsequently these habitats allow for a broad range of American White Pelican foraging strategies. Warm spring and summer days create excellent thermal systems and nearby mountains, islands and promontories form late morning updrafts, all of which assist adults in air lifting forage to awaiting young at Gunnison Island.

Significant life history and migration information for North America’s American White Pelican population has been collected from the Utah Gunnison Island colony and associated Wetlands (Behle 1958, Knopf 1975, 1979).

HABITAT AND/OR POPULATION OBJECTIVES:

1. Continue to manage Gunnison and Bird (Hat) Islands for breeding colonial birds with emphasis on American White Pelicans and California Gulls.
2. Provide, through statutory and wildlife rule regulation, breeding season protection from human disturbance to these and other breeding sites as they occur.
3. On the ground visits to breeding colonies should be carefully managed and planned to mitigate against disturbance, abandonment and mortality. Visits should only be made to collect important data and provide key educational outreach toward long term American White Pelican conservation.
4. Key foraging areas should be identified and managed for sustainable fisheries in balance with other Wetland management objectives especially within the Bear River, Ogden River and Jordan River systems.
5. Maintain breeding and foraging habitat within the Great Salt Lake ecosystem so as to provide

conditions that allow American White Pelican breeding adult populations to occur at the twenty-five year average of 10,120 per annum (Table 10).
6. Provide management and protection of breeding colonies from human and terrestrial predation to allow for a > 0.69 nesting survival rate per nest.

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: The American White Pelican is considered a species of moderate concern for conservation action in the North American Waterbird Conservation Plan (Kushlan et al. 2002). Utah hosts one of the largest American White Pelican breeding colonies in North America (Table 10). In 1933 a status report of American White Pelicans in continental North America found that there were only four colonies of significance in the United States, Gunnison Island on the Great Salt Lake was one (Thompson 1933). Three other colonies in Saskatchewan, Canada, in conjunction with the US sites made up the majority of the continental populations. In 1966 a follow up survey indicated a decline in the continental population with only four of the seven 1933 colonies remaining viable, the four US sites (Lies and Behle 1966). In the last three decades the Gunnison Island breeding population has demonstrated an increasing trend. Many other colonies have been compromised due to water diversion or human disturbance. All of Utah's breeding American White Pelicans are located on one site and because this site represents one of the three most stable and productive sites on the continent, it is critical that it be protected. Gunnison Island is sequestered north of a railroad causeway and because of this barrier is protected from most human disturbance. However, recent interest in the development of brine concentration ponds in the vicinity of Strongs Knob within Gunnison Bay have brought industry to the north arm. There has been and is interest in the possible extraction of fossil fuels from the lake bed near Gunnison Island. There is some discussion of breeching the railroad causeway that could potentially make boat trafficking near Gunnison a possibility.

Another management and conservation concern is the potential impact to foraging areas. A principle foraging site is located in the upper reaches of Bear River Bay including the Willard Spur. This is a key area that has been used by American White Pelicans for many decades, even recorded as a foraging site in the journal of early explorers. The site is the nearest foraging habitat to Gunnison Island and is known to support larger numbers of fall migratory American White Pelicans from other populations in addition to Utah pelicans. Potential threats to the integrity of the fishery in Bear River Bay included salt industry expansion, changing salt harvest methods and pond flushing and the dewatering of the system as up stream water use demands reduce flows to the bay. Other marsh area fisheries are challenged by similar potential and real water use practices.

Habitat Loss

1. Develop a sustainable water use plan for Bear River Bay.
2. Work with salt industries to eliminate, reduce or mitigate impacts to the Gunnison Island colony in the north arm and foraging sites in Bear River Bay.
3. Work with the Division of State Lands to protect American White Pelican habitats within state land holdings.
4. Work with Wetland managers within the greater Great Salt Lake ecosystem to manage for pelican habitat as part of their comprehensive management plans.

Human Disturbance

1. Provide modification to the railroad causeway that allows for better Great Salt Lake brine distribution, but precludes boat travel into the north arm of the Great Salt Lake.
2. Maintain and enforce Division of Wildlife Resources rule restricting human disturbance of Gunnison and Bird Islands during the American White Pelican breeding season.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

1. Continue the 25 year data base of breeding adult, nest and young surveys.
2. Work with Great Basin waterbird researchers to determine migratory corridors and patterns within and outside the Great Basin.
3. Work with Hill Air Force Base to understand more fully local use areas and time budgets of American White Pelicans to assist in understanding breeding ecology and strategies for reducing risk of bird-strikes to aircraft.
4. Carry out distribution surveys of American White Pelicans throughout western and southern Utah with emphasis on spring, fall and non-breeding migrants.

OUTREACH NEEDS

1. Educate public to the importance of rough fish fisheries to pelicans and other piscivorous birds.
2. Tell the story of Gunnison Island and its value to colonial nesting birds at the Great Salt Lake in Utah, and for the continent.
3. Educate the public at large, lake industries, agencies and NGO's as to the value of the Great Salt Lake ecosystem for western colonial waterbirds.

Table 10. White Pelican Population Estimates for Gunnison Island, Utah.

YEAR	# ADULTS	% CHANGE	# NESTS	FLEDGING EST.
1963	4,506	NA	2,500	1,000
1964	3,000	-33.42	1,500	897
1972	5,268	NA	2,634	1,817
1973	5,210	-1.1	2,605	1,797
1974	5,348	2.65	2,674	1,847
1976	5,590	NA	2,795	1,926
1980	6,466	NA	3,233	2,231
1981	6,966	7.73	3,483	2,403
1982	7,314	5	3,657	2,523
1983	9,638	31.77	4,819	3,325
1984	9,502	-1.41	4,751	3,278
1985	10,926	14.99	5,463	3,769
1986	11,860	8.55	5,930	4,092
1987	17,072	43.95	8,536	5,890
1988	16,048	-6	8,024	5,537
1989	9,912	-38.24	4,956	3,420
1990	11,604	17.07	5,802	4,003
1991	17,424	50.16	8,712	6,011
1992	20,270	16.33	10,135	6,993
1993	11,562	-43	,781	3,988
1994	9,804	-15.2	4,902	3,382
1995	8,326	-15.08	4,163	2,872
1996	12,840	35.0	6,420	4,430
1997	12,516	-2.59	6,258	4,318
1998	14,014	10.69	7,007	4,835
1999	11,702	-16.5	5,851	4,037
2000	17,958	35	8,979	6,195

BOBOLINK
(*Dolichonyx oryzivorus*)

Conservation Priority Score of 36

Peter Weber

ASSOCIATED SPECIES: Sandhill Crane, Killdeer, Common Snipe, Northern Harrier, Eastern Kingbird, Song Sparrow, Savannah Sparrow, Red-winged Blackbird, Yellow-headed Blackbird, Brewer's Blackbird.

DISTRIBUTION: The Bobolinks' breeding range is an east-west band across the northern US and southern Canada between the 50th and 39th parallels. Their distribution is fairly continuous in the East but patchy in the West. Isolated breeding populations occur in northern Utah and Nevada, central Washington and southeastern Arizona (Martin and Gavin 1995). Bobolinks do not breed in most of Utah. They occur in low abundance and in isolated patches primarily in the northern half of the state. Because of this spotty distribution, there are not enough Bobolinks encountered on the BBS to estimate abundance in Utah (Sauer et al. 1997). However, Bobolinks have been found consistently and are likely to breed or have bred near Logan, Brigham City, Kamas, Heber, Morgan, Mountain Green, Huntsville, West Layton, Provo and at the south end of Bear Lake (Hayward et al. 1976, Smith 1995). Bobolinks have also been reported from Deseret Ranch, Kaysville, West Springville, Goshen, Ibapah, Callao, Fish Springs, Skull Valley, Beaver County (Kaufmann Ranch), Washington Fields, and Lytle Ranch (Hayward et al. 1976, M. Webb pers. comm.) though the breeding status of birds at these sites is uncertain. Bobolinks were historically common in northern Utah; Hayward et al. (1976) indicated that "all of the early investigators visiting Utah prior to the turn of the century found this bird present and in considerable numbers." Bobolinks are now considered to be rare (Walters and Sorensen 1983) and somewhat erratic, probably not occurring during drought periods (Behle et al. 1985). Bobolinks winter primarily in southern South America from eastern Bolivia and southwestern Brazil through Paraguay and Argentina to Buenos Aires; wintering birds have also been recorded in portions of western South America (Martin and Gavin 1995).

ECOLOGY: Bobolinks have one of the longest annual migrations of any North American songbird. These Neotropical migrants travel about 20,000 km (12,500 mi) from their North American breeding grounds to their "wintering" grounds in southern South America. Their nonbreeding season actually occurs in the spring of the southern hemisphere. Bobolinks spend approximately half of each year in migration. Bobolinks typically arrive in Utah in early to mid May and probably begin southerly migration around mid August though some birds may still be present through September (Behle and Perry 1975). Pettingill (1983) commonly noted wintering birds on the Galapagos Islands and hypothesized that Bobolinks which breed in western U.S. might winter in western South America. However, this has not been researched.

Males arrive on the breeding grounds in early to mid May about one week before females. Courtship generally takes less than 3 days and all pairs within a patch are formed within a few days, some within a few hours. Males are strongly polygynous often taking 2 (sometimes 3, rarely 4) females. The occurrence and degree of polygyny may depend on habitat quality and/or food abundance.

Nest construction begins about a week after female arrival and takes 1-2 days to complete. Females build nests on the ground by first clearing a nest-sized area of vegetation exposing the bare ground beneath; if not in a natural depression, the area is often scraped by the female. The depression is then filled with a cup of coarse grasses and weed stems with an inner lining of finer grasses and sedges. Beginning one to 2 days after the nest is complete, eggs are laid at a rate of 1/day. Average clutch size is 5, though 3-7 eggs are not uncommon. Incubation begins with the second to last egg and is done by the female for about 11-13 days. Hatching occurs over a 20-30 hr period with most eggs hatching in the first 2-5 hrs (hatching of the last egg laid may be delayed for many hours). Nestlings are fed exclusively invertebrates by both males and females. Male contributions may focus primarily on the nest of his first mate or may be spread among nests of all mates (usually 2). Fledging occurs in 10-11 days (8-9 days if disturbed) though short flights are not performed until day 13. Both adults feed fledglings. Pairs will often renest after failure and double brooding is unusual but has been recorded. Often within about 6 days of fledging, pairs and their broods will flock together with other family units. Adults feed their own young in the flock and the flock grows throughout the season as more nestlings fledge. The flock remains relatively coherent until, and possibly after, migration has begun.

About half of all nests are successful, and these usually produce 2-3 young. An average of 54% of 422 nests was successful ($ 1 young fledged) in an upstate New York study. Productivity averaged 2.29 young per clutch in this study and 2.69 young per clutch in a Wisconsin study (Martin and Gavin 1995). Adult survival estimates are not available, but longevity records include a female $ 9 yr and a male $ 7 yr old. Annual return rates varied greatly by study with recorded return rates of 57%, 63%, and 70% for males and 61%, 34%, and 44% for females. Some, possibly many, birds do not return to their previous years breeding grounds, so these return rates are minimum estimates of adult survival. Recruitment of immature birds into the breeding population is not well understood and may be very low. Only about 2% of over 300 fledglings banded subsequently returned to their natal area; how much of this figure is attributable to juvenile mortality and how much is lack of natal site fidelity was not determined. Inclement weather and flooding of nests can be substantial causes of nestling and egg mortality. Predation of eggs and nestlings by snakes, domestic animals, skunks, and avian predators is also a major source of mortality. Predation of adults does occur but is much less frequent.

During the breeding season, Bobolinks feed primarily on invertebrates (adult and larval insects) as well as weed and grain seeds. Nestlings are fed exclusively invertebrates, but consume more seeds and forbs as they become independent. Bobolinks probably switch to a diet of almost exclusively grain seeds and plant parts during the nonbreeding season. Foraging is primarily by ground gleaning, though seeds are often gleaned by birds perched near the tops of plants (Ehrlich et al. 1992, Martin and Gavin 1995).

HABITAT REQUIREMENTS: Bobolinks in the West, nest and forage in Wet Meadow (grasses and sedges), wet Grassland, and irrigated agricultural areas (primarily pasture and hay fields). These habitats, particularly Wet Meadows, tend to be associated with riparian or Wetland areas. Precise habitat characteristics have not been well studied in the West. Bobolinks nesting in the East appear to be most successful in large ($ 30 ha), old ($8 yr) hay fields (Bollinger and Gavin 1992). Old hay fields typically have high proportions of grass (or grass and forbs) and low proportions of alfalfa; pure alfalfa fields were not considered suitable breeding habitats. Nest sites tend to be in wet habitats but also occur in transitional areas between wet and dry areas. Nests are almost always built on the ground and are often located at the base of large forbs. While grass usually makes up a large portion of the general nesting area, nests are rarely located in grass but are instead located in forbs and sedges.

HABITAT AND/OR POPULATION OBJECTIVES

1. Establish 20 populations of 20 males each in suitable habitats across northern Utah. Since most male Bobolinks are polygynous, this should provide for a viable population of at least 500 pairs in Utah.
2. Provide suitable Wet Meadow, wet Grassland, wet pasture, and/or wet hay habitats to support 20 subpopulations of 20 males each. Fewer large patches of contiguous habitat are better than several small patches (Bollinger and Gavin 1992). For each of the 20 subpopulations, a minimum of 40 ha of high quality habitat should be maintained; habitats should be distributed in blocks consisting of 4 or more patches of contiguous habitat (10-30 ha/patch) arranged within 5 km of one another.

ASSUMPTIONS:

1. 500 pairs of Bobolinks distributed into 20 subpopulations is a viable population for Utah.
2. 400 Bobolink males can consistently form and maintain 500 pairs.
3. An average density of 0.5 male Bobolinks/ha is attainable and sustainable if habitat blocks are of sufficient size and composition.
4. Dispersal of Bobolinks in Utah is similar to Bobolinks in the East (i.e., at least 5 km).

Bobolink populations have declined significantly range wide at 1.6%/year over the last 30 years; much of this decline (3.8%/year) has occurred over the last 15 years (Sauer et al. 1997). While it is not possible to determine from current monitoring programs what Bobolink populations trends are (Bobolink populations in Utah are too small to be sufficiently monitored by BBS), anecdotal evidence indicates that breeding densities may be decreasing. Certainly, bobolink populations are substantially lower than the historic populations of the late 1800s.

The Utah Gap Analysis Project (Edwards et al. 1995) classified Wet Meadow habitat in only 58 km^2 (150 mi^2) of Utah, i.e., < 0.5% of Utah's land cover is Wet Meadow. This amount of habitat, if properly managed, may be sufficient to support a viable population of Bobolinks in Utah. However, in order to support a sustainable viable population, habitats (Bobolink subpopulations) need to be distributed in such a way as to minimize the likelihood of a catastrophic population event. Thus it is desirable to increase the amount and enhance the distribution of Wet Meadow habitats in the state.

Rigorous density estimates are not available for Utah. The number of males/km^2 were 26 for tall grass and 33 for mixed grass habitats in Wisconsin; densities were 91 males/km^2 for hay fields in New York including 120 males/km^2 for the highest quality hay fields habitats. It is likely that Utah's habitats do not support the same Bobolink densities as habitats in the East; informal surveys indicate that densities may be an order of magnitude lower at Utah breeding sites (Goodell and Howe 1999).

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES:

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Bobolinks are listed as a State Sensitive Species because of (range wide) declining populations and limited habitat; they are not listed as federally Threatened or Endangered. Wet Meadow habitats have been decreased and fragmented in Utah due to many of the same factors that impact riparian areas, e.g., agricultural encroachment, urban encroachment, road development, water development (reservoirs and in-stream flow depletions) and channelization. Hay fields (primarily grasses with little or no alfalfa/legumes), particularly hay fields that are irrigated or flooded, can provide suitable breeding habitats. Bobolink success in these habitats depends primarily on the timing of hay cutting. Hay cutting during the incubation or nestling period may cause direct destruction, abandonment, or predation of all nests in an area; haying after young are flighted probably causes less damage, but may still expose fledglings to increased predation and other mortality sources (Bollinger et al. 1990). Nationwide, conversion of grass hay fields to alfalfa and other croplands is one of the major suspected causes of Bobolink declines. In Utah, many drier hay fields which historically were a mixture of grasses and forbs, have been converted to alfalfa; these fields are typically maintained as monotypic alfalfa (or rotated between alfalfa and grain crops) and are first mowed during the incubation or nestling periods (June). Most wetter hay fields have not been converted and remain as a mixture of grasses and forbs; these are not usually cut until the water table subsides--typically in August (J. Barnes, NRCS-Logan, pers. comm.) when the nesting cycle is advanced or completed. In drier years, these fields may be mowed earlier during the nestling or early fledgling periods. Wet Meadows may also be mowed in drier years. The effects of grazing on Bobolink nesting and productivity have not been studied. Grazing occurs in both Wet Meadows and hay fields, but grazing in wet hay fields does not usually occur until after the fields are mowed (August-September). However, grazing occurs during the breeding season in Wet Meadow habitats.

Nest parasitism by Brown-headed Cowbirds is considered to be uncommon but varies greatly by site (0-43% of nests parasitized) and does not appear to have a major impact on Bobolink populations (Martin and Gavin 1995). Parasitism of Bobolinks has not been studied in Utah, however, Bobolink habitats often have several factors favorable to cowbirds (high fragmentation, presence of cattle, and short distance to cowbird feeding areas, e.g., stockyards). Bobolinks will defend nesting areas against cowbirds but do not reject cowbird eggs and will raise young cowbirds.

The effects of pesticides on Bobolinks have not been well studied and pesticide impacts have not been implicated in population declines. However, nesting Bobolinks are likely to be exposed to a number of pesticides because of their proximity to agricultural areas on the breeding, migration, and wintering grounds. Also, since Bobolinks feed their young almost exclusively insects, food base reduction from pesticides may affect nestling and juvenile growth and survival.

Bobolink management issues (in italics) and recommendations are listed below.

Habitat Loss and Fragmentation

1. Increase Wet Meadow habitats statewide by 50%.
2. Manage for contiguous patches (patch size of 10-30 ha) of suitable Wet Meadow, wet Grassland, or wet hay field habitats. Blocks of habitat consisting of 4 or more contiguous patches located within approximately 5 km of each other should be established.
3. Design developments, i.e., roads, trails, pipelines, housing, etc., to avoid or minimize impacts to Wet Meadow habitats.
4. Cowbird parasitism should be controlled through maintenance and reestablishment of large, contiguous blocks of Wet Meadow habitat and reduction of habitat fragmentation.

Agricultural Impacts

1. Delay hay cutting of suitable patches until mid July. Cutting on a 1-2 year rotation will help to maintain habitat suitability.
2. Discourage heavy grazing of suitable habitats. Grazing should be timed to avoid the nesting season (early May though mid July) and may be used to maintain suitable habitats.

Pesticide Use

1. Avoid broad-scale use of pesticides of suitable habitats during the nesting and brood-rearing season (mid-May through July).
2. If used, avoid persistent pesticides and those with high bioaccumulation potential.
3. Avoid use of pesticides in years of low food abundance.

Implementation Opportunities

1. Increase cooperation between state and federal agencies (particularly NRCS) and private landowners regarding Wet Meadow/riparian inventory, conservation, and management.
2. Increase awareness of public regarding importance of Wet Meadow habitat and hay fields to birds.
3. National Farm Bills provide incentives for Wetland and riparian conservation by private land owners and these incentives can be used to enhance Bobolink habitat quality and distribution.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

1. Determine best methods for assessing Bobolink occurrence and population densities and develop appropriate inventory/monitoring protocols.
2. Determine best methods of evaluating and monitoring quality and quantity of Bobolink habitats at different scales through time (e.g., combination of ground-based and remote sensing change detection).
3. Establish inventory and monitoring program for Bobolinks and Bobolink habitats (Breeding Bird Surveys do not adequately monitor Bobolinks). Annually analyze trends in density and habitats (availability and suitability) to determine stability of population and habitats.
4. Determine habitat characteristics of breeding Bobolinks in Utah
5. Determine relative importance of Wet Meadow habitats and hay fields to Bobolink populations in Utah.
6. Determine how agricultural practices (e.g., hay cutting, grazing, flood irrigating) effect Bobolink nesting and productivity and how these practices can be used to enhance Bobolink habitat and productivity.
7. Determine the effects of commonly used pesticides on Bobolinks and their prey.
8. Determine factors that limit productivity and juvenile survival on the breeding grounds (including post-fledging period when Bobolinks form mixed age flocks).
9. Determine migration patterns and ecology and assess threats to migrating Bobolinks (Cooperate with other states and nations).
10. Determine ecology and assess threats to Bobolinks on wintering grounds (Cooperate with other states and nations).

OUTREACH NEEDS

Most Bobolink habitat occurs on private lands in Utah. Outreach efforts should focus on informing private land owners of the importance of and threats to Wet Meadow, wet Grassland (hay fields), and irrigated pastures. Agencies that implement private land stewardship programs should also be informed of the importance of these habitats. While some Bobolink habitats occurs on public lands, private land owner conservation efforts will be critical to stemming habitat loss and fragmentation, agricultural impacts, and pesticide use.

VIRGINIA'S WARBLER
(*Vermivora virginae*)

Conservation Priority Score of 36

Phil Dotson

ASSOCIATED SPECIES: The Virginia's Warbler was first discovered in New Mexico and described by Baird in 1860 (see Bent 1953). The species is closely related to both the Nashville Warbler and Colima Warbler and is considered by most systematists to form a superspecies with these two species. The Colima Warbler is not known to occur in Utah, and the Nashville Warbler is uncommon in the state and more frequently encountered during migration periods. Virginia's Warbler is mostly gray on the upper parts with a contrasting greenish-yellow rump and yellow undertail coverts contrasting with a whitish belly. Adult males show a large yellow breast patch and a rufous patch on the crown which is usually concealed. Overall, the males and females are much alike in plumage. No geographic variation has been reported, although there is some individual variation in plumage which is likely due to age. Lucy's Warbler also resembles Virginia's Warbler but is not considered to be closely related (Bent 1953, Curson et al. 1994).

In Utah, the primary breeding habitat for Virginia's Warbler is Oak with secondary breeding habitat as Pinyon-Juniper. At least 15 additional species are commonly found in Mountain Shrub habitat in Utah to include Gray Vireo, Fox Sparrow, Stellar's Jay , Spotted Towhee, Black-chinned Hummingbird, Western Scrub-Jay, Pine Siskin, Lewis's Woodpecker, Common Poorwill, Chipping Sparrow, Lazuli Bunting, MacGillivray's Warbler, Green-tailed Towhee, Sharp-shinned Hawk, and Orange-crowned Warbler. At least 18 additional species are commonly found in Pinyon-Juniper habitat in Utah to include Common Bushtit, Cedar Waxwing, Common Nighthawk, Juniper Titmouse, Cassin's Kingbird, Common Raven, Loggerhead Shrike, Bewick's Wren, Mountain Chickadee, Blue-gray Gnatcatcher, Black-billed Magpie, Pinyon Jay, Black-throated Gray Warbler, Black Phoebe, Gray Flycatcher, Western Bluebird, Ash-throated Flycatcher, and White-breasted Nuthatch (Partners in Flight 1999).

DISTRIBUTION: The breeding range of the Virginia's Warbler lies almost entirely within the southwestern United States. It is an uncommon to common breeder from montane areas in the Great Basin region in eastern California (White mountains, eastern slope of sierras in Mono and Inyo Counties; Clark Mountain, New York Mountains), Nevada (except northwest), southeastern Idaho, throughout Utah, southwestern Wyoming, western Colorado, northern New Mexico; and also in southern California (San Bernardino and San Gabriel mountains), central Wyoming, eastern ranges of Rocky Mountains in Colorado and New Mexico, central and southeastern Arizona, central and southern New Mexico, and western Texas (Guadalupe and probably Davis Mountains). Preferred breeding habitat includes chaparral and open stands of Pinyon-Juniper, yellow pine and scrub oak, mountain mahogany thickets or other low brushy habitats on dry mountainsides, open ravines or canyons, or in flat mountain valley bottoms from 2000 to 3000 m (A.O.U. 1998, Bent 1953, Curson et al. 1994, Kaufman 1996, Ryser 1985).

The Virginia's Warbler spends the winter in mid-elevation portions of west-central Mexico from southern Nayarit and northern Jalisco and Guanajuato south to Morelos and central and southern Oaxaca (west of the Isthmus of Tehuantepec). Casual to accidental occurrence in winter has also been reported for southern California and in the Rio Grande Valley of Texas (A.O.U. 1998,Bent 1953, Curson et al. 1994, Kaufman 1996, Ryser 1985).

Although some early ornithological records failed to mention Virginia's Warbler, the species occurs statewide in Utah as a common summer resident. Earliest occurrence date for the state is April 25 and the latest is October 14. No current estimates are available as to the number of breeding pairs occurring in Utah. Historical nesting records for Utah include Salt Lake and Summit County (1869), San Juan County (1936), Utah County (1937), Kane County (1946 and 1947), Garfield County (1952), Daggett County (1959), Beaver County (1965), Weber County (1973-1974), and the Uinta Basin (1977).

Elevation for nesting in Utah ranges from 1220 m (4,000 ft) in the Salt Lake Valley to approximately 3050 m (10,000 ft) in San Juan County (near the top of Navajo Mountain; Woodbury and Russell 1945). Nests are typically embedded or covered with dead or decaying leaves and grasses in areas of dense brush. Dense mountain brush areas and stream side thickets at mid-elevations and in lower valleys are preferred habitats. Occurrence overall is considered irregular in late April as well as in mid-September through mid-October. From May through early September the species is fairly common in suitable habitat (Behle and Perry 1975). As in other portions of the range, Virginia's Warbler is a ground nesting species in Utah chaparral and montane communities. Areas that have been subjected to snowslides typically develop thick shrub growth which may be particularly attractive for nesting (Hayward 1945 and 1948).

ECOLOGY: Individuals follow mountain valleys and foothills at night during both fall and spring migration periods. Virginia's Warbler uses a variety of semi-open habitats on migration, especially riparian areas. Southward (fall) migration begins in August, and northward (spring) migration begins in March. Late fall departure dates are September 11 in Arizona and New Mexico, September 21 in Colorado, September 16 in Texas, and September 20 in Utah. Fall arrival at Sonora, Mexico (Guadalupe Canyon) has occurred as early as August 31, and spring departure from Mexico has occurred as late as May 10. Early spring arrival dates are April 2 in Arizona, April 10 in New Mexico, April 20 in Texas, April 30 in Nevada, May 2 in Colorado, and May 5 in Utah. Spring arrival on breeding grounds has occurred as late as May 13 in Texas. In addition, Virginia's Warbler is a vagrant in Oregon, Nebraska, Kansas, Illinois, New Jersey and Ontario (A.O.U. 1998, Bent 1953, Curson et al. 1994).

Virginia's Warbler winters mostly in dense, semi-arid scrub and savannah in the highlands of west-central Mexico. The species occurs in small groups in winter and may occasionally join mixed-species feeding flocks foraging on insects. Diet, in fact, consists primarily of invertebrates year round, although Virginia's Warbler also feeds on nectar in winter (Curson et al. 1994, Rappole et al. 1995).

The first recorded nesting of Virginia's Warbler was of a nest found near Salt Lake City, Utah, on June 9, 1869 (Baird et al. 1874). However, Aiken and Warren (1914) reported on a nest found in Colorado on June 1, 1873 as "the first nest of this species known to science." Although nesting of the species both in Utah and Colorado have been known for quite a long time, the breeding behavior is not well understood.

Virginia's Warbler is a single brood species that begins its breeding cycle in mid-May to early June. Males defend large territories, and nests often occur within close proximity to Lucy's Warblers which has a very similar song and call. Pairs begin nesting by early June, and nests are typically placed on the ground and can be very difficult to find. The nest is probably built by the female and consists of a shallow cup lined with hair and grasses which is placed on the ground under grass tufts amid decaying leaves below dense brush. Usual clutch size is 4 eggs (range 3-5). Incubation lasts for 12 - 14 days and is done by the female. Nestlings are altricial and are tended by both parents. Young leave the nest at about 11 or 12 days and are independent at about 3 weeks of age (Baicich and Harrison 1997, Kaufman 1996, Curson et al. 1994, Bent 1953). Nesting is not known to occur north of the Wassuk Range in the western end of the Great Basin portion of the species' range north (Ryser 1985). It is not known what percentage of the total breeding population of Virginia's Warbler occurs in Utah, although the state encompasses approximately one-fourth of the species' geographic breeding range..

Preferred breeding habitat is within low brushy areas on dry mountainsides. Scrub oak, chaparral, and Pinyon-Juniper woods that are mostly open are of utmost importance to Virginia's Warbler during the breeding season. While the higher structure of preferred nesting habitats can be more open, Virginia Warbler requires a rather dense undergrowth for both foraging and nesting. Breeding may also occur in Aspen or Douglas-fir forests where a good under story of shrubs is present. In portions of Colorado, the species seems to require steep slopes with litter cover and shrub species richness for nesting with little or no dead trees present (Curson et al. 1994).

North American Breeding Bird Survey (BBS) data indicate a an increasing population of approximately 2% throughout the range of Virginia's Warbler from 1966 - 1996. However, in portions of the range the trend is mixed. In Colorado and the southern Rocky Mountains physiographic region, a declining trend of approximately 1% is indicated from the BBS data from 1966 - 1996. On the other hand, BBS trends for Utah, Arizona, and southern New Mexico are slightly increasing for the same time period. Numbers are generally high in western Colorado, northern New Mexico, and central Arizona portions of the range during annual BBS surveys. Populations may have increased since pre-settlement times due in part to an increase in shrubby under stories in certain forested areas.

Threats are largely unknown. More data on breeding and wintering ecology is needed. Greatest documented threats appear to be from predation from corvids, accipiters, and other avian species, snakes, and a variety of mammals (e.g., weasels, shrews, chipmunks, and squirrels). Virginia's Warbler is an occasional cowbird host although little information on parasitism of the species is known. The relatively low occurrence of cowbird parasitism may result from a preference for higher elevation areas for nesting which are above the usual range for the cowbird, and from the nests usually being very well hidden.

Environmental or human-induced effects likely pose the greater threat to Virginia's Warbler throughout its range including Utah. Breeding distribution is typically localized, although threats to breeding habitat in Utah are moderate. Factors affecting population size and distribution are unknown, and considerable data is needed for wintering areas. The species has a high ranking for Conservation Priority both in Utah and Colorado.

HABITAT REQUIREMENTS: In addition to the habitat preferences listed above, the Virginia's Warbler typically requires scrubby hillsides where a herbaceous or woody under story is well developed. Lower mountain habitats with dense stands of Gambel's oak and relatively high slope are preferred for breeding, although mountain mahogany, riparian areas, Ponderosa Pine forests, and Pinyon-Juniper woodlands, all with shrubby under stories, are also used for breeding. Breeding occasionally occurs in Douglas-fir and Aspen habitats with the required shrubby under story.

HABITAT AND/OR POPULATION OBJECTIVES: Specific data such as density and territory size for the species in Utah are sparse, although life history requisites are likely similar in appropriate habitat throughout most of the species' range. During the breeding season, home range and breeding territory are probably the same, and the entire breeding, feeding, and resting areas are defended. Actual territory size data are only available from Arizona. In southern Arizona a density of one pair per 1.8 miles was recorded in pine-oak woodland. Bent (1953) reported one territory of approximately 5.02 ha, and USFS (1994) reported one territory of approximately 1.24 ha in size. Fischer (1978) reported territories in

Arizona that ranged from 0.83 to 2.26 ha in size (cited in Martin and Olson, in press). On this basis, an average territory size for Arizona is 2.34 ha, which seems a bit excessive. Likely the typical territory size is closer to the smaller area sizes of those recorded for Arizona. The Virginia's Warbler is a relatively common species in appropriate habitats, but threats to habitats and to the species are poorly understood.

Virginia's Warblers are monogamous breeders. Males are intra specifically territorial on breeding grounds and likely defend territories that are non-overlapping. More closely related species may be tolerated within a closer proximity of a given nest, although territory boundaries can change from day to day as is common in other species. Territory shifting may be reflective of increasing territory size (Petersen and Best 1987). Females are territorial in the vicinity of the nest. Males establish their territory in spring as soon as they arrive from wintering grounds by singing from the tops of shrubs or from exposed snags or other elevated perches.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Specific management requirements for the Virginia's Warbler are unknown. Activities that remove preferred shrub habitats (e.g , shrub eradication, fire, livestock grazing, campground construction, mining, hiking trails in ravines and along stream sides, road construction, off-road vehicle use, urbanization) are likely detrimental but effects on the species are unstudied.

***Timber Harvesting*—**Gambel oak is vulnerable to fuel wood harvest in some areas. Regeneration of dense shrubs on timber harvest units are likely beneficial, but no data are available to support such a contention. A high percentage of dead trees has been negatively correlated with nesting areas.

***Fire Management*—**Response of Virginia's Warbler to fire effects is poorly understood. Likely declines occur immediately after fires that remove shrub habitats and brushy under stories, but burns that promote regeneration of shrubs and native under story grasses are likely beneficial. Some oaks regenerate and recolonize areas after fire, and use of fire to create forest openings and maintain oak in the landscape should benefit Virginia's Warbler. Controlled burns in Arizona that removed the combustible under story and thereby reduced the number of potential nest sites and foraging opportunities resulted in declines of the species (Horton 1987). The same response has also been reported for New Mexico (Johnson and Wauer 1996), but an eventual increase resulted within 4 years post-fire as shrubs regenerated and developed. Fire management practices have changed markedly in Pinyon-Juniper, mountain mahogany, scrub oak, and Ponderosa Pine habitats due to suppression for grazing, timber harvest, and other activities (Horton 1987, West 1988, Fule et al. 1997). The effects on Virginia's Warbler from changes in fire management practices is unknown.

***Livestock Grazing*—**Grazing practices that reduce the volume of shrub cover or that remove young shrubs suitable for nest sites are likely detrimental. Considering the ground nesting preference of the species, nests are likely vulnerable to trampling. Livestock grazing occurring in Pinyon-Juniper, mountain mahogany/scrub oak, and Ponderosa Pine habitats has altered vegetation composition, age structure, and fire patterns with unknown consequences for Virginia's Warbler.

***Brood Parasitism*—**Brood parasitism by Brown-headed Cowbirds occurs rarely and is believed to be due to Virginia's Warbler preferring higher elevation areas for nesting (Harrison 1984).

Virginia's Warbler management issues for Utah are listed below. Management issues and recommended conservation actions have not been identified in the past, and the issues and recommendations presented below represent an initial effort at identifying these parameters for Virginia's Warbler in Utah.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES:

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS

Habitat Loss/Alteration

1. Survey target areas for Virginia's Warblers prior to initiating habitat alteration activities.
2. Produce landscape scale mosaics of altered and unaltered habitat.
3. Prevent invasion of exotic plants.
4. Select native seed mixes for revegetation actions.
5. Reduce harvest of Gambel oak for firewood.
6. Avoid use of herbicides and insecticides in areas used by Virginia's Warbler for nesting.

Fire

1. Limit controlled burns to occur after July 20.
2. Use controlled burns that promote regeneration of shrubs and native under story grasses.
3. Create forest openings and maintain Gambel oak in the landscape.

Livestock Grazing

1. Grazing in areas of high Virginia's Warbler concentration should not be allowed until after 20 July.
2. Manage grazing practices (allotments) to maintain shrub component.

Implementation Opportunities

Pinyon-Juniper and Gambel oak habitat is a major component of the Utah Mountains and Colorado Plateau (Utah portion) physiographic regions. While some annual threats to these habitats occur with habitat alteration and fire, neither component should be considered as being limited in Utah. Habitat and resource managers should be sensitive to the needs of Virginia's Warbler in areas of known occurrence and to conserve ecological processes and functions to accommodate prolonged use. Considering that a substantial number of avian species co-occur with Virginia's Warbler in both its primary and secondary breeding habitat, prudent conservation actions would help to insure long-term richness and diversity in those areas where multi-species suites of birds occur.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

Virginia's Warbler represents a Neotropical migratory species that has been little studied and consequently much of the species' ecology and general life history data are lacking for Utah and other portions of the breeding range. Dispersal, site fidelity, average patch size, edge effects, sensitivities to management activities, population size, population trend, size of range, and distribution trend data are all currently lacking for Virginia's Warbler in Utah and throughout the species' range. BBS data indicate a low relative abundance for the species in Utah, but few detections have been recorded on routes in Utah. Perhaps existing BBS routes are below the preferred elevational range or by chance occur in habitats not typically used by the species.

Short of graduate-level research addressing the Virginia's Warbler in Utah, point count transects should be established in suitable habitats at multiple locations. Each point count transect should contain 10 points and follow established protocol for point count surveys in Utah developed by the Utah Division of Wildlife Resources. Each of these 10 points should be placed 250 meters apart within each transect. Management agencies with potential habitat occurring within their lands should jointly cooperate in establishing a minimum number of point count transects statewide necessary to establish baseline population data. The US Forest Service and Bureau of Land Management likely contain the majority of Virginia's Warbler breeding habitat, and tracts of Gambel oak within their lands should be considered as a primary locations for establishing point count transects.

Habitat Objectives—The presence of Gambel oak in both primary and secondary breeding habitat typically results in high numbers of Virginia's Warbler being present. In addition, results of multi-year point count surveys conducted statewide in riparian habitat indicate that Virginia's Warbler occurs mainly in the eastern two-thirds of Utah (Howe et al. 1999). Even so, a comprehensive, statewide, broad-scale assessment of Virginia's Warbler habitat in the Basin and Range, Utah Mountains, and Colorado Plateau physiographic regions should be conducted. Based on the results of the statewide assessment, establish a long-term monitoring program. Gambel oak is not typically associated with riparian zones within the state, although in some areas Gambel oak habitat may border a very narrow riparian zone where Virginia's Warblers frequently forage for insects or gather nesting material. Habitat objectives listed below are recommendations that should improve the knowledge of Virginia's Warbler in Utah and thereby increase the potential for effective management.

Statewide Habitat Assessment—Broad-scale assessment of Virginia's Warbler habitat, particularly Gambel oak, in the Basin and Range, Utah Mountains, and Colorado Plateau physiographic regions of the state using GAP analysis and the UDWR Critical Habitat Evaluation database should be undertaken. Results of the broad-scale assessment may be used to develop a Mountain Shrub habitat map for Utah which highlights Gambel oak.

Statewide Population Estimate—Critically evaluate existing BBS routes and their effectiveness at monitoring for Virginia's Warbler. Establish new BBS routes or point count survey transects in appropriate habitat to augment existing BBS data and results of the statewide riparian assessments. Establish a statewide database for Virginia's Warbler using BBS and point count data, federal and state agency files, historical and more recent literature, and other sources as appropriate. Use the Statewide Population Estimate to identify those areas with appropriate habitat that show a high, moderate, or low population size.

Identify Management Focus Areas—Using the results of the Statewide Habitat and Population Assessments, identify those areas of suitable habitat that may be in need of management or conservation action. Such potential areas are those that were once Mountain Shrub habitat but now consist of a poor or absent shrub component within a relatively broad-scale landscape that is otherwise potential habitat for Virginia's Warbler. Other potential areas are those that contain large reseeded tracts, areas that contain large tracts of exotic grasses, recent large-scale fire impact areas, and areas of heavy livestock grazing within the elevational zone where Virginia's Warbler would otherwise be expected to occur. Identify those areas that were once Mountain Shrub habitat but are now irretrievably lost for use by Virginia's Warbler and its associated species.

Evaluate Potential Threats—Overlay results of the statewide assessments with proposed development scenarios to determine those areas of potential or existing Virginia's Warbler habitat that are likely to experience alteration or loss. If possible, establish population trend estimates based in part on loss or alteration of existing or potential habitat that is known to occur and establish time lines associated with population trend estimates.

OUTREACH NEEDS

Inform agency personnel and the general public as to the results of the statewide assessments and results of the recommended habitat objectives. Inform timber and fire-wood harvesters as to the habitat requirements of Virginia's Warbler and associated species and solicit their assistance in reducing impacts resulting from their activities.

GRAY VIREO
(*Vireo vicinior*)

Conservation Priority Score of 36

Greg Lasley (www.greglasley.net)

ASSOCIATED SPECIES: Frequently found with any pinyon (*Pinus* spp.) and/or juniper woodland-obligate or semi-obligate species (Balda 1980); routinely observed in similar habitats with Ash-throated Flycatcher, Gray Flycatcher, Juniper Titmouse, Bewick's Wren, Blue-gray Gnatcatcher, Black-throated Gray Warbler, and Scott's Oriole.

DISTRIBUTION: Breeds locally from southern and east-central California (Garrett and Dunn 1981, Unitt 1984); southern Nevada (Alcorn 1988); southern Utah (Table 11); northwestern and central New Mexico (Hubbard 1978); southwestern Colorado (Andrews and Righter 1992, Kingery 1998); southwestern Wyoming (Fitton and Scott 1984, Dorn and Dorn 1990); Arizona except southwest (Phillips et al. 1964); southwestern and central Texas (Oberholser 1974, Peterson and Zimmer 1998); north-central Baja California (Wilbur 1987); and northwestern Coahuila (Wilbur 1987, Howell and Webb 1995). Single breeding records documented for southeaster Colorado, Las Animas County (Andrews and Righter 1992); Cimarron County, Oklahoma (Johnsgard 1979), and Quay County, New Mexico (Johnsgard 1979).

In Nevada, Gray Vireo occur from 28 April-3 September (Alcorn 1988). In Colorado, occurs from late April-early August (Andrews and Righter 1992). The species may occur at any elevation with suitable habitats; in Colorado 1400-1950 m [4500-6500 ft] (Kingery 1998), Nevada 1620-1980 m [5400-6600 ft] (Johnson 1972), and Arizona 975-2075 m (3200-6800 ft)(Latta et al. 1999). In Arizona, habitat partitioning separates this species from sympatric Bell's Vireo (*Vireo bellii arizonae*)(Brown 1993).

Winter Range includes southwestern Arizona, southwestern Texas, southern Baja California (occasionally offshore islands), western and central Sonora, in thorn scrub and arid open habitats with scattered trees or thickets, from sea level-1500 m (4950 ft) elevation (September-April): (Wilbur 1987, DeGraaf and Rappole 1995, Howell and Webb 1995). Terborgh (1989) describes western Mexican (arid scrub) wintering habitat for the Gray Vireo as geographically restricted inferring potential conservation issues (see Management Issues with Conservation Recommendations).

Breeder on arid slopes dominated by mature Pinyon-Juniper or juniper woodlands of southwestern Utah, north to Sevier County (Woodbury et al. 1949, Woodbury and Cottam 1962). Aspect of slope does not appear to influence nesting. Recently documented in Utah as breeding in central Tooele County.

Apparently suitable habitats often lack this species. Alternatively, this vireo may be more widespread in the Colorado Plateau than records indicate, however, distribution may be localized and disjunct from other populations (Ligon 1961, Andrews and Righter 1992). Currently known breeding areas in Utah are shown in Table 11. Observed from 20 Apr-22 August (Woodbury et al. 1949). Single record from Zion National Park in September (Wauer 1997).

ECOLOGY: Transient birds observed in western Sonora along coast and southwestern Coahuila (Howell and Webb 1995). Considered a short-distance migrant; as defined by the breeding populations not entirely departing the US for the winter (DeGraaf and Rappole 1995). During migration occasionally found in riparian corridors (Hubbard 1978, Brown et al. 1987, Alcorn 1988). Occurs at lower elevations during migration (Brown et al. 1987).

The Gray Vireo is more tolerant of heat and aridity than other vireos (Weathers 1983). It nests in dry, open, typically steep-sloped, pinyon and/or juniper woodlands with 1.8-2.4 m (6.0-8.0 ft) high under story (Kingery 1998). Nesting may occur between 1341-1951 m (4400-6400 ft) elevation. Pinyon-Juniper or juniper woodlands may have open under stories of grasses, sagebrush (*Artemisia tridentata*), mat saltbush (*Atriplex* spp.), or other desert scrub-shrub species. In the extreme southwestern U.S., oak (*Quercus* spp.) woodlands replace Pinyon-Juniper habitats (Tanner and Hardy 1958, Hubbard 1978). In Tooele County, Utah, occurs in monotypic stands of juniper that have not been invaded by exotic annual weeds. In northeastern Arizona, dense woodlands (> 280 trees/ha) are avoided (LaRue 1994).

In Texas, known to breed in: (1) Red Rolling Plains brushy canyons and hillsides, (2) Staked and Pecos Plains (Illano Estacado) semi-arid hilly oak scrub and canyon oak scrub, (3) Edward's Plateau ashe juniper (*Juniperus ashei*), oak, and (4) Chihauhuan desert and Mexican mountain (i.e., Trans-Pecos region) Pinyon-Juniper woodlands (Peterson and Zimmer 1998, Texas Partners in Flight 1998).

Typical of other vireos, cup-shaped nest is constructed in a fork, however; rather than horizontal, the fork is nearly upright. Nests are built in about 3-4 days by weaving dry grasses, hair, and plant stems and fibers (Baicich and Harrison 1997). The Gray Vireo adds sagebrush (*Artemisia* spp.) leaves to the exterior and edge of the nest (Kingery 1998). In the Colorado National Monument, nests are placed 0.6-2.5 m (2.0-8.0 ft) from the ground in a juniper with a snag protruding from the top (Kingery 1998) that may serve as a singing perch. Less frequently, nest may be placed in thorny or twiggy shrubs (Kingery 1998); including bitterbrush (*Purshia tridentata*), big sagebrush (*A. tridentata*), mountain-mahogany (*Cercocarpus betuloides*), and chamise (*Adenostoma fasciculatum*)(Taber 1950). Additionally, in southern Nevada, Johnson (1972) identified mountain mahogany (*C. ledifoius*), Gambel oak (*Q. gambelii*), Mexican manzanita (*Arctostaphylos pungens*), squaw apple (*Peraphyllum ramosissimum*), and cliffrose (*Cowania stanburyana*) as frequent substrates in addition to juniper, pinyon, and sagebrush.

From 3-5 eggs are laid and both adults incubate for about 13-14 days (Taber 1950). Young fledge from nest in about 13-14 days. Both sexes participate in care and feeding of young through post-fledging (Taber 1950). Usually single brooded but second broods are not uncommon (Taber 1950). No data available on nesting success (Table 12).

Based on the life histories of other vireos; assumed that both sexes attempt to breed at 1 year and normally breed each year thereafter. Breeding birds described as a lower-canopy gleaning insectivore (DeGraaf et al. 1985). Gleaning, from just above the ground to about 3.0 m (10 ft), is the most common foraging behavior, although towhee-like surface scratching has been documented. During the breeding season the Gray Vireo is primarily insectivorous but specific prey species are poorly described. Prey identified by Chapin (1925) in 2 vireos included: unidentified caterpillars, unidentified moth, tree cricket (*Oecanthus* spp.), stinkbug (*Prionosoma podopiodes*), treehopper (*Platycentrus acuticornis*), long-horned grasshopper (Family Tettigoniidae), dobson flies (*Chauliodes* spp.), and cicada (*Tibicinoides microphylla*). During winter, Gray Vireos may be partially frugivorous, including elephant tree (*Bursera microphylla*)(Bates 1992b).

The Gray Vireo is reported to be a frequent host for Brown-headed Cowbirds, however; this remains poorly documented in the literature and quantitative data is wholly lacking. In Utah, fragmentation of Pinyon-Juniper habitats and their proximity to livestock, preferred feeding habitat for cowbirds (Lowther 1993), may facilitate high rates of brood parasitism in Gray Vireos. For example, a Gray Vireo nest was located at US Army Dugway Proving Ground, Tooele County, on 29 July 1999. When discovered the nest contained 2 cowbird young tended by 2 adult Gray Vireos. When the nest was revisited on 1 August, the 2 cowbird young had fledged but were within 3 m (10 ft) of the nest. Inspection of the nest showed an unhatched cowbird egg and 2 dead, downy vireo chicks. No other vireo nests were located in a pristine monotypic stand of juniper unaffected by exotic annual weeds prevalent nearby (<0.4 km [0.25 mi]). Point count stations through site and adjacent sites indicated the presence of singing Gray Vireos and Brown-headed Cowbirds throughout May-August. The nearest livestock corral and cultivated lawns were > 6.4 km (4 mi) and > 8.0 km (5 mi), respectively, from the nest site.

Actual or potential predators are poorly documented, but more than likely are similar to other vireos, especially when individual nests are placed close to the ground. According to Kingery (1998), jays and squirrels destroyed 50% of vireo nests found in Colorado National Monument in 1995, and may be a greater concern to productivity than cowbirds. Weather, as a factor influencing productivity and survival of young or adults is unknown. Few data on survivorship. Return rates of marked adults to wintering territories in Mexico is 46-71% (Bates 1992a).

HABITAT REQUIREMENTS: Based on limited studies or anecdotal observations, the Gray Vireo is considered obligate of semiarid mature, relatively weed-free, Pinyon-Juniper, juniper, or oak woodlands that are relatively “open” with a shrubby under story (Balda 1980). Woodlands with moderate to steep slopes appear to be a critical factor, although quantified data including slope aspect are unknown Elevation does not appear to be a critical factor as long as the preferred habitat type is present. Proximity to water is not essential.

HABITAT AND/OR POPULATION OBJECTIVES: Based on Sauer et al. (1997), the highest relative densities of Gray Vireos are within the Colorado Plateau, specifically southern Utah, northern Arizona, and southwestern Colorado, with Utah containing the bulk of the distribution.

No habitat or population parameters have ever been established for the Gray Vireo as a management objective. Inadequate sample sizes within this species distribution are available to determine breeding population trends (Robbins et al. 1986, Price and Droege 1995). Some long-term declines have been noted in California and Arizona (DeSante and George 1994, Small 1997). Due to the lack of basic information, and increasingly northward breeding records (Johnson 1972, Martin et al., this account; T. Floyd, Great Basin Bird Observatory, pers. comm.), it may even be speculated that the Gray Vireo may be expanding its range outward from the Colorado Plateau similar to the Gray Flycatcher (Johnson 1994).

Therefore, high priority should be placed on Master’s- or Doctoral-level research investigating the statewide distribution, ecology, and life history requirements before attempting to establish management or sustainable population objectives.

In chamise-dominated chaparral near Deep Canyon, California, Gray Vireo density has been estimated at 2.4 individuals/40 ha (Grinnell and Swarth 1913) and later in the same location at 1.6 individuals/40 ha (Weathers 1983). Several anecdotal observations describe the Gray Vireo as occurring in “low densities.”

Based on density estimates of Grinnell and Swarth (1913) and Weathers (1983), territory size is estimated at 4-16 ha (10-40 ac), but this is speculative at best. Bates (1992a) describes wintering territories of marked individuals in Sonora as averaging 0.9 ha (2.2 ac), ranging from 0.3-1.4 ha (0.7-3.5 ac).

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES:

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Although described as a frequent host for Brown-headed Cowbirds, negative impacts on productivity and adult recruitment are not identified. The extremely specialized wintering diet described by Bates (1992) for this species may be of some management concern. Also, lacking specific life history information, it is impossible to determine to any extent human and land-use related impacts to this species. The Gray Vireo’s tendency to occupy

Pinyon-Juniper slopes in the Colorado Plateau and Basin and Range regions may afford some immunity to habitat-related issues.

A single study indicates that vireo numbers increased in Big Bend National Park following the termination of livestock grazing and subsequent recovery of shrubs, particularly Gregg ash (*Fraxinus greggii*)(Wauer 1977).

Regardless of a weak understanding of Gray Vireo habitat requirements, there is still substantial documentation regarding habitat degradation on western rangelands, including Pinyon-Juniper habitats, and its impact on migratory birds (Braun et al. 1976, Hejl et al. 1995, Saab et al. 1995).

Pinyon-Juniper habitats have traditionally been viewed as little more than wastelands, and any value attributed for wildlife has traditionally focused on game birds and big game (Balda 1980). Since the advent of European settlers, whether through direct or indirect actions, these habitats have been heavily impacted through a variety of land-use practices, including overgrazing, recreational vehicle use, fuel wood harvest, alteration for development of livestock or big game forage-browse, cultivation, urbanization, soil erosion, and the introduction of exotic annual weeds Of these, the most significant impact on these woodlands has been exotic annual weeds that have increased the frequency and intensity of wildfires in these habitats. Sagebrush and juniper are intolerant of fire (Cottam 1961). In an ecosystem that did not evolve with fire, the introduction of exotic weeds and associated increase in wildfires has changed the vegetation structure and fragmented the historically large expanses of Pinyon-Juniper and juniper woodlands, and shrub steppe communities. Increased habitat fragmentation facilitates brood parasitism by cowbirds.

With this understanding of habitat required to support sustainable populations of Gray Vireo and other Neotropical birds, federal and state land-managing agencies administering Pinyon-Juniper and Shrubsteppe habitats should develop guidelines to incorporate habitat considerations of Neotropical species, especially those that do not breed elsewhere.

Increasing fragmentation due to wildfire may be beyond the best-intentioned management at this time without considerable cost and human resources. Habitat manipulations such as tree thinning or chaining of mature Pinyon-Juniper may be a contributing factor to low occupancy and poor reproductive success of Gray Vireos. Chaining of Pinyon-Juniper habitats significantly reduces community vertical structure causing the immediate abandonment by species that forage or nest in trees (Sedgwick and Ryder 1987). Such actions should be considered an extreme measure and used sparingly.

Management Protection and Administrative Actions*:* No special federal or Utah statutes apply to the Gray Vireo beyond those afforded all other migratory birds. The Gray Vireo is considered a Species of Special Concern in Colorado and Arizona. State and federal land-administering agencies rarely consider the needs of Neotropical migratory birds in land-use planning of Pinyon-Juniper habitats. This could be a matter of oversight due to the lack of understanding of habitat relationships of birds such as the Gray Vireo. Until recently, Pinyon-Juniper and shrub steppe avifauna were poorly studied and understood in North American ornithology, and may be the last habitats to undergo intense research. Many management decisions for the Gray Vireo will depend upon better knowledge - driven by species-specific studies. However, some (stepwise) management recommendations are suggested:

1. Inventory existing Pinyon-Juniper, juniper, and mixed brush (i.e., Pinyon-Juniper or juniper and big sagebrush or other shrubby species) habitats, and classify by: (a) age-stand, (b) fire history (or lack of it), and (c) extent of infestation by exotic annual weeds.
2. Based on the above and combined with distributions of obligate or semi-obligate species, determine manageable habitat units at landscape level (based on percent or size) with focus on Neotropical bird conservation. Initiate coordination and consultation with appropriate land managing agencies.
3. Within the units identified above, identify land management practices conducive with conservation and preservation of birds. Land-use practices may include: (a) above.

4. Develop cooperative management agreements or memoranda of understandings with appropriate agencies.

Implementation Opportunities

Species-specific research and development of monitoring strategies in Pinyon-Juniper habitats, including a complete inventory of suitable habitats statewide should be the highest priority prior to implementation of specific species/habitat management actions. However, as noted above, some management actions could be implemented for bird conservation in Pinyon-Juniper habitats prior to a full understanding of habitat requirements of the Gray Vireo.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

Basic knowledge of the Gray Vireo is poor or poorly documented. This could be due to a combination of factors; including populations occurring in low densities (locally abundant but a minor component in local avifauna), or the species is secretive in behavior (difficult to monitor or observe under conventional field-protocols). Statewide inventories, some as recent as the mid-1960s (Table 11), have not documented the Gray Vireo within potential Utah habitats. Further, there are large distances between occurrences. Indeed, some of these studies have listed the Gray Vireo as a hypothetical species. This begs the question of why seemingly suitable habitats do not host Gray Vireos. There is documentation that the species may range as far north as southeastern Wyoming. Therefore, ongoing inventories or research projects should not overlook the possibility of breeding or migrating Gray Vireos throughout the state. It cannot be over-emphasized that the highest priority for Gray Vireo conservation should be research in the following areas:

1. Basic distribution and density within known centers of population (Colorado Plateau) and other juniper-pinyon habitats throughout Utah (i.e., Basin and Range).
2. Life history chronology (arrival-departure dates), nesting phenology, etc.
3. Population dynamics (clutch size, fledging success, impact of brood parasitism, survivorship and recruitment, population trends and stability, etc.).

OUTREACH NEEDS

Development of Pinyon-Juniper habitat management standards such as those developed for Grasslands by the Committee on Rangeland Classification (1994) or shrub steppe by Braun et al. (1976) may be useful in implementing a uniform approach to this habitat for bird conservation. A major thrust will need to focus on public awareness and education to overturn traditional attitudes towards Pinyon-Juniper habitats. Pinyon-Juniper is the second most abundant habitat in Utah with over 10.5 million acres statewide. While Pinyon-Juniper habitat is not limited in Utah, the state should be considered as a major component of Pinyon-Juniper distribution worldwide. Specific audiences would include agency managers, including UDWR personnel, wood harvesters, and conservation-oriented non-government organizations (NGOs).

Table 11. Documented areas for breeding Gray Vireo in Utah and adjacent states, within preferred Pinyon-Juniper habitats.

GEOGRAPHIC AREAS	REFERENCE
UTAH	
High plateaus; Kane and Garfield Counties	Behle et al. 1958, Hayward 1967, Atwood et al. 1980, Walters and Sorenson 1983
Canyonlands National Park and Arches National Park; Grand and San Juan Counties	Woodbury and Russell 1945, Behle 1960, Hayward et al. 1976, Dalton et al. 1978, Walters and Sorenson 1983
Henry Mountains, Burr Desert, Capitol Reef National Park, La Sal Mountains, Escalante River; Garfield and Wayne Counties	Hayward et al. 1976, Dalton et al. 1978, Walters and Sorenson 1983
San Rafael Swell, San Rafael Desert; Emery County	Dalton et al. 1978, Walters and Sorenson 1983
Zion National Park, Washington County	Behle 1943, Wauer and Carter 1965, Walters and Sorenson 1983, Wauer 1997
Sevier County (location not specified)	Woodbury et al. 1949
Duchesne and Sanpete Counties (Pinyon-Juniper)	US Geological Survey 1999 (Unpubl. BBS data) F. Howe, UDWR (pers. comm.)
Cedar Mountains, Tooele County	US Army Dugway Proving Ground
NEVADA	
Sheep and Spring Mountains; Clark and Lincoln Counties	Johnson 1965, Johnson 1972
Nevada Test Site (Shoshone Mountain and Paiute Mesa); Grapevine Mountains; Nye County	Miller 1946, Hayward et al. 1963, Johnson 1972
Round Mountain, Toiyabe Range (Nye County)	Alcorn 1988
Snake Range and Goshute Mountains; White Pine and Elko Counties – suspected breeding	Great Basin Bird Observatory (Ted Floyd pers. comm.)

Table 12. Gray Vireo breeding phenology based on pairs in Colorado National Monument (Kingery 1998).

ACTIVITY	DATE	SAMPLE SIZE
Courtship	23-24 June	2
Nest Building	22 May - 9 June	3
Occupied Nest	23 May - 17 June	2
Nest with Eggs	11 June	1
Nest with Young	29 June	1
Feeding Young	7 June - 11 July	1
Fledged Young	20 June - 27 July	5

BELL'S VIREO
(*Vireo bellii*)

Conservation Priority Score of 35

Mike Danzenbcaker www.avesphoto.com

ASSOCIATED SPECIES: In Utah considered an obligate of riparian habitat with lush under story vegetation. Associated with other riparian-obligate species: Yellow-billed Cuckoo, Willow Flycatcher, including the Endangered Southwestern subspecies, Wilson's Warbler, Yellow Warbler, Lucy's Warbler, Orange-crowned Warbler, Yellow-breasted Chat, and Veery (BLM undated). Also associated with species dependent upon, but not obligates of, riparian habitats: Swainson's Hawk, Northern Goshawk, Lewis's Woodpecker, Blue-gray Gnatcatcher, Bewick's Wren, Song Sparrow, and Fox Sparrow (BLM undated, Brown 1993).

DISTRIBUTION: There are 4 subspecies of Bell's Vireo, each isolated from each other throughout the year (Hamilton 1962). The subspecies are: (1) Least Bell's Vireo *V. b. pusillus* occurring in southwestern California (principally San Diego, Orange, Riverside, and Santa Barbara Counties) and northwestern Baja California; (2) *V. b. bellii*, midwestern US from eastern Colorado to western Tennessee, north to southern Michigan, southeastern Minnesota, southwestern Wisconsin, and south-central North Dakota; (3) *V. b. medius*, south-western Texas south to Durango and Coahuila, Mexico; and (4) *V. b. arizonae*, southwestern US along Colorado River and its tributaries (northwestern and central Arizona, southeastern California, southeastern Nevada, southwestern Utah and Sonora, Mexico (A.O.U.1997, Brown 1993).

The *V. b. pusillus* subspecies winters in southern Baja California. The remaining subspecies winter in thorn scrub and riparian corridors along the west coast of Mexico, and tropical deciduous forest and arid tropical scrub of southern Mexico, Guatemala, El Salvador, Honduras, and Nicaragua (Wilbur 1980; Hands et al. 1989; Brown 1993; Howell and Webb 1995).

In Utah, *V. b. arizonae* breeds in the southwestern corner of the state (Washington and western Kane Counties), specifically the Virgin River drainage and Beaver Dam Wash, and Zion National Park (Hayward et al. 1976, Behle et al. 1985, Wauer 1997). This is the currently known northern-most distribution for *V. b. arizonae*. Migratory populations occur from 16 April-26 August, but more typically from mid-May to mid-July (Wauer 1997). Nests within Zion National Park are described as "scarce" (Wauer 1997).

ECOLOGY: Along the lower Colorado River Valley, *V. b. arizonae* occurs from early March through late-September (Rosenberg et al. 1991). In Nevada, it occurs from 20 April-20 September (Alcorn 1988). In Nebraska along the Platte River, peak migrations occur 6-20 May and 25 August-17 September (Faanes and Lingle 1995).

Nesting habitat for *V. b. pusillus* in southern California and *V. b. arizonae* in Arizona, Nevada, and

Utah are nearly always associated with cottonwood-willow (*Populus* spp.-*Salix* spp.) dominated riparian habitats (Alcorn 1988, Rosenberg et al. 1991, Brown 1993, Wauer 1997). Bell's Vireo in the midwestern States appear to accept a wider variety of habitats, including upland and lowland dense second-growth or mid-successional shrubs and trees, including scrub oak (*Quercus* spp.), rose (*Rosa* spp.), coastal chaparral, and mesquite (*Prosopis* spp.) brush lands (Bent 1950, Hands et al. 1989, Brown 1993). However, the habitat structure utilized by all subspecies is consistent; trees 5-10 years old with a mean canopy height of 7.8 m [26 ft] (Franzreb 1989, Hands et al. 1989, Brown 1993). A critical structural habitat component at nesting sites appears to be a dense shrub layer, variable from ground up to 4 m [13 ft] (Franzreb 1989, Hands et al. 1989, Brown 1993). Occurs in elevations > 1300 m (4290 ft) in the US and > 1900 m (6270 ft) in Mexico (Brown 1993).

Along the lower Colorado River Valley, Arizona, Bell's Vireo distribution has extended northward into the Grand Canyon closely following the expansion of exotic salt cedar (*Tamarix ramoissima*) (Rosenberg et al. 1991). Of 121 nests, 77 (64%) were in salt cedar and 29 (24%) in honey mesquite (*P. glandulosa*) (Brown 1993). In these salt cedar habitats, Bell's Vireo occurs in higher densities than higher elevation cottonwood-willow habitats. Other bird species rarely use salt cedar for nesting substrate (Rosenberg et al. 1991).

Near Las Vegas, Nevada, occurs in dry bosque dominated by mesquite < 4.5 m (15.0 ft) in height with dense canopy foliage (Austin 1970). In southern California and southern Arizona, breeds in oak woodlands (Block et al. 1992).

Within preferred riparian habitats noted above, the cup-shaped nest is typically suspended in lateral or terminal forks of sapling-sized trees (2.4-3.0 m [8-10 ft] high), 0.3-1.5 m (1-5 ft) above the ground (Nolan 1960, Barlow 1962, Brown 1993). In California, nests are frequently < 1 m (3 ft) off the ground (Franzreb 1989). Alternatively, nests may be placed in shrubs (Johnsgard 1979). Nests are always overhung with foliage from taller trees/shrubs. Nests are intricately woven with a variety of dried grasses, shredded bark supplemented with spider web or cocoon silk (Johnsgard 1979, Baicich and Harrison 1997). Nests are built in about 4-5 days (Nolan 1960, Barlow 1962).

From 3-5 eggs (mean = 3.4) are laid, each oval, white with brown specks (Barlow 1962, Baicich and Harrison 1997). Both adults incubate for about 14 days. Young fledge from nest in about 11 days. Both sexes participate in care and feeding of young through post-fledging (Bent 1950, Brown 1993). Usually single brooded but second broods are documented, especially in California and along the lower Colorado River Valley (Barlow 1962, Rosenberg et al. 1991, Brown 1993). *V.b. pusillus* may occasionally produce 4 broods in a single season (Franzreb 1989).

Productivity for *V. b. pusillus* is fairly well documented; however, other subspecies need study. In California where Brown-headed Cowbird parasitism was not controlled, productivity ranged from 0.17-2.85 fledglings/breeding pair (Franzreb 1987 – no sample size or other parameters provided). Productivity rates in Illinois were similar (Graber et al. 1985). Productivity of Bell's Vireo increased to 1.90-3.38 fledglings/breeding pair when all cowbird eggs and/or young were removed (Gray and Greaves 1984, Collins et al. 1989, 1991). Least Bell's vireos breed at one year of age and every year thereafter. Vireos begin breeding activities 1-2 days after arrival in spring with most breeding completed by the end of July (Brown 1993).

Considered a lower-canopy gleaner (DeGraaf et al. 1985). Bell's Vireo diet is primarily insectivorous (99.3%), with little plant matter (0.7%)(Chapin 1925). Adults forage for prey in dense vegetation by gleaning (93%) from leaves, stems and bark, hovering and picking prey off stationary objects (30%), hawking and aerial pursuit (2%; note values exceed 100% because more than one method may be used in foraging bouts; (Salata 1983). The most common foraging method is gleaning < 3.5 m (< 12 ft) above the ground (Salata 1986). Foraging methods have not been described on their wintering grounds.

Brown-headed cowbird parasitism is a serious problem for Bell's Vireo throughout its range; enough so that local populations in California have been extirpated (Laymon 1987). For California and southwestern U.S., a contributing factor for increased parasitism rates appears to be habitat fragmentation and/or degradation, i.e., impacts due to river channelization, vegetation clearing, water impoundments (Franzreb 1989). Cowbird parasitism may be symptomatic of larger land-use issues, e.g. habitat loss and degradation (Franzreb 1989). In Kansas, brood parasitism accounted for 65% of 79 eggs (Barlow 1962). Other studies discussed by Hands et al. (1989) and Franzreb (1989) indicated parasitism rates of 30-71%, with rates over 50% typical.

Cowbirds parasitize nests during the vireo's egg-laying period, normally depositing 1 or 2 (rarely 3) eggs (Brown 1993) at 1 egg/da intervals (Brown 1993). If cowbird eggs are deposited prior to vireo egg-laying, nests are usually abandoned (Brown 1993). Also, if vireo eggs are removed by cowbirds, the nest may be abandoned (Hands et al. 1989). If nests are abandoned, renesting efforts typically occur within close proximity to old nests (Hands et al. 1989). This behavior may facilitate continued parasitism.

In California and southwestern U.S., vireos readily accept cowbird eggs, but are relatively poor hosts as few cowbirds are fledged (Friedmann 1963). The same is true for vireo young – few host young are fledged in parasitized nests (Laymon 1987). Cowbird fledging success from Bell's Vireo nests is estimated at < 21% based on very small sample sizes (Gray and Greaves 1984). Current data on cowbird fledging success from host nests is unknown as investigators routinely remove cowbird eggs or young from nests (Brown 1993).

Both sexes react vigorously to cowbirds, Brown Thrashers, Blue Jays, Scrub Jays, Greater Roadrunners and mammalian predators near nests (Brown 1993). In Kansas, 11% of 79 eggs lost were due to predation (Barlow 1962). In California, 7 of 14 nests (50%) showed evidence of predation (Franzreb 1989; Hands et al. 1989). A series of California studies discussed by Franzreb (1989) indicated predation rates ranging from 18-45%. Rat snake (*Elaphe obsoleta*), common garter snake (*Thamnophis sirtalis*), and black racer (*Coluber constrictor*), house mouse (*Mus musculus*), white-footed mouse (*Peromyscus* spp.), dusky-footed woodrat (*Neotoma fuscipes*), black rat (*Rattus rattus*), feral cat (*Felis domesticus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), coyote (*Canis latrans*), long-tailed weasel (*Mustela frenata*) have been identified at nest predators (Nolan 1960, Barlow 1962, Cink 1977, Franzreb 1989, Hands et al. 1989, Brown 1993). In Kansas, weather accounted for 13% of egg losses (Barlow 1962).

Limiting factors for this species are poorly understood. The scarcity of suitable habitat for studies and adequate sample sizes are undoubtedly a contributing factor. The longevity of *V. b. pusillus* is not known. Adult and juvenile mortality rates have been estimated to be 53% and 76%, respectively (Salata 1983). The oldest documented individual Bell's Vireo is 6 yr 11 mo based on band recovery, but actual maximum lifespan may be longer (Klimkiewicz et al. 1983). Most Bell's Vireos probably do not live longer than 3-4 yr; only 8% and15% of banded populations in California were > 4 years old (Greaves and Gray 1991).

HABITAT REQUIREMENTS: Regardless of subspecies or location, Bell's Vireo is associated with dense shrubby vegetation, typically early successional stages, specifically second-growth forests or woodlands, scrub oak, coastal chaparral, or mesquite brush lands. In California and the southwestern U.S., Bell's Vireo may be considered a riparian-obligate species, preferring dense under story vegetation (0-4.0 m [0-13 ft]), especially in seepwillow (*Baccharis* spp.) and mesquite, and more recently introduced salt cedar along the lower Colorado River (Franzreb 1989, Hands et al. 1989, Brown 1993). Eastern and arid-land subspecies may use uplands distant from riparian corridors, but often nests near water (Brown 1993). Habitat requirements for Bell's Vireo during migration and wintering areas are unknown.

HABITAT AND/OR POPULATION OBJECTIVES:

No population objectives have been identified. Habitat objectives can be considered with other lowland or desert riparian species such as Abert's Towhee.

Faanes and Lingle (1995) found the largest breeding density of Bell's Vireo in the Platte River islands (27.0 pairs/km^2), followed by lowland forest (2.2 pairs/km^2), and upland prairie (0.1 pairs/km^2). Rising (1974) found that breeding densities of Bell's Vireo were greatest along the Cimarron River in southwestern Kansas in deciduous thickets of *Prunus* spp., willow (*Salix* spp), and salt cedar (*Tamarix* spp.).

Sharp declines (ca. 40%) have been observed based on Breeding Bird Surveys (BBS) from 1966-1979 for most central States (Robbins et al. 1986). However, numbers in California have stabilized and increased slightly due to intense management efforts including cowbird trapping (Brown 1993). Vireos may be increasing where they are adapting to exotic salt cedar in Grand Canyon immediately below Glen Canyon Dam (Brown 1993). Recent management actions may have changed this positive scenario with recent flushing-flow releases from Glen Canyon, designed specifically to enhance habitat for endangered native Colorado River fishes and remove vegetation from sandbars (Brown and Johnson 1985, Bell's Vireo populations along the lower Colorado River have declined steadily since 1950 and are nearly extirpated (Rosenberg et al. 1991). It should be noted that disjunct vireo populations are susceptible to extirpation (Rosenberg et al. 1991; Brown 1993).

Based on high adult and first-year mortality (53% and 76% respectively: Salata 1983), a mean productivity rate of 2.25 fledged young/pair is necessary to sustain stable populations in California (Franzreb 1989, Hands et al. 1989). Reported territory sizes ranges differ regionally: Kansas, mean 0.5 ± 0.4 ha (1.2 ac), ranging from 0.1-1.3 ha (0.3-3.2 ac), n = 9 (Barlow 1962); California (Santa Barbara County), 0.4-1.6 ha (1.0-4.0 ac) (Gary and Greaves 1984); California (Riverside County), mean 0.58 ± 0.26 (1.45 ac), ranging from 0.1-1.3 ha (0.4-3.3 ac) (Franzreb 1989); and California (Orange County), mean 0.7 ± 0.3 ha (1.7 ac), ranging from 0.3-1.3 ha (0.7-3.3 ac), n = 13 (Collins et al. 1989). Smaller territories may be used at sites with taller trees and denser vireo populations (Barlow 1962). In Indiana, territory size decreased from 0.6-0.9 ha (2.0-3.0 ac) prior to young fledging to about 0.3 ha (1.0 ac) after fledging (Nolan 1960). Wintering territorial behavior and territory size is unknown.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: In the southwestern U.S., Bell's Vireo are highly susceptible to alterations to riparian habitats; i.e., agriculture, urbanization, firewood cutting, livestock grazing, reservoir construction, and stream-flow control (Brown 1993). In California, significant vireo increases have resulted from riparian revegetation efforts, reduction of livestock grazing rates in riparian habitats, and cowbird management, specifically trapping, selective shooting, relocation of feedlots, dairies, and stables (Beezley and Rieger 1987; Brown 1993). Habitat fragmentation and degradation should be considered the ultimate issue in Bell's Vireo conservation, with cowbird parasitism a contributing factor associated with habitat quality. Implementation of recommendations for Abert's Towhee should address these same habitat issues for Bell's Vireo.

Management Protection (Administrative) Actions—Least Bell's Vireo (*V. b. pusillus*) was listed as Endangered under the Endangered Species Act in 1986 due to declines in 95% of its California distribution – no other California passerine has declined so dramatically (Goldwasser et al. 1980, Lowe et al. 1990). Preceding federal listing, California listed the vireo as Endangered. The Utah Division of Wildlife Resources (UDWR) listed Bell's Vireo (*V. b. arizonae*) as a Species of Special Concern due to declining populations or limited distribution (UDWR. 1998).

A sound monitoring program is essential for determining vireo population status, both baseline (existing) and future changes. UDWR, under the Partners in Flight program, has been monitoring riparian birds for at least the past 7 yr via constant-effort mist netting and associated point counts.

In California, several regional, county-wide, and habitat-oriented management plans have been implemented (prepared by California Fish and Game Department, USFWS, and/or local governments) to benefit the Least Bell's Vireo (Regional Environmental Consultants 1988). Success of these plans appears to be positive based on increases in breeding vireos within the management areas (Brown 1993).

Implementation Opportunities

Direct planting of willow or other species for riparian habitat restoration may be accomplished through volunteer or UDWR efforts. Management of land use issues (livestock grazing reductions and stream flow control) may be problematic and require considerable cooperation and coordination between private individuals, industry, water conservation districts, Bureau of Reclamation, and UDWR. Successes in California for the Least Bell's Vireo may provide a basis for management of Utah's Bell's Vireo.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

Due to the focus on the endangered *V. b. pusillus*, this subspecies is fairly well-researched and there is considerable information available. Other subspecies may be considered poorly understood. Master's- or Doctorate-level species-specific research may be warranted to determine micro-habitat differences and population demographics (productivity and recruitment) between *V. b. pusillus* and *V. b. arizonae* occupying southwestern Utah. Continued monitoring of vireo populations is essential to determining influences of habitat impacts or improvements and influence of cowbird parasitism on productivity and survivorship. Exotic salt cedar, conventionally viewed as an undesirable species, may need to be reconsidered at least for vireo habitat if only temporarily. Concurrent with studies focusing on Bell's Vireo, Brown-headed Cowbird ecology and life history in southwestern Utah. Also, community studies (vegetation- or guild-oriented) should be considered to determine influences of habitat improvements and their relationship with associated riparian bird species. Finally, wintering and migration studies should be emphasized to identify potential population "sinks" that might be influencing recruitment of young into breeding populations.

OUTREACH NEEDS

1. Educate agency and public of the importance of mesquite, desert habitats adjacent to riparian areas with cottonwood and willows.
2. Inform and work with land developers and encourage natural xeric landscape practices that maintain large blocks of habitat and retain riparian areas.

BLACK ROSY-FINCH
(*Leucosticte atrata*)

Conservation Priority Score of 35

Mike Danzenbcaker www.avesphoto.com

ASSOCIATED SPECIES: Other bird species (some of the species nest at edge of Rosy-Finch habitat and mainly enter that habitat to feed) that may respond similarly to habitat components used by the Black Rosy-Finch are: Horned Lark, American Robin, Water Pipit, and White-crowned Sparrow.

DISTRIBUTION: This species breeds in the mountains of the western Unites States from central Idaho, southwestern and south-central Montana and north-central Wyoming south to northeastern and east-central Nevada (south to the Snake Mountains) and central Utah (southern limits, which occur in Utah are: east at the La Sal Mountains, west-central Utah in the Tushar Mountains, and the Deep Creek Mountains of extreme western Utah) (A.O.U. 1983). The largest breeding populations in Utah are in the Wasatch and Uinta Mountains. In winter the species shifts slightly southward by moving mainly out of Montana and northern Wyoming but remain in central Idaho and southeastern Wyoming south to eastern California, southern Nevada, and northern parts of Utah and New Mexico (Austin 1968). The first specimen known to science came from somewhere in the Uinta Mountains in 1870 during the Hayden Expedition. It was thought to be a young of the Gray-crowned Finch and it was not until four years later when additional specimens were acquired from Colorado that the error in identification was recognized (Austin 1968).

ECOLOGY: The spring migration is not known in detail but by early April they have disappeared from the wintering grounds and some have arrived at breeding locations. Seen in April at 3,600 m (11,000 ft) in Wasatch Mountains (the most complete data on this species are supplied and written by N. R. French in Austin 1968). Deep snow still exists there but some scattered areas have spots blown free of snow. So they arrive on breeding grounds and prepare for breeding before breeding conditions are at a prime. The primary foods are taken from the ground and in summer insects are fed young but about 97% of adult food is seeds, usually of small tundra plants, e.g., Siversia, Arabis, Silene, Claytonia, and Lewisia that are stored and carried in a gular sac similar to the Pine Grosbeak (French 1954). Winter food is strictly seeds and other vegetable matter Nest building has been observed between early June and mid-July. Nests usually in a crevice or hole in almost inaccessible location on a vertical cliff but sometimes in rocks of talus slopes (Austin 1968). The nest is composed of grasses, moss and perhaps feathers mixed in with a finer lining of grass and hair. The species is social and only during the breeding season is territorial behavior demonstrated although flocking still occurs then. Since sex ratios are skewed towards males by about 6:1 these summer flocks may be largely composed of unpaired males. Preparation for fall migration starts as soon as young are independent of parents and flocks may consist of several hundred birds. But the flocks remain at high elevations until well after freezing weather sets in; some flocks still at high elevations in early November in the Uinta Mountains.

HABITAT REQUIREMENTS: Breeds beyond timberline in Alpine tundra using barren, rocky or grassy areas and cliffs among glaciers or at bases of snow fields. Often feeds on the open glaciers and snowfields picking up insects or other wind wafted animal matter. In winter pattern of movement not documented but may, in part, simply shift altitudinally downward where it uses open situations such as fields, cultivated lands, along road sides and even human habitations. Some of the movement seems to depend on the amount of snow cover. In mid-January, where snow cover is light or non existent on some slopes, rosy-finches may occur as high as 2,650 m (8,100 ft) (Uinta Basin, H. L. Black, pers. comm.). Feeds and roosts either in single species flocks or mixed flocks of Gray-crowned Rosy-Finch, both *L.t. tephrocotis* and *L.t. littoralis*. Night roosts, consisting of small flocks, are usually in some man-made structures such as abandoned buildings, culverts, and bridges or in natural caves and abandoned mine shafts with protection overhead (Austin 1963).

HABITAT AND/OR POPULATIONS OBJECTIVES: No population objectives have been identified for the species in Alpine habitat. Habitat objectives can be considered with other higher elevation forest management practices that would include Alpine areas. An initial objective might be to assess grazing practices in areas where Black Rosy-Finches are known to occur. Restoring or resting those areas whenever feasible should also be a priority.

IMPLEMENTATIONS RECOMMENDATIONS AND OPPORTUNITIES:

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: There are no readily identifiable management or conservation issues. Although the species may nest in limited densities and in isolated populations, e.g., La Sal Mountains, Raft River Mountains, the breeding habitat is secure. There are no obvious human caused threats to Alpine tundra. Rosy-Finches readily adapt to human modified habitats and large night time winter roosts may be adjacent to human occupied situations. Winter habitat is so varied that it is also secure. Black Rosy-Finch management issues may involve wintering habitat.

Roost Sites

1. Determine if abandoned mine shafts are traditional roost sites before mines are sealed or collapsed.
2. Determine extent of roosting use near human populations areas.
3. Determine extent and use regularity of winter roosts that may be in human constructions that risk being destroyed.

Implementation Opportunities

1. Increase cooperation between state and federal agencies and private organizations regarding Black Rosy-Finch inventory, conservation and management.
2. Increase awareness of public regarding importance of Alpine habitat to Black Rosy-Finches and other birds.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

1. Quantify environmental factors that correlate with the appearance of winter flocks that may be irregular from winter to winter.
2. Quantify habitat structure in areas that show regular winter use.

OUTREACH (EDUCATION) NEEDS

Land managers and the general public should be made aware of Black Rosy-Finch population dynamics in Utah. Outreach efforts should have the primary goal of soliciting information on the location of breeding and wintering areas in Utah. Land and wildlife management agencies should inventory potential habitats and assess their suitability as Black Rosy-Finch habitat.

Tim Provan

LONG-BILLED CURLEW
(*Numenius phaeopus*)

Conservation Priority Score of 34

ASSOCIATED SPECIES: Other bird species that may respond similarly to habitat components used by the Long-billed Curlew are: Willet, Mountain Plover, and other upland Grassland birds.

DISTRIBUTION: This species breeds from south-central British Columbia, southern Alberta, southern Saskatchewan, and southern Manitoba south to east-central California, central Nevada, central Utah, central New Mexico, and northern Texas, and east to southwestern North Dakota, northwestern South Dakota, north-central Nebraska, and southwestern Kansas. It winters from Washington, extreme northern Mexico, southern Texas, southern Louisiana, southern Alabama, and coastal South Carolina south to southern Mexico (Oaxaca, Veracruz, and the Yucatan Peninsula) and southern Florida, irregularly through northern Central America to Honduras and Costa Rica (A.O.U. 1998). The Long-billed Curlew is a fairly common summer resident and migrant in Utah, especially through the central and more northern valleys. Less common in the Colorado River drainage. This species lives and breeds in higher and drier meadowlands than many other shorebird species (Hayward et al. 1976). Paton and Dalton (1994) recorded Long-billed Curlews breeding at several locations along the eastern shores of the Great Salt Lake: Howard Slough WMA, West Layton marsh, West Warren WMA, Harold Crane WMA, northeast of Saltair Beach, North Ogden Bay WMA, Locomotive Springs WMA and Antelope Island (Paton and Dalton 1994). Nesting attempts have also been described in Box Elder and Cache Counties (Forsythe 1972). Utah Bird Latilong Distribution recorded curlews breeding in the following blocks: Fish Springs, Delta, Hanksville and Lake Powell. The curlew has been recorded as a migrant in Lucin, Great Salt Lake, Ogden, Roosevelt, Vernal, Wah Wah, Beaver, Fish Lake, Cedar City, Kanab, and Escalante blocks. Since the compilation of the Latilong Distribution in 1981 there has been an increased number of records of breeding Long-billed Curlews in the uplands adjacent to the northern, eastern, and southern shores of the Great Salt Lake (Don Paul, personal communication).

ECOLOGY: In Utah, most Long-billed Curlews that nested around the Great Salt Lake started to arrive on the breeding ground during the last week in March and established territories by mid-April. Birds in northern Utah arrived later and remained longer than curlews in other parts of its range, probably as a result of climate differences. Foods taken are diverse, including: crustaceans, mollusks, worms, toads, the adults and larvae of insects, sometimes berries (Bent 1929) and nesting birds (Sadler and Maher 1976). The Long-billed Curlew forages by probing and pecking (Johnsgard 1981). Clutch initiation dates also varied with climate, and in northern Utah were started from mid-April to mid-May (Paton and

Dalton 1994). Nests found in Box Elder County and Cache County, Utah were typically a grass-lined depression located in a clump of grass (Forsythe 1972). Female Long-billed curlews are monogamous and lay only one clutch each season. Clutch size is typically 4 eggs (Redmond and Jenni 1986). Young are precocial and tended by both adults (Baicich and Harrison 1997). In western Idaho, mammalian carnivores were the most important predators of curlew eggs and clutches. Long-billed Curlew chicks have cryptic plumage and behavior, making them difficult to locate after they leave the nest. Survival of very young chicks (0-5 days) probably depends more on their learning to feed effectively and receiving occasional thermoregulatory assistance from parents than on avoiding predation (Redmond and Jenni 1986). There is a bias in natal philopatry in male curlews, but they do not return and to attempt to breed until they are 3 or more years of age (Redmond and Jenni 1982, 1986). Average adult survival is approximately 85% per year, and the average longevity may be 8-10 years (Redmond and Jenni 1986).

HABITAT REQUIREMENTS: Long-billed Curlews have four essential nesting habitat requirements in the northwestern United States: (1) short grass (less than 30 cm tall), (2) bare ground components, (3) shade, and (4) abundant vertebrate prey (Pampush 1980). They seem to be most successful nesting in mixed fields with adequate, but not tall grass cover and fields with elevated points (Cochran and Anderson 1987). Uncultivated rangelands and pastures support most of the continental Long-billed Curlew breeding population (Johnsgard 1981, Pampush 1980). Curlews tend to place their nests near manure piles or other conspicuous objects, camouflaging them from aerial predators (Cochran and Anderson 1987). At the Great Salt Lake the ground is relatively level and curlews prefer to nest near the edges of barren alkali flats (Paton and Dalton 1994, Wolfe 1931).

HABITAT AND/OR POPULATION OBJECTIVES:

1. Identify Long-billed Curlew habitat use and breeding pair density within the greater, Great Salt Lake ecosystem.
2. Identify Long-billed curlew habitat use and breeding pair density in upland environments within its breeding range in Utah outside the greater, Great Salt Lake ecosystem.
3. Develop Long-billed curlew HMPs for key breeding complexes identified through the investigations outlined in numbers 1 and 2.
4. Establish breeding pair objectives for the Long-billed curlew complexes.
5. Use the GSL Waterbird Survey to assess the important use areas of migratory Long-billed curlews and identify these values in the forth coming Utah Shorebird Management Plan and within the Intermountain West Shorebird Regional Plan.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES:

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: The Long-billed Curlew has decreased dramatically in this century (Johnsgard 1981). The Intermountain West region is considered the most important area for breeding Long-billed Curlews, and population targets for the species in the United States Shorebird Conservation Plan call for a 30% increase (Brown et al. 2001). In addition, Haig and Oring (1998) include the Great Basin as an area of importance in the maintenance of breeding populations of Long-billed Curlews. Breeding habitat loss and modification has occurred on the east side of the Great Salt Lake through housing development and resulting human disturbance, including the introduction of pets into the area. In Curlew Valley, Utah, rangeland has been modified by deep well irrigation. It is not known whether this is an issue regarding Long-billed Curlews, but such habitat change warrants investigation. A known breeding area on Antelope Island has also undergone some disturbance with the construction of a new road through curlew habitat. There has also been an intrusion of red fox into the breeding habitat. Paton and Dalton (1994) recorded red fox as common on the eastern shores of the lake, but only one coyote. On Antelope Island, however, coyotes were present in larger numbers as were Long-billed Curlews.

Habitat Loss

1. Restrict development on Long-billed Curlew breeding habitat on the eastern shores of the Great Salt Lake. Managing upland habitats associated with Wetlands is important in breeding shorebird conservation.

Predation by Red Fox

1. Fragmentation and loss of adjacent uplands have provided predators with travel corridors where predation of ground-nesting birds can be high. The use of predator barriers, such as electric fences, is important in reducing nest loss (Helmers 1992).

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

1. Currently a researcher from Colorado State University is conducting a study in known Long-billed Curlew habitat on Antelope Island to determine the relationship between visitor use and curlew populations and breeding success.
2. Identify the interaction between coyotes and red fox.

OUTREACH NEEDS:

1. Incorporate the importance of upland habitats associated with Wetlands to Long-billed Curlews in shorebird educational initiatives.
2. Incorporate a Long-billed Curlew educational component in the Utah portion of the Intermountain West Regional Shorebird Outreach Plan.
3. Incorporate a Long-billed Curlew educational element in the forth coming Great Salt Lake Shorebird Plan.


UDWR Archives

SHARP-TAILED GROUSE
(*Tympanuchus phasianellus*)

Conservation Priority Score of 34

Since the initial drafting of this species account in 1999, the Utah Division of Wildlife Resources has developed and begun to implement a more detailed statewide Columbian Sharp-tailed Grouse Conservation Plan (2001). The plan is still in draft, but will be presented for public comment at Utah Division of Wildlife Resources Regional Advisory Council Meetings in May, 2002 and to the Utah Wildlife Board in June, 2002.

ASSOCIATED SPECIES: According to Paige and Ritter (1999), other bird species that may respond similarly to various habitat components used by the Sharp-tailed Grouse are as follows: sagebrush obligate species: Sage-grouse, Sage Thrasher, Sage Sparrow, Brewer’s Sparrow; shrub land species: Black-throated Sparrow, Green-tailed Towhee, Lark Sparrow; shrub land and Grassland species: Swainson’s Hawk, Ferruginous Hawk, Prairie Falcon, Loggerhead Shrike; Grassland species: Long-billed Curlew, Burrowing Owl, Short-eared Owl, Vesper Sparrow; and dry woodland species: Gray Flycatcher.

DISTRIBUTION: Sharp-tailed Grouse are found only in North America (Johnsgard 1983), and originally inhabited 21 states and 8 Canadian Provinces. Sharp-tailed Grouse are extirpated from the following states: California, Illinois, Iowa, Kansas, Nevada, New Mexico, Oklahoma, and Oregon. Distribution of sharptails in the southern portion of their range has been greatly reduced primarily due to conversion of native rangeland to agricultural fields and other urban and industrial developments (Connelly et al. 1998). Efforts to introduce or reintroduce sharptails to their historical range have occurred in many areas over the past 10-15 years, including: Idaho, Iowa, Kansas, Nevada, Oregon, Utah and Ontario (Connelly et al. 1998). Range wide distribution, from Connelly et al. (1998), is as follows: breeds from central Alberta, central Saskatchewan and Manitoba south through Montana (except western-most areas) and North Dakota (except eastern-most areas) to northeastern Wyoming, central and western portions of northern Nebraska, northern Minnesota, and north-central Wisconsin. Range extends north in central Canada to north-central Manitoba, northern Saskatchewan, and northwestern Mackenzie, but distribution is scattered and poorly known within this area.

To the west of this area, breeds in central Alaska, as well as southwestern Yukon Territory, northern British Columbia (Fort Nelson Lowlands, Peace Lowlands), southeastern British Columbia (eastern Kootenay), from central British Columbia (Bulkley Basin region south to Thompson and Nicola Valleys) south to northeastern Washington, west-central Idaho (local), and from southeastern Idaho to extreme northeastern Utah. Introduced to Wallowa County in northeastern Oregon, but current status in Oregon is uncertain.

To the east, breeds in scattered locations where suitable habitat exists in northern Ontario (south to northern shores of Lake Huron), and locally in west-central Quebec (east to Chapais and Lake Chibougamau), and in northern Michigan (Upper Peninsula and north-central Lower Peninsula). Introduced to several counties in Ontario along northern shores of Lake Ontario. To the south, breeds in scattered locations from southwestern Nebraska and south-central Wyoming south to southern Colorado. Introduced to northwestern Kansas.

In Utah, Sharp-tailed Grouse are currently found only in the northern part of the state in Box Elder, Cache, Morgan and Weber counties. Although not confirmed, it's suspected that sharptails might also inhabit the Bear Lake Plateau area in Rich County. The historic distribution of sharptails in Utah consisted of a narrow strip extending from the town of Junction in Paiute County on the south to the Idaho border on the north, and from there west across the northern part of Box Elder County to the Nevada border (Hart et al. 1950). Although not mentioned in the text in Hart et al. (1950), the Utah distribution map in the manuscript also shows a narrow strip of sharptail distribution beginning at the Wasatch-Utah county border (east of Utah Lake) extending northeast through Duchesne and Uinta counties to the Colorado border.

There are seven recognized subspecies of sharp-tailed grouse in the world. According to Connelly et al. (1998) the seven recognized subspecies include: Northern Forms. Dark brown or blackish, with prominent white spotting.: 1) (*Tympanuchus phasianellus caurus*) (Friedman 1943), 2) (*T. p. kennecotti*) (Suckley 1981), 3) (*T. p. phasianellus*) (Linnaeus 1758), 4) (*T. p. campestris*) (Ridgway 1884), Southern Forms. Paler; generally brown with black mottling; white spotting not prominent: 5) (*T. p. columbianus*) (Ord 1815) This is the subspecies that inhabits Utah. This bird inhabits chiefly the Columbia Plateau and Great Basin, occupying sagebrush (*Artemisia* spp.)-Grassland and Mountain Shrub habitats from interior central and southern British Columbia south to Utah and southwestern Colorado (formerly west to northeastern California). Smallest (shortest wing); upper parts ruddy brown; throat buffy, with moderate to heavy spotting; markings on underparts narrower and darker: 6) (*T. p. jamesi*) (Lincoln 1917), and 7) (*T. p. hueyi*) (Dickerman and Hubbard, 1994).

The sharp-tailed grouse is found in only a fraction of it's historical range in Utah. The majority of Utah native rangelands that used to support sharptails has been converted to agricultural lands or has been developed. In many instances, the Ring-necked Pheasant, Utah's most popular upland game bird, inhabits irrigated agricultural lands that have taken the place of native sharptail habitats. The Utah Division of Wildlife Resources monitors a total of 27 sharptail dancing grounds in four counties. Fifteen dancing grounds are monitored in Box Elder County, 8 in Cache County, 3 in Morgan County and 1 in Weber County (Mitchell, et al. 1998). Most recent monitoring through 1997 consisted simply of assessing activity/inactivity of dancing grounds.

The Sharp-tailed Grouse is classed as an upland game species in Utah. Sharptails were not legally hunted in Utah from 1925-1975 and then again between 1980-97, mostly because of limited numbers of grouse as a result of limited distribution. In 1998, because of observed and counted increases in sharptail numbers in northern Utah, intense survey work was conducted in eastern Box Elder County to measure densities of dancing grounds and numbers of sharptails in the county. The intent of the survey work was to determine if there were enough sharptails to provide limited hunting opportunity for Utah sportsmen, as well as to assess sharptail status in the county. Based on spring 1998 survey work, a fall 1998 population size of over 8,000 birds was estimated for Box Elder County.

In 1998, the Utah Wildlife Board authorized a hunt on sharptails in eastern Box Elder County. A total of 663 two-bird permits were made available to Utah sportsmen through a limited entry drawing. Successful applicants were allowed to take two sharptails over a 7-day season. The number of permits authorized allowed for the harvest of no more that 10-15% of the estimated fall population of sharptails. Utah hunter interest in obtaining sharptail permits was low. Only 57% of the permits were issued.

Harvest statistics from Mitchell et al. (1999) for the 1998 sharp-tailed grouse season are shown in Table 13 below.

ECOLOGY: The male sharptail is approximately 50 cm (20 in) in length. The female is slightly smaller. These birds are a medium-sized grouse weighing 454 g to 795 g (1 - 1.75 lbs). Both sexes are gray/brown with black and buffy markings. White spots on the primary wing feathers and the barred pattern of the wing are distinctive features. The underparts are buffy-white, while the belly and underparts of the tail are white. Breast feathers have a pattern of dark, V-shaped markings. The two central tail feathers are longer than the rest. Males have purple air sacs on the sides of the neck that cannot be seen except when inflated.

Table 13. Utah 1998 Harvest Statistics for Sharp-tailed Grouse.

STATISTIC	NUMBER
Hunters Afield	233
Sharp-tailed Grouse Harvested	166
Hunter-days Afield	166
Sharp-tailed Grouse per Hunter-day	1.00
Sharp-tailed Grouse per Hunter	0.71

Males gather on leks or dancing grounds during early spring for courtship displays of dancing. Dancing takes place first thing in the morning and again just before sunset. Females visit these grounds (March-July) where mating takes place. Peak mating activity occurs from mid- to late April. Nesting begins in April and is initiated 1-3 days after mating on the dancing ground. Nests are scratched out of the ground as shallow, oval hollows lined with mosses, grass, leaves and other herbaceous plants. Nests are usually placed under or near shrubs or small trees, or thick and taller residual cover. Average clutch size is 11-12 eggs. Incubation period averages 21-23 days. Peak hatching period occurs from June 5-20 (Connelly et al. 1998). Sharptails raise only one brood per year.

Most nesting and brood-rearing takes place within 3 k (2 mi) of the lek (Connelly et al. 1998). Most males remain within 1.5 k (1 m) of the lek (Giesen and Connelly 1993). The daily summer cruising radius for sharptails in Utah and Idaho ranged from < 0.9 - 0.4 k (< 0.06-0.25 mi) (Hart et al. 1950, Giesen and Connelly 1993). Home ranges have been reported from 15 to 406 ha (37 - 1003 ac), while a 1987 study in Colorado reports and 2 k (1.27 mi) radius around leks as the average spring-to-fall home range (Giesen and Connelly 1993, Connelly et al. 1998). Movements between breeding areas and winter areas average 2.5 - 4.3 k (1.64 - 2.8 mi), however a 1991 study in Idaho documented movements of 17.6 k (12.43 mi) between the two areas (Giesen and Connelly 1993).

HABITAT REQUIREMENTS: Vegetative communities associated with historic and current distributions of Sharp-tailed Grouse include: sagebrush steppe (*Artemisia-Agropyron*), mountain mahogany-oak scrub (*Cercocarpus-Quercus*), fescue-wheatgrass (*Festuca-Agropyron*), wheatgrass-bluegrass (*Agropyron-Poa*) and riparian and Mountain Shrub (Giesen and Connelly 1993). The Mountain Shrub community is described as a site dominated by $1 deciduous shrub including service berries (*Amelanchier* spp.), snowberries (*Symphoricarpos* spp.), common chokecherry (*Prunus virginiana*) and Gambel oak (*Quercus gambelii*) (Giesen and Connelly 1993).

Insects constitute a major portion the chick sharptail's diet in the spring and summer (Johnsgard

1983). Adult diets in spring and summer consist of a variety of species including: salsify (*Tragopogon* spp.), creeping barberry (*Berberis repens*), common dandelion (*Taraxacum officionale*), sagebrush buttercup (*Ranunculus glaberrimus*), bluegrasses (*Poa* spp.), brome grasses (*Bromus* spp.), other grass seeds and leaves, and insects including Coleoptera, Hymenoptera and Orthoptera (Giesen and Connelly 1993, Connelly et al. 1998). Fall diets are similar, but include a higher portion of insects and agricultural crops, especially wheat, where available (Giesen and Connelly 1993, Connelly et al. 1998).

Winter foods include fruits and buds of deciduous trees and shrubs including chokecherries, service berries, hawthorns (*Crataegus* spp.), snowberries, Aspens (*Populus* spp.), willows (*Salix* spp.), birches (*Betula* spp.), and wild roses (*Rosa* spp.) (Giesen and Connelly 1993, Connelly et al. 1998). Winter dependence on deciduous trees and shrubs as food and cover is likely a limiting factor for sharptails in Utah (Hart et al. 1950).

Leks are a focal point in the management of Sharp-tailed Grouse. Leks are observed annually to determine population numbers for local areas. Leks typically are located on knolls, ridgetops or benches that are higher than the surrounding topography. Leks are the hub of breeding activity. Leks are sometimes associated with disturbed sites and are often found in areas with little slope and sparse vegetation compared to surrounding areas (Hart et al. 1950, Connelly et al. 1998). Lek sites have been characterized as having thin, rocky, easily eroded soils, or as a claypan that supports sparse vegetation or as native rangeland used for livestock grazing (Giesen and Connelly 1993). Some leks are located in cultivated areas such as alfalfa, hay, wheat grasses or dryland wheat-fallow rotations (Rogers 1969).

Leks of Columbian Sharp-tailed Grouse often have taller vegetation and more shrub cover than leks of other subspecies (Rogers 1969). Male Columbian Sharp-tailed Grouse selected vegetation density with 20-30% visual obstruction on leks (Ward 1984). Columbian Sharp-tailed Grouse in Wyoming selected lek sites that had less vegetative cover than at random sites (35% vs 68%) (Klott and Lindzey 1989).

Most female sharptails nest beneath a shrub such as sagebrush, serviceberry or snowberry. Giesen and Connelly (1993) suggest that females select dense stands of shrubs for nesting with clumps of taller and denser shrubs at the actual nest site. Meints et al. (1992) suggest that Columbian Sharp-tailed Grouse prefer a minimum vegetative height-density measure (Robel et al. 1970) of 2.5 dm for nesting. In Utah where most of the native rangeland has been lost as sharptail habitat, females selected alfalfa and wheat stubble as nesting areas. Nest failure in these areas was 53 and 82% respectively, but only 30 % in rangelands (Hart et al. 1950)

Giesen and Connelly (1993) characterize summer habitats as shrub steppe vegetation with a diversity of forbs and bunch grasses or Mountain Shrub habitat dominated by serviceberry and Gambel oak. Vegetative composition of summer and brood-rearing habitats varies geographically. Open, free-standing water is not mentioned in the literature as being a critical component of these habitats. Broods depend on areas with abundant forbs and insects, often with a high diversity of shrubs and interspersion of cover types. Important areas include food patches, farm fields and sites in early successional stages with dense forb cover (Connelly et al. 1998).

Deciduous trees and shrubs in upland and riparian areas as well as draws are critical to sharptail survival in winter. Important trees and shrubs throughout sharptail range include: quaking Aspen (*Populus tremuloides*), chokecherry, serviceberry, snowberry, sagebrush, hawthorn, willow and birch. Sharptails are known to use grain fields and Conservation Reserve Program (CRP) lands as well in winter. Sharptails in Utah often moved > 5 k (3 mi) to find suitable food and cover in the winter (Hart et al. 1950). Columbian Sharp-tailed Grouse will roost in snow when conditions are adequate (Giesen and Connelly 1993).

HABITAT AND/OR POPULATION OBJECTIVES: The reader is referred to the Strategic Management Plan for Columbian Sharp-tailed Grouse (UDWR 2002) for information on Habitat and Population Objectives. The Plan has established 4 separate Sharp-tailed Grouse Management Areas each with its own set of strategies and objectives designed to meet the statewide management objectives and population strategies for the species.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES:

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: The Columbian Sharp-tailed Grouse was petitioned for listing under the federal Endangered Species Act in 1989. The subspecies was listed as a Category 2 species (i.e., a species that may be considered threatened or endangered if more information were available). As of this writing, no official position on a listing has been released by the USFWS. Sharp-tailed Grouse are currently on the Utah Sensitive Species List as a Species of Special Concern SD: Due to limited distribution. Factors contributing to the decline of the Columbian Sharp-tailed Grouse in Utah include:

Habitat Loss/Fragmentation/Degradation: Sagebrush steppe habitats in Utah have undergone rampant, broad scale conversion from native shrub/Grasslands to monotypic annual and perennial grasses and to cropland. This conversion is due to sagebrush control efforts through chemical and mechanical methods and is often combined with introductions of aggressive, nonnative grasses such as crested wheatgrass (*Agropyron cristatum*). The introduction of the exotic annual cheatgrass (*Bromus tectorum*) has drastically altered the natural fire regime of many sagebrush steppe areas. Increases in the frequency and intensity of rangeland fires strongly favor annual grasses and forbs to the detriment of many native grasses and perennial shrubs such as sagebrush.

Several deciduous shrubs, including snowberry, chokecherry and Gambel oak, and perennial grasses critical to sharptails have adapted to historical fire regimes where wildland range fires were infrequent and of low to moderate intensity. Even though sagebrush typically declines post- fire, prescribed burns can be beneficial. Increasing frequency and intensity of range fires across the Great Basin is a significant threat to native grasses and shrubs. Frequent and intense fires kill native plants and deplete or destroy native seed sources; natives are then replaced by exotic annuals, such as cheatgrass. Post-fire vegetation restorations have often resulted in introduction of aggressive and/or nonnative plants which dominate burned areas and inhibit reestablishment of native sagebrush steppe habitats.

Excessive livestock grazing, including the removal of nesting and brood-rearing cover and destruction of deciduous trees and shrubs through trampling, browsing and rubbing, is one factor responsible for the decline of the Columbian Sharp-tailed Grouse (Giesen and Connelly 1993). Severe loss of deciduous cover in riparian areas, where livestock prefer to be in the summer because of water and shade, eliminates critical foraging and escape cover for sharptails.

Pesticide spraying, especially of 2,4-D to eliminate sagebrush, in sharptail habitats has a negative effect on the species. Deciduous trees and shrubs (food and cover sources) are killed and there is an immediate loss of nesting, brood-rearing and winter cover.

Physical Disturbance : Physical disturbance has been caused by hunting, predators, bird watchers, off-highway vehicle use, and harassment. Physical disturbance can result in Sharp-tailed Grouse death or stress particularly if it occurs during biologically critical periods (i.e., nesting, mating, brood-rearing, wintering).

Columbian Sharp-tailed Grouse management issues (in italics) and recommendations are listed below:

Habitat Loss/Fragmentation/Degradation

1. Monitor and maintain records of locations of all leks and make maps of leks available to land management agencies for use in environmental evaluations of proposed management activities.
2. Vegetation manipulation within a breeding complex (lek and nesting areas within a 2 k (1.24 mi) radius of the lek) should be avoided.

3. Prohibit physical, mechanical and audible disturbances within the breeding complex during the breeding season (March-June), if they might impact courtship activities and breeding during the daily display period (within 3 hours of sunrise and sunset).
4. Avoid manipulation or alteration of vegetation within the breeding complex during the nesting period (May-June). Management practices should not reduce height, canopy cover, or density of chokecherry, snowberry, sagebrush, serviceberry or other shrub species important for nesting.
5. No vegetation manipulation or disturbance that results in loss of deciduous tree and shrub height, canopy cover and density should occur within 100 m (328 ft) of streams, including seasonally dry and intermittent secondary drainages. Cottonwoods (*Populus* spp.), willows and deciduous shrubs in riparian areas should be protected and maintained. Livestock use of riparian areas should be managed or eliminated to minimize destruction of associated shrubs and trees.
6. Manipulation or disturbance of vegetation, including pesticide application, burning or mechanical destruction that results in long-term (> 5 year) or permanent reduction of height, canopy cover, or density of Mountain Shrub habitats within occupied ranges should be avoided if shrubs comprise < 10% of the cover within occupied areas. Management practices to rejuvenate or increase Mountain Shrub communities within breeding complexes or winter ranges should be restricted to #25% of this cover type annually.

Physical Disturbance
1. Minimize research and data collection that negatively impacts Sharp-tailed Grouse.
2. Remove unused overhead utility lines and fences.
3. Reduce speeds on roadways in high use Sharp-tailed Grouse areas.
4. Manage impacts from motorcycles, mountain bikes, OHVs and other mechanical or motorized vehicles.
5. Manage recreational hunting opportunity.
6. Deter poaching.
7. Conduct predator control where necessary.
8. Manage recreational bird watching activities.
9. Avoid disturbance which impairs the "acoustical component" of breeding displays in the spring.

Implementation Opportunities
1. Increase cooperation between state and federal agencies and private organizations and landowners regarding sagebrush, sagebrush steppe, deciduous tree and shrub and riparian inventory, conservation, and management.
2. Increase awareness of public regarding sagebrush, sagebrush steppe, deciduous tree and shrub and riparian inventory, conservation, and management habitat importance to Sharp-tailed Grouse.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

Efforts to increase what is known about Sharp-tailed Grouse need to continue. Research to identify impacts to Sharp-tailed Grouse and methods of habitat improvement are needed. Research topics could include: baseline data gathering and documentation of active leks and locations of Utah populations; genetic analysis of individuals and populations; how predators affect Sharp-tailed Grouse populations; the manipulation of vegetation communities by herbicides, fire, or mechanical methods; the effects of hunting on Sharp-tailed Grouse, and how to better manage other land uses in Sharp-tailed Grouse habitat such as livestock grazing, big game herd management, and recreation. Existing monitoring of Sharp-tailed

Grouse and their habitat needs to be continued and in some cases intensified.

Sharp-tailed Grouse distribution information will need to be developed and shared by all resource management agencies and made available to the public. All Sharp-tailed Grouse habitat and related information should be identified and mapped, at a high level of accuracy, on a Geographic Information System. This should increase the understanding of Sharp-tailed Grouse, their habitat needs and identify future improvement projects and activities. In some cases, inventory of important Sharp-tailed Grouse habitat needs to occur before mapping.

OUTREACH NEEDS

A more coordinated approach to inform the public about the importance of Sharp-tailed Grouse habitat and methods to improve their habitat is needed. Collectively, information and education activities are considered to be highly effective in improving Sharp-tailed Grouse conditions as it is believed that increasing the understanding of Sharp-tailed Grouse needs will lead to a cooperative and coordinated effort to improve conditions.

The recent focus on the status of Sage-grouse has elevated awareness of the importance of Shrubsteppe habitats to birds. However, further outreach efforts need to focus on the importance of managing Shrubsteppe habitats for a diversity of bird species. Most Shrubsteppe habitats are under federal and state land management in Utah; thus land managers should be a primary target of outreach efforts. These efforts should include incorporation of bird diversity into Sage-grouse management plans and Conservation Agreements.

Public awareness of the importance and uniqueness of Shrubsteppe habitats is extremely limited. Preparation of a Shrubsteppe bird Wildlife Notebook suitable for classroom use would provide a vehicle for increased public awareness. This notebook would feature Priority Species (Sage-grouse, Sharp-tailed Grouse, Sage Sparrow, Brewer’s Sparrow) and other associated Shrubsteppe birds.

BREWER'S SPARROW
(*Spizella breweri*)

Conservation Priority Score of 34

Frank Howe

ASSOCIATED SPECIES: Other Shrubsteppe obligates (Braun et al. 1976) such as Sage Thrasher, Sage Sparrow, and Sage-grouse as well as species which frequently inhabit Shrubsteppe habitats (but are not "obligates") such as Black-throated Sparrow, Northern Mockingbird, Loggerhead Shrike, Gray Flycatcher, Western Meadowlark, Brown-headed Cowbird, Mourning Dove, Lark Sparrow, Vesper Sparrow, Green-tailed Towhee, Horned Lark, Sharp-tailed Grouse, Burrowing Owl, Ferruginous Hawk, and Prairie Falcon.

DISTRIBUTION: Two subspecies of Brewer's Sparrows are recognized, but only *Spizella breweri breweri* breeds in Utah; the more northerly subspecies--Timberline Sparrow (*S. b. taverneri*)--is restricted to high elevation sites in Canada and Alaska. The Brewer's Sparrow (*S. b. breweri*) is primarily a Great Basin species, but it occurs in Shrubsteppe habitats in all western states; it breeds throughout Utah and Nevada as well as Montana, Wyoming, western Colorado, northern New Mexico, northern Arizona, eastern California, eastern Oregon, eastern Washington, and southern Idaho. Its range also extends to southwestern Saskatchewan and southeastern Alberta (Rotenberry et al. 1999). In Utah, Brewer's Sparrows are common (Behle et al. 1985) to very common (Hayward et al. 1976) summer residents, breeding throughout the state in appropriate habitats. Densities in Utah are high in the northern and western parts of the state and highest in Rich and Summit counties (Sauer et al. 1997). Brewer's Sparrows winter in southeastern California, southern Arizona, and southern New Mexico, south into Baja and the central states of Mexico (Rotenberry et al. 1999); they occur rarely in Utah during the winter (Behle et al. 1985) most often in the southwestern corner of the state (Sauer et al. 1997).

ECOLOGY: Brewer's Sparrows are considered Neotropical migrants, though some populations may travel only a short distance between breeding and wintering ranges. Northern populations migrate farthest south (Rotenberry et al. 1999) and Utah Brewer's Sparrows probably winter in the Sonoran and Chihuahuan deserts of southern US and northern Mexico in mixed-species flocks with other sparrows. Brewer's Sparrows typically arrive in Utah in mid April and depart in mid October (Behle and Perry 1975).

Upon arrival, male Brewer's Sparrows establish territories (usually about 0.5 ha [1.2 ac]) which are vigorously defended both vocally and physically (Reynolds 1981). Females arrive a few days after males; and while no noticeable courtship behaviors are exhibited, pairs form a few days later. Territory establishment and pair formation might be delayed by cold weather (Peterson and Best 1985).

Nests, tight cups of grass and forbs lined with finer materials such as hair, are constructed in mid May. Nest construction is primarily by the female and takes about 5 days. Nests are typically placed between 20 and 50 cm (8-20 in) high and average around 40 cm (15.5 in); they are usually in the top ½ of the shrub (Peterson and Best 1985). Nests are usually located in patches of sagebrush that are taller and denser, with more bare ground and less herbaceous cover, than the surrounding habitat. In Idaho, nest shrubs averaged 69 cm (27 in) and height of the surrounding habitat was 43 cm (17 in) (Peterson and Best 1985). The vast majority of Brewer's Sparrow nests are in sagebrush; however, other shrubs are occasionally used (Rotenberry et al. 1999).

Clutch size is usually 3-4 eggs, occasionally 2 and rarely 5, and the clutch is laid at a rate of 1egg/day. Incubation begins when the second-to-last egg is laid and lasts for 10-12 days (Rotenberry and Wens 1991). The female performs most of the incubation duties, but the male frequently remains near the nest and occasionally incubates and delivers food to the female. Brewer's Sparrows will renest in a few days if the initial clutch is lost. Hatching begins in late May and peaks in the first 2-3 weeks in June (Howe et al. 1996). Hatching of altricial young takes place over a 1 to 2 days (up to 4 days) period and usually occurs in the mornings (Rotenberry et al. 1999). Both parents brood nestlings for 8 - 9 days. Adults feed nestlings almost exclusively insects (Petersen and Best 1986, Howe et al. in press) which are caught within 50 m of the nests (Rotenberry et al. 1999). Food items are delivered to the nestlings on average every 8 - 13 minutes (Howe et al. 2000) and feeding frequency increases with age of the nestlings (Rotenberry et al. 1999). Nestlings leave the nest at 6 - 9 days; early fledging (< 8 days) is often the result of nest disturbance. Nestlings remain in the nest area (< 10 m [< 33 ft] from the nest) for several days before they are able to fly. Parents attend the nestlings after they leave the nest for several days, though it is not known exactly how long parents remain with the fledglings. Late nests (late June - mid July) may represent renesting after failed attempts or double brooding. Brewer's Sparrows are frequent Brown-headed Cowbird hosts and often abandon parasitized nests (Rotenberry et al. 1999).

Daily nest survivorship over the entire nesting period is typically above 95% (Rotenberry and Wens 1989, Peterson and Best 1985, Howe et al. 1996). The proportion of successful nests and the number of young produced varies greatly from year to year. Howe et al. (1996) reported 68% successful nests and 1.75 young/nest attempt in one year and 32% success with 0.7 young/nest attempt the following year. Rotenberry and Wens (1989) found similar fluctuations which they attributed to predation (by ground squirrels) and precipitation in the winter preceding nesting.

Brewer's Sparrows are primarily insectivorous during the breeding season though their diet consists mostly of grass and weed seeds in winter. They glean insects from shrub foliage and bark and take seeds from the ground. Insect foraging occurs primarily (< 75%) in shrubs as opposed to on the ground between shrubs or in bunch grasses; foraging shrubs are usually sagebrush and are larger and more vigorous than those generally available in the surrounding habitat. Brewer's Sparrows diets change throughout the breeding season and differ between years (probably in relation to food availability). They feed on a wide variety of arthropods including spiders, leaf bugs, cicadas, snout beetles, caterpillars, crane flies, ants, and grasshoppers (Rotenberry et al. 1999). Nestlings are fed a similar diet with most of the diet made up of caterpillars, butterflies, spiders, beetle larvae, crane flies, cicadas, and grasshoppers (Petersen and Best 1986, Howe et al. in press).

Snakes and ground squirrels are the primary egg and nestling predators and these predators may regulate productivity in some years. The primary predators of adults are probably Loggerhead Shrikes; American Kestrel and Prairie Falcon predation has also been recorded. This predation is not likely to regulate adult populations (Rotenberry et al. 1999).

HABITAT REQUIREMENTS

Brewer's Sparrows breed primarily in Shrubsteppe habitats in Utah and are considered to be Shrubsteppe obligates by Braun et al. (1976). However, Brewer's Sparrows may also be found in High

Desert Scrub (greasewood) habitats, particularly where these habitats are adjacent to Shrubsteppe. They may also breed in large sagebrush openings in Pinyon-Juniper habitat or coniferous forests.

Breeding habitats are usually dominated by Big Sagebrush (*Artemisia tridentata*) and canopy height of breeding habitats is almost always < 1.5 m (5 ft) and usually 30 - 70 cm (1 - 2.3 ft). Nesting and foraging areas are usually in patches, sometime individual shrubs, that are taller than the surrounding vegetation. These areas also tend to have a greater percentage of live shrub growth, less bare or rock-covered ground, and greater canopy coverage than surrounding patches. See Ecology for detailed description of nesting and foraging site characteristics.

HABITAT AND/OR POPULATION OBJECTIVES:

1. Population trend should be stable or increasing (p = 0.10) over a 5-year period Population should be maintained at the current population level with an average relative abundance of 11 birds/BBS route on at least 50 routes statewide over 5 year period. This is based on the 30 year average as measured by Breeding Bird Survey relative abundance.
2. Maintain or increase suitable nesting habitat in Shrubsteppe and High Desert Scrub areas of the state.

ASSUMPTIONS:

1. The current Brewer's Sparrow population in Utah is a viable population.
2. Sagebrush habitats can be maintained or restored to provide suitable Brewer's Sparrow breeding habitats.
3. BBS relative abundance provides an adequate index of gross population trend for Brewer's Sparrows.

While Brewer's Sparrow populations are declining range wide at 3.7%/year (Sauer et al. 1997), the Brewer's Sparrow population in Utah appears to be stable and possibly increasing. And, given that Brewer's Sparrows are one of the most common species in Shrubsteppe habitats around the state, it is probable that the Utah population is viable at the current level. Because Utah's population is doing well while the overall population is declining sharply, it is important to maintain or increase our population, since Utah may act as a refugium or source for other Brewer's Sparrow populations in the West.

Edwards et al. (1995) classified Shrubsteppe in 38,438 km^2 (14,841 mi^2) of Utah, i.e., 17.5% of Utah's land cover is Shrubsteppe. Also, High Desert Shrub was present in 55,354 km^2 (21,372 mi^2) or 25.2% of the state's land cover. This does not address the condition of these habitats, but indicates that there is a great potential to provide suitable Brewer's Sparrow habitats in Utah.

Density estimates range widely depending on habitat and year, Wiens and Rotenberry (1981) found densities from 29-533 individuals/km^2. Annual variation on a single plot can run from 50-350 individuals/km^2, and one site was unoccupied in one year then had a density of 150 individuals/km^2 the following year. A reasonable estimate of healthy Brewer's Sparrow populations appears to be 150-200 individuals/km^2 averaged over several years. Relative abundance, a rough index of density, as measured by Breeding Bird Surveys is 10.97 birds/route (n = 52 routes) over the last 30 years in Utah.

Mean territory size also ranges widely from 0.10 ha to 2.36 ha (Rotenberry 1999). Average territory size of about 0.50 ha was reported by Reynolds (1981) in southeastern Idaho and this seems like a reasonable estimate for territory sizes in Utah. As with density, year and habitat influence territory size; also territory size might be density-dependent. Regardless of territory size, territories tend to be contiguous with adjacent territories (Rotenberry et al.1999).

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Brewer's Sparrows are not listed as a state or federal Threatened, Endangered, or Sensitive Species. Brewer's Sparrows are listed as a UPIF Priority Species because of range wide population declines and the importance of Utah to the overall species. Sagebrush habitats, i.e., Shrubsteppe and High Desert Scrub UPIF habitats, have undergone a broad scale conversion from native shrub/Grasslands to monotypic annual and perennial grasses. This conversion is due to sagebrush control efforts through chemical and mechanical (primarily chaining) methods often combined with introduction of aggressive, nonnative grasses such as crested wheatgrass (*Agropyron cristatum*). Also, introduction of the exotic annual cheatgrass (*Bromus tectorum*) has drastically altered the natural fire regime of many Shrubsteppe areas; increases in the frequency and intensive of rangeland fires strongly favor annual grasses and forbs to the detriment of many native grasses and perennial shrubs such as sagebrush. These conversions have also increased the fragmentation of Shrubsteppe habitats throughout the intermountain West (Braun et al. 1976). Rotenberry (1998) stated that loss and fragmentation of habitats may be the reason for range wide Brewer's Sparrow declines. Furthermore, his modeling predicts that more than half of the remaining shrub lands will be lost.

Most shrubs and perennial grasses have adapted to historical fires regimes where range fires were infrequent and of low to moderate intensity. Increasing frequency and intensity of range fires across the Great Basin is a significant threat to native grasses and shrubs which makeup Brewer's Sparrow habitat. Frequent and intense fires kill native plants and deplete or destroy native seed sources; natives are then replaced by exotic annuals, such as cheatgrass. Post-fire vegetation restorations have often resulted in introduction of aggressive and/or nonnative plants which dominate burned areas and inhibit reestablishment of native Shrubsteppe habitats.

Additional causes of habitat loss and fragmentation include agricultural conversion (to crop land), urban encroachment, roads, and rights-of-way (e.g., power lines, pipelines). These and other sources of fragmentation are likely to increase Brown-headed Cowbird nest parasitism of Brewer's Sparrows. Cowbirds are attracted to fragmented habitats.

Brown-headed Cowbird parasitism varies greatly by site (0-52% of nests parasitized) (Rotenberry et al. 1999). Nest parasitism is likely related to fragmentation, presence of cattle, and distance to cowbird feeding areas, e.g., stockyards. Brewer's Sparrows frequently abandon parasitized nests (Rotenberry et al. 1999), but cowbird young have been observed in nests where nestlings are near fledging age (Howe pers. obs.). A few observations of fledgling cowbirds with adult Brewer's Sparrows have been reported (Friedman et al. 1977).

The effects of Malathion, a pesticide used to control grasshoppers, on nesting Brewer's Sparrows appear to be minimal. No direct mortality of adults or young was observed and food base reductions appeared to be compensated for in most cases. However, nestling growth and food delivery intervals were impacted during one year of study suggesting that pesticide application in years of low food abundance may be detrimental (Howe et al. 1996, Howe et al. 2000). Little information is available for other pesticides, but the potential to affect Brewer's Sparrows through both direct and indirect (e.g., food reduction) pathways is of concern, since many insect control efforts focus on Shrubsteppe habitats and habitats directly adjacent to Shrubsteppe.

Brewer's Sparrow management issues (in italics) and recommendations are listed below:

Habitat Loss and Fragmentation

1. Establish a "no net loss" policy for Shrubsteppe (sagebrush and sagebrush plus grass) habitats.
2. Maintain or modify existing grazing regimes to promote growth of native shrubs and grasses. Temporarily remove grazing from degraded habitats and habitats recovering from fire or other detrimental factors.

3. Promote use of grazing to reduce cheatgrass dominance and prepare areas for native grass and shrub reseeding.
4. Promote reestablishment of native Shrubsteppe habitats through the use of prescribed fire and revegetation. Burns should be timed to promote growth of native grasses, minimize loss of sagebrush, and minimize establishment/regrowth of exotic annuals; revegetation should promote native grass and shrub reestablishment.
5. Promote use of prescribed burning and revegetation to avoid catastrophic wildfires.
6. Post-wildfire revegetation should focus on reestablishment of native grasses and shrubs, avoid use of nonnative and aggressive species and strive to exclude cheatgrass.
7. Use green-stripping, if necessary, to prevent stand-replacing fires in high quality Shrubsteppe patches.
8. Avoid road and right-of-way construction in large, contiguous patches of Shrubsteppe habitat. Construction footprints should be minimized and all rights-of-way should be revegetated with native grasses and shrubs.
9. Manage large blocks of land for contiguous Shrubsteppe habitat and avoid activities that cause fragmentation. Revegetate old roads and other disturbance corridors to native grasses and shrubs.
10. Avoid conversion of existing Shrubsteppe habitats to crop land, urban areas, etc. Maintain or reestablish native Grassland/shrub land open spaces in urbanized areas.
11. Monitor all revegetation efforts for success and enhance areas with poor native plant reestablishment.
12. Establish economic and reliable sources of native seeds for revegetation efforts and stockpile native seeds whenever possible.
13. Cowbird parasitism should be controlled through maintenance and reestablishment of large, contiguous blocks of Shrubsteppe habitat and reduction of habitat fragmentation.
14. Eliminate large-scale chaining and chemical control of Shrubsteppe habitats and eliminate large scale establishment of nonnative grasses in disturbed areas.
15. Use small-scale chemical and mechanical control methods to enhance Brewer's Sparrow habitats.

Pesticide Use
1. Avoid broad-scale use of pesticides during the nesting and brood-rearing season (mid-May through July).
2. If used, avoid persistent pesticides and those with high bioaccumulation potential.
3. Avoid use of pesticides in years of low food abundance.

Implementation Opportunities
1. Increase cooperation between state and federal agencies and private organizations regarding Shrubsteppe inventory, conservation, and management.
2. Increase awareness of public regarding Shrubsteppe habitat importance to birds.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH
1. Continue to annually monitor Brewer's Sparrow populations through the Breeding Bird Survey. Annually analyze 5-year trend to determine stability of population.
2. Determine effects of various habitat altering activities (e.g., grazing, oil exploration, wildfire, prescribed fire, chaining) on Brewer's Sparrow and their habitats and determine how such activities might be used to enhance Brewer's Sparrow habitats.
3. Determine best methods for controlling cheatgrass invasions and reestablishing native Shrubsteppe habitats (Rotenberry 1998). Include research use of prescribed fire and revegetation (e.g., best

mixture of native seeds, broadcast and drilling methods) after prescribed and wild fire.
4. Determine the effects of commonly used pesticides on Brewer's Sparrows and their prey.
5. Determine best methods of evaluating and monitoring quality and quantity of Shrubsteppe habitats at different scales through time (e.g., combination of ground-based and remote sensing change detection).

OUTREACH NEEDS

The recent focus on status of Sage-grouse has elevated awareness of the importance of Shrubsteppe habitats to birds. However, further outreach efforts need to focus on the importance of managing Shrubsteppe habitats for a diversity of bird species. Most Shrubsteppe habitats are under federal and state land management in Utah; thus land managers should be a primary target of outreach efforts. These efforts should include incorporation of bird diversity into Sage-grouse management plans and Conservation Agreements.

Public awareness of the importance and uniqueness of Shrubsteppe habitats is extremely limited. Preparation of a Shrubsteppe bird Wildlife Notebook suitable for classroom use would provide a vehicle for increased public awareness. This notebook would feature Priority Species (Sage-grouse, Sharp-tailed Grouse, Sage Sparrow, Brewer's Sparrow) and other associated Shrubsteppe birds.

BLACK SWIFT
(*Cypseloides niger*)

Conservation Priority Score of 34

Tom Ulrich

ASSOCIATED SPECIES: Black Swifts are aerial insectivores that nest in close association with waterfalls; American Dippers nest in similar habitats; White-throated Swifts, Violet-green Swallows, Cliff Swallows, Barn Swallows, and other swallows forage sympatrically with Black Swifts.

DISTRIBUTION: The Black Swift occurs in mountainous regions of the western US and Canada. The only subspecies that breeds in this range is *Cypseloides niger borealis*, other subspecies occur in Mexico/Central America and in the West Indies. Little is known of the historic range. Currently Black Swifts occur in three widely separated areas: central Colorado through central Utah; central and southwestern coastal California; and southern Alaska to northern Washington and inland to southwestern western Alberta, northern Idaho, and northwestern Montana. Abundance varies greatly among and within the 3 subpopulations. In the northwestern subpopulation, Black Swifts are fairly common to locally very abundant (Chantler and Driessens 1995); in California the swift is a local and restricted breeder (Foerster and Collins 1990); in Colorado Black Swifts are uncommon (700-800 pairs)(Boyle 1998) and in Utah they are extremely rare (Knorr 1962).

Only 2 confirmed breeding locations are known in Utah: the Bridal Veil Falls area and Aspen Grove area (Knorr 1962). Other possible breeding areas where birds have also been seen or collected include Weeping Rock in Zion National Park (Wauer and Carter 1965), Doughnut Falls in Big Cottonwood Canyon (Wheeler unpublished data), Pete’s Hole in the Manti-La Sal National Forest (Howe 1998) and Bullion/Cascade Falls near Marysvale (Howe pers. comm.). Stewart Falls near Sundance has also been reported as a possible breeding area (Behle et al. 1985). Sighting records also exist for the Salt Lake City area, Red Creek near Fruitland (Hayward et al. 1976), and Upper Provo Falls near Mirror Lake (Shirley pers. comm.). Additional breeding sites are possible in Utah, particularly in the Uinta and Wasatch ranges (Knorr per. comm.), Boulder Mountain, and drainages originating in the Monticello Ranger District of the Manti-La Sal National Forest (Howe pers. comm.) where the proper habitat conditions exist. In Colorado, Knorr (1961) found 27 active colonies in the high Rockies including 12 colonies in southwestern Colorado approximately 80 k (50 mi) from the Utah Border. Wintering range of the Black Swift is thought to be Central America possibly into northern South America (Chantler and Driessens 1995).

ECOLOGY: Black Swifts are one of the latest migrants and one of the latest breeders in Utah They arrive in extremely late May or early June and may still be tending nests in early September. Swifts probably start their southerly migration in mid to late September but may remain in the state until October. Black Swifts are aerial insectivores and feed exclusively on flying insects. They generally forage thousands of meters above the ground, but may also forage low over rivers and streams. Foraging forays last throughout most of the daylight hours, and swifts may forage up to 40 km (25 mi) from nesting colonies. Black Swifts usually forage in flocks often with other species; they also migrate in flocks (Chantler and Driessens 1995).

Black Swifts nest in small colonies (usually < 10 pairs) near and often behind waterfalls at middle (1820 m [6000 ft]) to high elevations (> 3500 m [11,500 ft]). Both courtship and copulation occur while in flight. Nesting sites are used traditionally and adults are long-lived. Collins (1995) reported capturing an individual at the same colony 9 years after its initial capture. Nesting habitat is classified as Mountain Riparian (Behle and Perry 1975); however, waterfalls are the key characteristic of nesting sites. Nesting sites typically exhibit 6 ecological characteristics: water (waterfalls), high relief (cliffs), inaccessibility to humans and predators, darkness, unobstructed flight paths (Knorr 1961) and ledges or cracks (for nest placement) (Knorr pers. comm.). Nests are on ledges, cracks, or crevices and are often behind or in the spray of waterfalls. The nest is constructed of moss, algae and ferns and contains little or no mud. It is often lined with conifer needles or rootlets (Knorr 1961, Ehrlich et al. 1988). Nests are often reused after addition of new layers of material. Typically only 1 egg is laid (sometimes 2) in mid to late July; both adults incubate the egg for 24-27 days. Nestlings are altricial and develop over a period of 45-49 days; both adults feed the nestlings. Since adults forage during the day, nestlings are not fed until dusk and may be fed throughout the night (Knorr pers. comm.). The Black Swift's nesting period (egg to fledging) is extremely long for a bird this size and is similar to the nesting period of many buteos (hawks ~4 times the size of a swift).

HABITAT REQUIREMENTS: Black Swifts require waterfalls for nesting; typically the falls are permanent but may be intermittent if they flow throughout the breeding season (June-early September). There are no studies of minimum fall height required by Black Swifts, but falls less than 10 m (~30 feet) in height are not likely to be suitable. Knorr (1961) described the ecological requirements of nesting Black Swifts:

1. Water - present at every nest site whether as a torrent or a trickle; nests are usually wet directly by running water or by spray;
2. High Relief - nesting sites are high above the surrounding terrain on cliffs;
3. Inaccessibility - nests are located so that "anything without wings" cannot reach them.
4. Darkness - most nests are placed so that they do not receive any direct sunlight throughout the nesting period.
5. Unobstructed Flyways - the area in front of the nest is free of any obstructions.
6. Nest pockets - cracks, crevices, pockets, or small ledges are required for nest placement (Knorr pers. comm.)

Nesting sites are typically surrounded by coniferous forests often Mixed Conifer or spruce-fir but this varies depending on elevation and aspect and may include Mountain Shrub, Aspen, or even Alpine components. Streams that create the waterfalls are typically Mountain Riparian habitats but may also occur at lower elevations in the canyon country.

HABITAT AND/OR POPULATION OBJECTIVES:

1. Maintain flow and water quality of waterfall-producing streams in middle to high elevations (> 1820 m [6000 ft]).
2. Waterfalls should be protected from intensive human disturbance during the breeding season (June - early September).
3. Increase number of breeding areas to 20 statewide with at least 6 pairs per site.

ASSUMPTIONS:

1. 20 breeding sites is sufficient to maintain a stable population of Black Swifts.
2. Black Swifts can be reliably detected for inventory and monitoring purposes.
3. Stream flow and water quality can be maintained or enhanced to provide suitable breeding sites.
4. Black Swift requirements for suitable breeding habitat are correctly identified.
5. 20 breeding sites can be discovered, enhanced, or created in mountain (possibly canyon) areas of the state.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: There is no comprehensive inventory of waterfalls in Utah. In order to assess the distribution and status of Black Swifts in the state, an inventory of suitable waterfalls must be done. This will include identifying Utah waterfalls and assessing whether they exhibit the habitat characteristics required by Black Swift.

Black Swifts are listed as sensitive, due to declining populations and limited distribution, on the Utah State Sensitive Species list. While the Utah population is too small to reliably detect population trends, the range wide Black Swift population appears to be declining by about 6% per year ($p = 0.20$) over the last 30 years (Sauer et al. 1997). Reasons for this decline are unclear. Most waterfalls in Utah are not presently threatened with destruction; however, reductions in stream flows (either natural or from water diversions) may reduce waterfall flows during the breeding season and cause permanent streams to become intermittent. Reductions in water quality could effect both emergent insects (prey base) and potentially contaminate nestlings. Reductions in air quality could also effect prey species. Alteration of Mountain Riparian habitats or adjacent upland habitats could effect Black Swifts by degrading water quality. The use of pesticides could reduce the availability of insect prey.

Black Swift management issues (in italics) and recommendations are listed below:

Habitat Loss and Modification

1. Protect flow to all permanent waterfalls in the state.
2. Restore flows to intermittent or dry waterfalls that were historically permanent.
3. Maintain or restore pristine water quality to all streams above waterfalls.
4. Protect, enhance, and restore habitats in and adjacent to streams which create waterfalls.
5. Protect Black Swift nesting areas from disturbance by humans and predators.

Lack of Habitat

1. Create artificial waterfalls where conditions are feasible and suitable for Black Swift colonization.
2. Enhance existing waterfalls that lack the ecological requirements for Black Swift nesting (e.g., create nesting pockets).

Pesticide Use

1. Avoid use of pesticides in Mountain Riparian habitats and areas adjacent to riparian areas.
2. Avoid use of persistent and bioaccumulating pesticides within 16 km (10 mi) of known Black Swift nesting sites.

Human Disturbance

1. Eliminate intense and repeated human disturbance of nesting areas from 1 June - 15 September.

Implementation Opportunities

1. Increase cooperation between state and federal agencies and private organizations regarding Black

Swift (waterfall) inventory, conservation and management.
2. Increase awareness of public regarding importance of waterfalls, riparian habitat, and water quality to Black Swifts and other birds.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

1. Annually, over a 5-year period, survey (inventory) all waterfalls in the state to determine current flow regimes, water quality, and habitat suitability as well as presence/absence and breeding status of Black Swifts.
2. Inventory all waterfalls and determine where suitable and restorable swift habitat occurs; all suitable habitats should then be surveyed for presence of swifts as in number 1 above.
3. Monitor Black Swift populations annually for density, site occupancy, nesting success, productivity and, if possible, adult and juvenile survival (recruitment) and return rate to determine current population trends.
4. Monitor quality (water quality, flow, and ecological requirements) of presently suitable habitat and restored unsuitable habitats.
5. Determine feasibility of creating artificial waterfalls for Black Swifts.
6. Determine demographic and genetic characteristics of Black Swift populations, particularly adult and juvenile survival, dispersal potential, and whether swift populations function as metapopulations.
7. Determine life history characteristics of Black Swifts nesting in Colorado and Utah including identification of wintering grounds (cooperate with other western states and Latin American countries).
8. Determine factors that may effect Black Swift populations and their habitats on breeding and wintering grounds (cooperate with other western states and Latin American countries).
9. Determine the effects of pesticides on Black Swifts including indirect effects of prey reduction in riparian and foraging areas.
10. Determine effects of upstream (above waterfalls) impacts such as grazing, water diversion, and timber harvest on maintenance of Black Swift habitat.
11. Determine effects of water quality on swift nesting and juvenile survival.

OUTREACH NEEDS

Land managers and the general public need to be made aware of the importance of waterfalls to this extremely rare species. Outreach efforts should have the primary goal of soliciting information on the location of waterfalls in Utah. Waterfalls are popular hiking destinations; however, precise locations of waterfalls are rarely recorded. The UDWR is preparing a questionnaire to be distributed to land managers, hiking clubs, etc. in an attempt to inventory waterfall locations and assess gross suitability (height, permanence, relief) for Black Swifts. Land and wildlife management agencies should inventory waterfalls and assess their suitability as Black Swift habitat. Suitable falls should be surveyed for Black Swift presence; this could be done by UDWR, agency biologists, and/or volunteers (with adequate training). A Black Swift habitat assessment and bird survey form and accompanying protocol is available from UDWR. Identifying Black Swifts can be extremely difficult. An identification fact sheet should be prepared and distributed to agencies and bird clubs.

BLACK-NECKED STILT
(*Himantopus mexicanus*)

Conservation Priority Score of 34

Ray Kirkland

ASSOCIATED SPECIES: Other bird species that may respond similarly to habitat components used by the Black-necked Stilt are: Wilson's Phalarope, American Avocet, Long-billed Dowitcher, Marbled Godwit, Willet, Baird's, Least, and Western Sandpipers, and the Greater Yellowlegs.

DISTRIBUTION: Distribution of the Black-necked Stilt, like that of the American Avocet, is highly dependent on suitable local habitat, making the breeding range somewhat spotty and localized. The Black-necked Stilt breeds in North America in the western and west-central United States, the Gulf and Atlantic Coasts, Baja California, western Mexico, southwest-central Canada, and portions of the Bahamas and West Indies.

The Black-necked Stilt breeds locally on the Atlantic coast from southern New Jersey, southeastern Pennsylvania, Delaware, Maryland, and Virginia south to southern Florida, in Bermuda, and the West Indies from the Bahamas south to Antigua, St. Kitts, and Montserrat), and from central coastal California, western Oregon, Washington, east to southern Alberta, southern Saskatchewan, and eastern Montana, south to western and central Nebraska, central Kansas, north-central Oklahoma, and central Texas, and southeast to southeastern Missouri, Arkansas, southwestern Kentucky, western Tennessee, and along coastal Texas east to southern Louisiana, southern Mississippi, and southern Alabama south through Central America and South America (including the Galapagos Islands, islands off Venezuela, and Tobago and Trinidad) to coastal and Andean Peru, eastern Ecuador, and Amazonian Brazil. Recorded in summer and probably breeding in North Dakota and western South Dakota (American Ornithologists' Union 1998, Terres 1991, Peterson 1990, National Geographic Society 1987).

Breeding in Utah occurs on mudflats and shorelines in the Wetlands associated with the Great Salt Lake, Utah Lake, the Bear and Malad Rivers in northern Utah, the Logan and Little Bear River in Cache Valley (Hayward et al. 1976; at Bear River Migratory Bird Refuge in Box Elder County (Roy 1998); and, in the Uinta Basin at Ouray National Wildlife Refuge and other reservoirs in Uinta County (Sjostrum 1998, Hayward et al. 1976); at Fish Springs National Wildlife Refuge in Juab County (Banta 1998, Ryser 1985); in the Wetlands surrounding Clear Lake Waterfowl Management Area (WMA) near Delta in Millard County (Zubeck 1998); at Blue Lake WMA south of Wendover in Tooele County; at Desert Lake WMA south of Price in Grand County; and in the Scott M. Matheson Preserve north of Moab in also in Grand County (McIvor 1998).

The stilt winters from Northern California, Sonora, the Gulf Coast, and central Florida south locally through Central America, the West Indies, and South America to the limits of the breeding range (American Ornithologists' Union 1998, Terres 1991)). Resident populations occur in coastal southern

California, western Mexico, the Gulf Coast, and southern Florida (Peterson 1990, National Geographic Society 1987).

ECOLOGY: The primary foods for the Black-necked Stilt are invertebrates of the water column and flying insects near the water's surface including brine shrimp (Artemia), water boatmen (Order Hemiptera, Family Corixidae), beetle larvae (Order Coleoptera), flies and fly larvae (Order Diptera), mosquitos and midges (Order Diptera, Family Chironomidae); terrestrial invertebrates including grasshoppers; small fish, crayfish, and seeds, especially sago pondweed (*Potamogeton* spp.) and bulrushes (spp.). Stilts forage on bare ground and while wading in water in depths up to 15 cm, usually in water fresher than avocets prefer. They do not usually swim and forage as the avocet does (Bent 1927). The stilt's principal hunting technique is pecking-seizing insects on or near the surface of the water or on land while standing still or walking slowly (Ryser 1985). Black-necked Stilts can be found foraging along the shallow borders of freshwater and alkaline lakes, brackish ponds, salt marshes, and wet pastures (Terres 1991).

The birds arrive in Utah in early April (Roy 1998). Very little information exists as to where and when pair formation occurs among stilts. Observations made by Sordahl in the 1970's suggest that Black-necked Stilts do not form pair bonds until reaching the breeding grounds (Sordahl 1984). Further observation notes that some stilts remain in pairs after the breeding season at migration stopovers; however, it is also noted that males and females differ in their migratory behavior on wintering ranges (Robinson and Oring 1996). More research will be required to fully understand the breeding behavior of Black-necked Stilts, particularly away from the breeding grounds. Stilts build their nests in loose colonies, sometimes with avocets; however, it appears that stilts will put more distance between their nest and another stilts than an avocets (Sordahl 1996). Site selection is similar to that of avocets-in very sparse vegetation in an area affording an unobstructed view all around. Locations are generally on islands, when available, on dikes, or other areas associated with the water's edge. Nests are built on the ground, scraped into bare mud usually near patches of saltgrass or salicornia (*Distichlis* spp., *Salicornia* spp.), and then lined with small bits of weeds, grasses, twigs, shells, or bones (Sordahl 1996, Terres 1991). The Black-necked Stilt is a monogamous species. It is believed that both sexes share in the site selection and building of the nest, but there is little written documentation of this. An average clutch size for the Black-necked Stilt is 4 eggs. The eggs are pyriform to long pyriform shaped, approximately 3cm x 4.5cm, buff colored irregularly marked with dark brown or black spots. Incubation is shared by both sexes, alternating throughout the day and night, and lasts 22-26 days (measured from the day the first egg is laid to the day first egg is hatched. Chicks are hatched precocial, downy, and able to feed themselves (Erlich et al. 1988). After a day or two the parents move the brood to areas more suitable for feeding and hiding from predators. The brood is cared for by both parents, but as the chicks mature the parents will begin to leave the brood. At about day 28 the young are able to fly, and are usually on their own, the parents having departed 1-2 weeks earlier (Sordahl 1996, Terres 1991). Similar to avocets, stilt juveniles will spend time in flocks with other stilts and depart for wintering grounds in small flocks beginning in August and throughout September. Birds have been observed at Bear River Refuge as late as mid-November (Roy 1998).

HABITAT REQUIREMENTS: Black-necked Stilts breed in fairly specific habitat regimes similar to the American Avocet. Their somewhat spotty breeding range is indicative that breeding occurs in specific suitable areas. Nesting occurs in areas with salt ponds, potholes, or shallow alkaline Wetlands. It also occurs in some mudflats of inland lakes and impoundments and evaporation ponds. The alkaline Wetlands are characterized by the presence of common cattail (*Typha latifolia*), bulrushes (*Scirpus* spp.), and sedges (*Carex* spp.); however, most time is spent in more open areas with no vegetation or with sparse vegetation consisting of glasswort (*Salicornia* spp.), saltgrass (*Distichlis* spp.), or greasewood (*Sarcobatus* spp.). The birds feed in open water generally fresher than that chosen by avocets from 0-15 cm deep, or on dry ground. The nests are usually built on islands or dikes with sparse vegetation. In desert Wetlands, Utah in particular, stilts nest along the lake shoreline among scattered patches of vegetation, along barren mudflats, or upon small patches of vegetation over water. Wintering habitats include intertidal mudflats and brackish-water impoundments (Robinson et al. 1997).

HABITAT AND/OR POPULATION OBJECTIVES:

HABITAT OBJECTIVES:

1. Work to establish and maintain important habitats for American Avocets and Black-necked Stilts within each of the managed Wetland habitat complexes that are found in association with Great Salt Lake, Utah Lake and Cutler Marsh.
2. Maintain situations where fresh water and saltwater complexes are in close proximity to one another.
3. Work to ensure no additional loss of existing natural Great Salt Lake shoreline habitats to anthropogenic activities.
4. Work with the Divisions of State Lands and Parks and Recreation to restrict off-road vehicle use in important foraging habitats, especially on the south shore of Great Salt Lake.
5. Insure that Black-necked Stilt habitat issues are addressed as conservation action is implemented through ongoing State Wildlife Management Area procedures.

POPULATION OBJECTIVES:

1. Strive to maintain a breeding population of Black-necked Stilts of at least 25,000 pairs within the Great Salt Lake ecosystem. Fall staging numbers should be at least 40,000 birds.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: The Intermountain West region is the most important breeding area for B lack-necked Stilts in North America. The current goal under the United States Shorebird Conservation Plan is to maintain Black-necked Stilt populations. The change status (e.g., increasing or decreasing) of Black-necked Stilts is presently unknown (Brown et al. 2001).

Breeding, migration, and wintering habitat for Black-necked Stilts has been observed to be similar to that of the American Avocet (*Recurvirostra americana*) (Robinson and Oring 1996, Sordahl 1996). The management issues and concerns mentioned below were, for the most part, written about avocets; however, they apply to stilts as well.

Wetland losses and deterioration across the Western United States have led to population declines of American Avocets and Black-necked Stilts. Breeding and staging areas have been lost or degraded due to development, agricultural diversions, and urban water storage and flood control projects. Increased salinization from agricultural drain water, surface flow, and subsurface flow is a serious problem in many inland Wetlands. The increase in salinization has wide-ranging impacts upon an ecosystem, and will have significant impacts on breeding avocets and stilts. Many Wetlands used by American Avocets and Black-necked Stilts have been contaminated as a result of irrigation and other human activities. Selenium pollution has been documented as a widespread problem associated with irrigated agriculture in many western states (Robinson et al. 1997, Helmers 1992). The ephemeral nature (both seasonally and multi-year) and patchy distribution of Wetland habitats in the Great Basin create challenges to breeding and migrating populations of avocets and stilts. One study was conducted to examine how avocets used these Wetlands (Plissner 1998). Avocets and stilts demonstrate wide-ranging and highly variable dispersal patterns; however, there is a lack of understanding and knowledge of migratory routes and wintering sites in Mexico for either avocets or stilts. There is conflict among management priorities for various shorebird species, and there is no mechanism bringing all federal, state, and private interests together for the purpose of setting regional priorities (Haig and Oring 1998).

Black-necked Stilt management issues are listed here in italics. Below each issue are conservation recommendations.

Habitat Loss and Degradation

1. Develop local and regional Wetland conservation plans with the cooperation of local government, resource managers, and landowners.

Contaminants

1. Require contaminant discharges to provide mitigation habitat targeted for Black-necked Stilts and other shorebirds.

Habitat Distribution and Use by Black-necked Stilts

1. Consider large-scale habitat connectivity strategies for Great Basin Wetland ecosystems.
2. Conduct long-term monitoring of Black-necked Stilt breeding, migrating, and wintering populations.

Setting Management Priorities

1. Develop an organization dedicated to establishing regional and local priorities based upon the potential contribution of different areas to global biodiversity (Haig and Oring 1998).

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

1. Continue the assessment of Black-necked resources in Utah and the Great Basin.
2. Identify interactions among water quality and quantity, invertebrates, plants, and birds in Great Basin ecosystems.
3. Develop management techniques specifically aimed at increasing productivity.
4. Increase the knowledge and understanding of migratory routes and wintering sites and the behavioral characteristics at these sites.
5. Increase the knowledge and understanding of the energetics and nutrition of the Black-necked Stilt.
6. Continue to explore and expand the understanding of impacts of irrigation drainwater contamination on adults and juveniles.

OUTREACH NEEDS

1. Educate managers, local governments, and the community as to the importance of Wetlands to birds as well as the economic and cultural values.
2. Work with recreationists and land managers to restrict boat and vehicle use in important nesting and foraging areas during he breeding season.

BROAD-TAILED HUMMINGBIRD
(*Selasphorus platycercus*)

Conservation Priority Score of 33

UDWR Archives

The Broad-tailed Hummingbird is *the* hummingbird of the Rocky Mountain region (Bent 1953). The species is essentially a mountain bird, and it is common throughout Utah. It has been described as the most common species in Utah, and it occurs in every part of the state. The Broadtail appears in the lower valleys in April and later nests near streams in the valleys and at higher elevations.

The Broadtail is most conspicuous wherever it occurs. The wings of the male make a loud shrill whirring or buzzing noise in flight which is characteristic of summer in the mountain west. Breeding males defend their territory in U-shaped flight displays which they perform in a pendulum fashion consisting of a series of power dives. The male will fly vertically to a height of 9 or 12 m (30 or 40 ft) before turning to dive vertically over the nesting area. The vertical climb is then repeated, and these breeding males perform these flights repeatedly during the day over the nesting area (Bent 1953, Hayward et al. 1976, Ryser 1985, Kaufman 1996).

Dorsal coloration of both males and females is iridescent green. Males have a gorget that is rose-magenta colored which is similar in color to the gorget of the eastern Ruby-throated Hummingbird. Many of the bright iridescent colors of hummingbirds are created more by the structure of the feather than by pigments. The pigment may be brown or gray, but is overlaid by transparent cells that are structured to reflect only certain colors of light. When the angle between an observer, the feather (hence the bird), and the light source, a brilliant color becomes visible. This explains why the bright reds, blues, purples, or greens of hummingbird gorgets seem to flash on and off as the birds move, turning to dull black in the shade. The green dorsal feathers are also iridescent but are structured to reflect the color in more directions and thus is usually more visible.

ASSOCIATED SPECIES: In Utah, the primary breeding habitat for Broad-tailed Hummingbird is Lowland Riparian with secondary breeding habitat as Mountain Riparian. Some of the species associated with the Broadtail in these two habitats can also be found in both lowland as well as Mountain Riparian. At least 25 species like the Broadtail occur in both habitats to include American Dipper, American Goldfinch, American Redstart, Black-capped Chickadee, Black-headed Grosbeak, Cedar Waxwing, Cooper's Hawk, Gray Catbird, Great Horned Owl, Hairy Woodpecker, House Wren, Lincoln's Sparrow, Long-eared Owl, Northern Flicker, Northern Pygmy-Owl, Song Sparrow, Townsend's Solitaire, Warbling Vireo, Western Screech-Owl, Western Wood-Pewee, White-crowned Sparrow, Willow Flycatcher, Yellow Warbler, and Yellow-breasted Chat (Utah Partners in Flight 1999).

At least 72 additional species are commonly found in Lowland Riparian but not in Mountain Riparian habitat in Utah to include Abert's Towhee, American Crow, American Kestrel, American Robin, Bald Eagle, Barn Swallow, Bell's Vireo, Belted Kingfisher, Bewick's Wren, Black Phoebe, Black Swift, Black-billed Magpie, Black-crowned Night-Heron, Black-tailed Gnatcatcher, Black-throated Gray Warbler, Blue Grosbeak, Blue-gray Gnatcatcher, Brown Creeper, Brown-crested Flycatcher, Bullock's Oriole, Cassin's Finch, Cassin's Kingbird, Cliff Swallow, Common Black-Hawk, Common Grackle, Common Nighthawk, Common Poorwill, Common Yellowthroat, Crissal Thrasher, Dark-eyed Junco, Double-crested Cormorant, Downy Woodpecker, Eastern Kingbird, European Starling, Evening Grosbeak, Gambel's Quail, Great Blue Heron, Great-tailed Grackle, Green Heron, Hooded Oriole, House Finch, House Sparrow, Inca Dove, Indigo Bunting, Ladder-backed Woodpecker, Lark Sparrow, Lesser Goldfinch, Lesser Nighthawk, Lewis's Woodpecker, Lucy's Warbler, MacGillivray's Warbler, Merlin, Mourning Dove, Northern Rough-winged Swallow, Northern Goshawk, Peregrine Falcon, Phainopepla, Pine Siskin, Red-tailed Hawk, Spotted Owl, Spotted Sandpiper, Spotted Towhee, Summer Tanager, Townsend's Solitaire, Veery, Verdin, Vermillion Flycatcher, Western Kingbird, White-winged Dove, Wild Turkey (Rio Grande), Yellow-billed Cuckoo, Yellow-rumped Warbler (Partners in Flight 1999).

An additional 21 species are commonly found in Mountain Riparian but not Lowland Riparian habitat in Utah to include Bushtit, Calliope Hummingbird, Chipping Sparrow, Cordilleran Flycatcher, Dusky Flycatcher, Fox Sparrow, Hermit Thrush, Least Flycatcher, Mountain Bluebird, Mountain Chickadee, Orange-crowned Warbler, Northern Saw-whet Owl, Plumbeous Vireo, Red-naped Sapsucker, Ruffed Grouse, Swainson's Thrush, Tree Swallow, Violet-green Swallow, Western Tanager, White-tailed Ptarmigan, and Wilson's Warbler (Partners in Flight 1999).

DISTRIBUTION: The breeding range of the Broad-tailed Hummingbird extends discontinuously from eastern Guatemala north through Mexico north in the western United States through east-central California, Arizona, New Mexico, Colorado, west Texas, to Nevada, Utah, Wyoming, southwestern Montana, and northern Wyoming. The Broadtail is a common breeder in the eastern and central parts of the Great Basin. It is common throughout Utah and across eastern and central Nevada to as far west as the Pine Forest Range in Humboldt County, the Toiyabe Ranger in Lander and Nye counties, and the White Mountains in Esmeralda County and adjacent California. It is considered accident in the northwestern portion of the Great Basin, and there are no modern records for the Broadtail in the west central Great Basin.

The Broad-tailed Hummingbird spends the winter in mid-elevation portions of west-central Mexico from southern Nayarit and northern Jalisco and Guanajuato south to Morelos and central and southern Oaxaca (west of the Isthmus of Tehuantepec). Casual to accidental occurrence in winter has also been reported for southern California and in the Rio Grande Valley of Texas (A.O.U. 1998, Bent 1953, Curson et al. 1994, Kaufman 1996, Ryser 1985).

Ridgway found the Broadtail abundant in Utah as early as 1869. Other early naturalists also recorded the species as common within the state, and many collections of both birds and nests have been made in past times from various locations statewide. Overall, early ornithological records for Utah mention the Broadtail as a common species statewide. Earliest occurrence date for the state is March 18 and the latest is September 30. Most recorded observations are for July. No current estimates are available as to the number of breeding pairs occurring in Utah. Historical nesting records for the state include Box Elder County (1948 & 1958), Cache County (1937), Carbon County (1932), Duchesne County (1954), Juab County (1950), Kane County (1946), Millard County (1965), Salt Lake County (1898, 1910, 1913, 1914, 1925, 1928, 1930, 1931, 1932, and 1946), San Juan County (1935), Summit County (1869, 1929, 1930, 1931, 1932, and 1944), Uinta County (1937 and 1954), Utah County (1893, 1898, 1902, 1908, 1929, 1938, and 1941), Washington County (Zion National Park, 1965), and Weber County (1973 and 1974) (Behle and Perry 1975, Behle 1981, H. Frost unpublished data).

In Utah, the Broadtail breeds in riparian or adjacent habitats both in lower valleys and at higher elevations. While stream-side habitat is preferred irrespective of elevation, Broadtails in Utah have also been recorded as breeding in Aspen, Ponderosa Pine, Engelmann spruce, subalpine fir, and Douglas fir dominant habitats (Behle 1981, Ryser 1985, Calder and Calder 1992). Breeding in Utah has been confirmed from as high as 3,170 m (10,400 ft) to as low as 1,370 m (4,500 ft) (Behle 1981, H. Frost unpublished data). In the Uinta Basin, the most common occurrence of the Broadtail was at approximately 2,133 m (7,000 ft) (Behle 1981). The Broadtail is also commonly found at 1,830 m to 1,890 m (6,000 - 6,200 ft) in portions of Wasatch and Uinta National Forests in north-central Utah (J. Parrish, pers. obs.).

Statewide, the majority of Broadtail nests typically occur at the 1,830 to 2,440 m (6,000 - 8,000 ft) elevation most commonly in stream side habitat and at the edge of adjacent patches of box elder or oak mixed with various shrubs. Occurrence at extremely high elevations is uncommon in Utah but does occur in conjunction with seasonal behavior patterns. At least three occurrences of Broadtails in Utah above 3,415 m (11,200 ft) (well above timberline) have been recorded. In each instance, the observations occurred late in the typical breeding season, and individuals observed were either females or immatures that were probably post-breeding wanderers (Behle 1981).

Approximately 2% of total point counts conducted in Utah riparian habitat statewide for Neotropical migratory birds during breeding periods from 1992 - 1998 were Broad-tailed Hummingbirds. Approximately 85% of the Broadtails recorded were counted in the Utah Mountain (63%) and Basin and Range (22%) physiographic regions which comprise approximately the western-most two-thirds of the state (Howe et al. 1999).

ECOLOGY: In Utah, the Broadtail is typically more common during periods of migration than during the summer (Behle 1981). However, migration routes, departure/arrival dates, etc., in Utah and elsewhere are unknown. Likewise, habitat preferences during migration are also unknown. Weather patterns, photoperiod, and flower availability are likely key factors in triggering and sustaining migratory restlessness during both spring and fall periods.

In spring migration, males reach southern Arizona in late February or early March, northern Arizona in early April, Colorado in late April to late May, Wyoming in mid-May, and the northern limits of the range in Idaho by late May (Calder and Calder 1992). In Utah, most spring arrival dates recorded are for early May. Behle and Perry (1975) report an early spring date of mid-March (18th), which was likely a reflection of unseasonably warm weather. Spring arrival dates are generally associated with blossom appearance in various species of wildflowers.

Habitat preferences during migration are unknown. Males typically depart breeding areas earlier than females and juveniles, and older-aged individuals typically return earlier in spring. Early arriving individuals frequent artificial feeders daily until local natural foraging is available from wildflower blossoms. Late fall departure dates are September 16 for Wyoming, September 21 for Colorado, September 30 for Utah, and October 5 for New Mexico. Broadtails are casual during migration to the east as far as Nebraska and central Kansas, eastern and southeastern Texas, and to the west as far as Oregon and coastal California. Prior to fall departure for wintering grounds, individuals reportedly increase body mass by as much as 50-59% (A.O.U. 1998, Bent 1953, Calder and Calder 1992, Curson et al. 1994).

In Mexico, breeding and winter range overlap extensively. Broad-tailed Hummingbirds winter from the highlands of northern Mexico south to western Veracruz and Oaxaca and within the breeding range in Chiapas and Guatemala. Broadtails regularly occur during winter along coastal Texas and southern Louisiana, casually to southern Mississippi, southern Alabama, Georgia, and also southern Arkansas.

Winter habitat in Mexico consists of oak forest with pines and cypress interspersed at elevations of 2,300 - 3,000 m. At higher elevations, fir forests mixed with oaks are preferred. Locally, Broadtails become a subordinate species and feed at flowers not preferred by larger and/or resident hummingbirds at an elevation of 1,500 - 2,500 m. In humid pine-oak forests above 2,500 m, various species of non-hummingbird flowers with open, cup-shaped corollas are used for foraging. Sap is used as a nectar substitute, and insect foraging occurs both on the wintering grounds and during breeding periods throughout the range (A.O.U. 1998, Bent 1940, Calder and Calder 1992).

Breeding begins in early May in the southern portions of the Broadtail's range and early June in the north; breeding usually ends by mid-August. Typically one, but possibly two broods are raised each season (Baicich and Harrison 1997, Kaufman 1996, Calder and Calder 1992).

Nesting coincides with availability of flower nectar. After mating, male and female Broadtails go their separate ways. The female raises the young completely by herself. Males that are successful at mating are promiscuous but likely many males fail to mate each year. Males are very aggressive in holding their territories all summer, but high turn-over can occur from year to year (based on results of banding studies). Since males do not participate in the incubation of eggs or rearing of young, they spend all of their energy attempting to attract females throughout the breeding season.

Nests are from as low as 0.9 cm (3 ft) to as high as 9 m (30 ft) above the ground and are often found overhanging a stream. Reoccupancy of nests has been reported with the same female returning in subsequent years, but different females are known to use the same site in succeeding years, selecting for a covered overhang and clear escape route as their predecessor. Nests are constructed entirely by the female and can take up to 5 days. Acquiring nesting material is a major investment energetically, especially in cooler environments, and occurs during times when energy demands for egg synthesis are high. The exterior of the nest is often camouflaged with lichens, bark fragments, and moss. The inside of the nest is lined, typically with spider webbing or other soft material such as the "cotton" like material associated with cottonwood trees.

First egg dates vary from year to year by as much as 15 days, depending on snow-melt and floral phenology. Usual clutch size is 2 eggs. Incubation is accomplished by the female alone and lasts for 14 - 17 days. Young are altricial and dark-skinned and are tended by the female alone. Young leave the nest and take their first flights at approximately 23 days of age (Baicich and Harrison 1997, Kaufman 1996, Calder and Calder 1992, Curson et al. 1994, Bent 1953).

The earliest recorded nesting of Broadtails in Utah occurred in 1869 in Parley's Park near Snyderville in Summit County at an elevation of 2,133 m (7,000 ft) (Ridgway 1875). Females occasionally experience difficulty in finding enough food for themselves and their nestlings. Male Broadtails defend choice feeding areas with the best nectar-producing flowers, and females are often restricted to widely scattered flowers where nectar quantity is low and when they often must compete with other resident males for foraging. If a female experiences limited foraging time, she may go into cold torpidity at night while incubating eggs or brooding young which can extend incubation and fledging time. Cooperative breeding and brood parasitism have not been recorded. Females have abandoned normal healthy chicks in response to declines in food supply due to drought or freezing conditions or excessive competition that limit flower availability (Calder and Calder 1992).

Trend data for the Broad-tailed Hummingbird are varied. North American Breeding Bird Survey (BBS) data indicate a net stable to increasing population throughout the breeding range. However, point counts conducted in Utah riparian habitat statewide for Neotropical migratory birds during breeding periods from 1992 - 1998 indicate a significant declining trend for Broad-tailed Hummingbirds throughout Utah (Howe et al. 1999). Broadtails may suffer severe declines during winter. For instance, the winter of 1957-1958 was likely responsible for less than one-fourth of the breeding population returning from wintering territories to attempt to nest during 1959. Geographical or temporal trend information for Broadtails is lacking.

Threats are largely unknown. More data on breeding and wintering ecology is needed. Popularity of feeders has led to widespread artificial energy subsidy which may unnaturally maintain populations in times of natural flower scarcity. Tree-cutting may allow flowers to achieve greater abundance than under a forest canopy. Long-term effects due to climate are unknown. Electric livestock fences with red-colored insulators pose a potential hazard to Broadtails, particularly females, that are attracted to these objects thinking they are flowers and are electrocuted. Automobile collisions and windows that reflect open sky are other hazard sources for Broadtails and other hummingbird species.

HABITAT REQUIREMENTS: In addition to the habitat preferences listed above, the Broad-tailed Hummingbird typically requires stream side areas adjacent to open patches of meadows or grasses with good quantities of wild flowers available throughout the breeding season. Principal species used for foraging during the early stages of the breeding cycle include various species of larkspur (*Delphinium* spp.), scarlet gilia (*Ipomopsis aggregata*), and Indian paintbrush (*Castilleja* sp.). Generally, species with red-tubular flower such as red columbine (*Aquilegia elegantula*, and *A. triternata*), scarlet gilia, bearded tongue (*Penstemon* spp.), bouvardia (*Bouvardia ternifolia*), scarlet mint (*Stachys coccinea*), and red-flowered hedgehog cactus (*Echinocereus triglochidiatus*) are used extensively when available. During migration, other nectar sources are also used, including numerous species not typically considered as “hummingbird flowers”. In late summer, montane meadows with paintbrush, larkspur, Mexican fire pink (*Silene laciniata*) are used (Calder and Calder 1992).

HABITAT AND/OR POPULATION OBJECTIVES: Habitat or population parameters have not been established for the Broad-tailed Hummingbird in Utah as a management objective. Specific data such as density and territory size for the species in Utah are sparse, although life history requisites are likely similar in appropriate habitat throughout most of the species’ range.

During the breeding season, home range and breeding territory vary. Males typically defend the higher quality foraging habitat while females build, defend, and maintain the nest in higher quality habitat for nesting. Although the two areas are often adjacent or co-occur, females are forced to forage over a broader area due to the aggressive nature of territorial males holding quality foraging areas. In Colorado a density of 1.1 Broadtails/ha (1.1/2.47 ac) was recorded based on mark-recapture studies. In the same study, an average inter-nest distance of 107 m (351 ft) was also recorded.

Density estimates are difficult to assess. Unquestionably habitat quality is a primary consideration, but abundance in a given area may be strongly influenced by the availability of artificial feeders. Data on mortality and reproductive success and the relationship of these life history parameters to flower availability and weather are lacking.

Males are intensely territorial through the mating period and issue vocal challenges which are followed by chasing if unsuccessful at repelling intruders. Chase frequency apparently depends on resources available and the potential competitors that are attracted into the defending male’s territory. Females are apparently aggressive towards defending males but typically are forced to forage over a broader area to meet resources demands. Territory size is apparently associated with resource distribution and density of Broadtails and other hummingbirds in a given area.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Management requirements for the Broad-tailed Hummingbird are unknown. Activities that create open areas with meadow or park-type habitat with a suitable density of wildflowers are likely beneficial to Broadtails and other hummingbirds. Livestock grazing likely reduces wildflower availability, but the effects on Broadtail densities from grazing are unknown. Controlled burns that result in a long-term reduction in availability of flowers in breeding areas would not be beneficial to Broadtails. Females will abandon nesting attempt if resources decline substantially.

Timber Harvest—Tree cutting activities for lumber or fuel wood that create open patches and increase density of wildflowers are likely beneficial to Broadtails, but no data are available to support such a contention.

***Fire Management*—**Response of Broadtails to fire effects in Utah or elsewhere is unknown. Likely declines occur immediately after fires that remove nesting and foraging habitat, but burns that promote regeneration of wildflowers and native under story grasses are likely beneficial.

Livestock Grazing—Effects of livestock grazing on Broad-tailed Hummingbirds in Utah is unknown. Grazing practices that reduce the availability of wildflowers or nesting habitat are likely detrimental. Grazing practices for areas known to contain high densities of Broadtails should be modified to provide maximum availability of forage and nesting habitat during breeding periods.

Habitat Loss/Alteration

1. Survey target areas for Broad-tailed Hummingbirds prior to initiating habitat alteration activities
2. Produce landscape scale mosaics of altered and unaltered habitat
3. Prevent invasion of exotic plants
4. Select native seed mixes for revegetation actions
5. Provide some open patches adjacent to or within wooded areas
6. Avoid use of herbicides and insecticides in areas used by Broad-tailed Hummingbirds for nesting and foraging

Fire

1. Limit controlled burns to occur after August 1
2. Use controlled burns that do not promote establishment of cheatgrass monocultures in existing or potential habitats for nesting Broadtails.
3. Create openings and maintain wildflower density in the landscape.

Livestock Grazing

1. Grazing in areas of high Broad-tailed Hummingbird concentration should not be allowed until after 1 August
2. Manage grazing practices (allotments) so as to not reduce density of wildflowers in areas used for nesting and foraging by Broadtails

IMPLEMENTATION OPPORTUNITIES

Habitat and resource managers should be sensitive to the needs of Broad-tailed Hummingbird in areas of known occurrence and to conserve ecological processes and functions to accommodate prolonged use. Considering that a substantial number of avian species co-occur with Broad-tailed Hummingbird in both its primary and secondary breeding habitat, prudent conservation actions would help to insure long-term richness and diversity in those areas where multi-species suites of birds occur.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

Broad-tailed Hummingbird represents a Neotropical migratory species that has been little studied and consequently much of the species' ecology and general life history data are lacking for Utah and other portions of the breeding range. Dispersal, site fidelity, average patch size, edge effects, sensitivities to management activities, population size, population trend, size of range, and distribution trend data are all currently lacking for Broad-tailed Hummingbird in Utah. Multi-year riparian studies statewide indicate that Broadtails are declining over most of the state but reasons for declines are unknown. Perhaps existing riparian study sites are below the elevations used by Broadtails or that quality of riparian habitat is becoming less attractive for nesting and foraging. Evaluate densities of nesting Broadtails with elevation to establish areas potentially available for breeding.

1. Habitat Objectives: A statewide, broad-scale assessment of Broad-tailed Hummingbird occurrence and habitat preferences should be conducted Utah Mountains, Basin and Range, and Colorado Plateau physiographic regions. Based on the results of the statewide assessment, establish a monitoring program to record nesting and behavioral data for Broadtails in Utah. Habitat objectives listed below are recommendations that should improve the knowledge of Broad-tailed Hummingbird in Utah and thereby increase the potential for effective management.
2. Statewide Habitat Assessment: Broad-scale assessment of Broad-tailed Hummingbird habitat, particularly Gambel oak, in the Basin and Range, Utah Mountains, and Colorado Plateau physiographic regions of the state using GAP analysis and the UDWR Critical Habitat Evaluation database. Use results of the broad-scale assessment to develop a Mountain Shrub habitat map for Utah which highlights Gambel oak.
3. Statewide Population Estimate: Critically evaluate existing BBS routes and their effectiveness at monitoring for Broad-tailed Hummingbirds. Establish a statewide database for Broad-tailed Hummingbird using BBS and point count data, federal and state agency files, and other sources as appropriate. Use the Statewide Population Estimate to identify those areas with appropriate habitat that show a high, moderate, or low population size.
4. Identify Management Focus Areas: Using the results of the Statewide Habitat and Population Assessments, identify those areas of suitable habitat for Broadtails that may be in need of management or conservation action. Such potential areas are those that once contained a high density of nesting and foraging habitat within a relatively broad-scale landscape that is otherwise potential habitat for Broadtails. Identify those areas that were once good habitat but are now irretrievably lost for use by the Broadtail and its associated species.
5. Evaluate Potential Threats: Overlay results of the statewide assessments with proposed development scenarios to determine those areas of potential or existing Broad-tailed Hummingbird habitat that are likely to experience alteration or loss. If possible, establish population trend estimates based in part on loss or alteration of existing or potential habitat that is known to occur and establish time lines associated with population trend estimates.

OUTREACH NEEDS

1. Inform agency personnel and the general public as to the results of the statewide assessments and results of the recommended habitat objectives. Inform timber and fire-wood harvesters as to the habitat requirements of Broad-tailed Hummingbird and associated species and solicit their assistance in reducing impacts resulting from their activities.

FERRUGINOUS HAWK
(*Buteo regalis*)

Conservation Priority Score of 33

UDWR Archives

ASSOCIATED SPECIES: Other species that may respond similarly to habitat components used by the Ferruginous Hawk are in two different associations. The cliff breeding habitat contains a different suite of species than open desert or Pinyon-juniper habitats: Cliff associations: Barn Owl, Great Horned Owl, Red-tailed Hawk, Golden Eagle, Prairie Falcon, American Kestrel, Common Raven and Cliff Swallow. Open Desert and Pinyon-juniper habitat: Swainson's Hawk, Red-tailed Hawk, Long Eared Owl, Great Horned Owl, Common Raven, and a series of passerines that are more or less obligates of the Pinyon-juniper forests.

DISTRIBUTION: This species breeds in western North America from southernmost Canada between the Great Plains and Rocky Mountains south to northen Utah and New Mexico (Olendorff 1993). Breeds from southeast Alberta, south Saskatchewan and extreme southwestern Manitoba south through central and western North and South Dakota, western Nebraska, westernmost Kansas, Cimarron and Texas counties Oklahoma, north west corner of Texas Panhandle, and northern New Mexico and Utah west to the Great Basin, Columbia River Basin portions of eastern Oregon and southeastern Washington. Absent from spotty locations within that area such as north eastern Idaho, western Montana, northeastern Wyoming, central Utah, and the Black Hills of South Dakota. One breeding record in British Columbia and its presence in summer in other portions of British Columbia are suspected breeders. Winters primarily in Grasslands and shrub steppes from northern California, western Nevada, central Utah, extreme southern Wyoming , southwestern Nebraska and central Oklahoma south through east-central Texas and Mexico to Baja California, northen Sonora, Durango and Coahuila. Some irregular, and extremely local, winters in central South Dakota, Wyoming, southern Idaho and Oregon (Bechard and Schmutz 1995).

ECOLOGY: In spring this hawk returns to South Dakota in late March while in Utah most return by late February or early March. The primary food are mammals and frequently on few species which change from region to region. West of continental divide usually lagomorphs and pocket gophers. Although in eastern Utah and western Utah eat large numbers of prairie dogs. East of continental Divide typically ground squirrels and prairie dogs (Olendorff 1993). Oscillations in prey cause variable numbers or success in hawk breeding and during low prey years breeding attempts frequently fail. Food is caught during flights of # 100 m from perches; or short-distance strikes from the ground where individual hawk stands near gopher, squirrel, or prairie dog burrows; or aerial hunting at altitudes

< 30 m; or from hovering flight at times when wind is strong (McAnnis 1990). During winter may communally feed in groups of 6-12 birds. Nesting starts generally in March or April depending on latitude. Nest substrates vary throughout range and shows great flexibility from trees and shrubs (49% of 2,119 nests), cliffs (21%), utility structures (12%), and ground outcrops (10%). Locally use haystacks, abandoned buildings, or ground. Since 1980's artificial tower and platform structures (up to 4 m high) are used successfully in many locations (Schmutz et al. 1984). Bulky sticks (e.g., sagebrush) are used for nest construction and through time nests become very large (e.g., < 1.5 m). Density varies regionally and also temporally as prey densities vary. Nests have varied from 0.05/ 100 km^2 (Fitzner et al. 1977 to 11.6 / 100 km^2 (Schmutz et al. 1980). Fall migration is extended from August (young) to late September-early October. There is no known parasitism on them by other species.

HABITAT REQUIREMENTS: During breeding, flat and rolling terrain in Grassland or shrub steppe most used. Avoids high elevations, forest and narrow canyons. Occurs in Grasslands, agriculture lands, sagebrush/saltbush/greasewood shrub lands and the periphery of Pinyon-Juniper forests. The latter is usually at interface between Pinyon-Juniper and Shrubsteppe habitats and especially in outlier trees from main woodlots. Because of strong preference for elevated nest sites cliffs, buttes, and creek banks are usually present (Olendorff 1993). During winter use open farmlands, Grasslands, deserts and other arid regions where lagomorphs, prairie dogs or other major prey items are present (Olendorff 1993).

HABITAT AND /OR POPULATIONS OBJECTIVES: Stop population reductions. Species numbers estimated at 5,842 -11,330 individuals but show reductions in population number. In some areas locally, populations of over 20 pairs have disappeared in the last two decades (Woffinden and Murphy 1989). Thought to be function of prey base loss, removal of nesting trees, or excessive human intrusion during breeding.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: The effects of human activities include: shooting and trapping, collisions with stationary/moving structures or objectives such as automobiles (when feeding on roadside carrion), power lines and large wind mills for wind power, disturbance at nest sites and degradation of habitats by conversion from native to agricultural purposes by chaining/clearing of large, mature juniper stands and replacement with exotic grasses for livestock grazing. Habitat conversion also reduces prey populations such as lagomorphs. The frequence of the first three impacts are not well documented. Increased unregulated use of ORV's disturb nesting individuals, which are particularly sensitive during incubation.

Habitat Conversion

1. Discourage clearing of juniper woodlots and sagebrush shrub lands.
2. Encourage maintenance of native Grasslands for cattle grazing where prey populations may be maintained.

Prey Base Conservation

1. Encourage change in attitude towards jackrabbits and their wanton killing.

Artificial Habitat Enhancement and Reduction of Industrial Activities

1. Where nesting trees have been removed near good foraging lands, erect artificial nesting platforms.
2. Encourage adequate buffer zones around nests in areas of land development (oil, mining etc.).
3. Increase public awareness of conservation issues in areas of development.

Implementation Opportunities

1. Consider habitat needs in agency (USFWS) management plans and projects.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

1. Wintering ecology, especially in Mexico, is poorly known.
2. Dispersal, especially of breeders, is poorly known.
3. Little is known about why some populations have declined or disappeared locally.
4. Better documentation of the species response to management is needed, e.g., what factors cause use and non-use of artificial platforms.

OUTREACH NEEDS

The Ferruginous Hawk is a high profile species that was once considered as a candidate species for listing under the Endangered Species Act. The Ferruginous Hawk remains listed as a Threatened Species on the State Sensitive Species list. At the time the species was petitioned for listing under ESA, little was understood about its occurrence in Utah. In addition, the life history of the species is poorly understood. Studies have been conducted in certain portions of Utah using satellite telemetry in attempts to better understand nesting and overwintering dynamics.

Public involvement in attempting to better understand Ferruginous Hawk dynamics in Utah would be very helpful. Local birding groups should be queried for information in portions of the state where little information is currently available. An information exchange could be established on a local web site whereby volunteers could record sightings and breeding locations that can be passed on to managers. A public information program could be established to update the status and/or trends of the species in Utah.

YELLOW-BILLED CUCKOO
(*Coccyzus americanus*)

Conservation Priority Score of 32

Robert Royse

ASSOCIATED SPECIES: Species which use multi-storied, low-elevation riparian habitats are likely to be associated with Yellow-billed Cuckoos. These species are more common than Yellow-billed Cuckoos and can be expected in many places where cuckoos do not occur; they include Abert's Towhee, Bell's Vireo, Bewick's Wren, Black-chinned Hummingbird, Black-headed Grosbeak, Blue Grosbeak, Broad-tailed Hummingbird, Bullock's Oriole, Cooper's Hawk, Gray Catbird, Great Horned Owl, House Wren, Lucy's Warbler, MacGillivray's Warbler, Mourning Dove, Northern Flicker, Plumbeous Vireo, Song Sparrow, Warbling Vireo, Yellow Warbler, Yellow-breasted Chat.

DISTRIBUTION: The taxonomy of Yellow-billed Cuckoo subspecies is currently being debated. Most authors have recognized both an eastern (*Coccyzus americanus americanus*) and western (*C. a. occidentalis*) subspecies (A.O.U. 1957). Fleischer (2001), however, found only a small genetic difference between eastern and western populations but his analysis also indicated that the populations had recently expanded and may now be genetically separate. It is germane to the purposes of this conservation strategy to treat the Yellow-billed Cuckoo in the western United States as taxonomically distinct. The USFWS (2001) lists the "Distinct Population Segment" of Yellow-billed Cuckoos in the western United States as a "Candidate" for protection under the Endangered Species Act. The cuckoo is also listed as State Threatened in Utah (UDWR 1998). Only the "Western" Yellow-billed Cuckoo occurs in Utah (Behle and Perry 1975). Its historic range included all states west of the Rocky Mountains and extended into southern British Columbia at the northern extent and into the northwestern states of Mexico at the southern limit. Estimates of the number of current breeding pairs range widely; however, it is apparent that the cuckoos' population and range have been largely diminished since Ridgeway (1877) first described the subspecies. Currently, the range of the cuckoo is limited to disjunct fragments of riparian habitats from northern Utah, western Colorado, southwestern Wyoming, and southeastern Idaho southward into northwestern Mexico and westward into southern Nevada and California Cuckoos are long-range migrants which winter in northern South America south to Peru, Bolivia and Argentina in tropical deciduous and evergreen forests (Ehrlich et al. 1988).

Historically, cuckoos were probably common to uncommon summer residents in Utah and across the Great Basin (Ryser 1985, Hayward et al. 1976). Records from the Utah Museum of Natural History (E. Rickart pers. comm.) indicate that eggs were collected in Salt Lake county (1989 and 1913) and at Woodbury Farm (near Virgin River and Washington Fields) in Washington county (1939); skins were collected from Bountiful (1955), Salt Lake City (1946), Capitol Reef National Park (1980) and near Hurricane (1932). The current distribution of Yellow-billed Cuckoos in Utah is poorly understood, though they appear to be an extremely rare breeder in Lowland Riparian habitats statewide (Walters 1983, Behle et al. 1985, Benton 1987). Over the last 10 years, only 3 breeding records exist for this species in Utah. In 1999 and 1998, female cuckoos with brood patches were banded on the Provo River between Deer Creek and Jordanelle Reservoir (J. Parrish pers. comm.); in 1994, an adult was seen feeding a fledged bird in the Moab Slough/Matheson Preserve (N. Boschen pers. comm.); and in 1992, a nest was discovered in the Ouray National Wildlife Refuge (Howe 1993). Recent surveys have identified probable cuckoo breeding sites on the Duchesne (Howe unpubl. data) and San Juan Rivers (Howe 2000). Other sites where several records exist and breeding is possible include the northern Salt Lake Valley, Utah Lake near the mouth of the Provo River, Cedar City, and Beaver Dam Wash (historically cuckoos were resident in Beaver Dam Wash)(Hedges 1985). One of the state's most extensive patches of riparian habitat occurs at the confluence of the Duchesne, White, and Green Rivers on the Uinta and Ouray Reservation. This area has not been surveyed but is likely to contain breeding cuckoos.

ECOLOGY: Yellow-billed Cuckoos are one of the latest migrants to arrive and breed in Utah. They arrive in extremely late May or early June and breed in late June through July. Cuckoos typically start their southerly migration by late August or early September. Yellow-billed cuckoos feed almost entirely on large insects which they glean from tree and shrub foliage. They feed primarily on caterpillars including tent caterpillars; they also feed frequently on grasshoppers, cicadas, beetles and katydids, occasionally on lizards, frogs, and eggs of other birds, and rarely on berries and fruit (Ehrlich et al. 1988, Kaufmann 1996).

Nesting habitat is classified as dense Lowland Riparian characterized by a dense sub-canopy or shrub layer (regenerating canopy trees, willows or other riparian shrubs) within 100 m (333 ft) of water. Over story in these habitats may be either large, gallery-forming trees (10-27 m [33-90 ft]) or developing trees (3-10 m [10-27 ft]), usually cottonwoods. Nesting habitats are found at low to mid-elevations (750-1820 m [2500-6000 ft]) in Utah. Cuckoos may require large tracts (40-80 ha [100-200 ac]) of contiguous riparian nesting habitat; however, cuckoos are not strongly territorial and home ranges may overlap during the breeding season; home ranges can range from 4 to 40 ha (10 to 100 ac). Nests are usually 1.2-2.4 m (4-8 ft) above the ground on the horizontal limb of a deciduous tree or shrub, but nest heights may range from 1-6 m (3-20 ft) and higher. The nest is a loosely arranged platform of twigs lined with softer materials such as grass, rootlets, and dried leaves. Nests are built in 1-3 days. The female lays 1-8 (usually 3) eggs over a period of several days; laying often begins before the nest is complete. Both males and females incubate eggs for a period of 9-11 days beginning when the first egg is laid. Nestlings are altricial and hatch asynchronously over several days. Young are brooded by both adults for 7-8 days before leaving the nest, an unusually rapid development for a bird this size. Young climb on branches for about 2 weeks after leaving the nest until they are capable of flight at about 3 weeks old. Both adults tend the fledglings, and in some cases early fledglings are attended by the male and later fledglings are attended by the female. It is not know whether cuckoos have more than one brood per season in Utah, but multiple brooding has been recorded in California.

Yellow-billed Cuckoo nesting behavior may be closely tied to food abundance. In years of low food abundance, cuckoos may forego nesting; in years when the food supply is abundant, cuckoos may lay a large number of eggs and even parasitize the nests of other species (Nolan and Thompson 1975). Cuckoos are rarely hosts to Brown-headed Cowbirds.

HABITAT REQUIREMENTS: Yellow-billed cuckoos are considered a riparian obligate and are usually found in large tracts of cottonwood/willow habitats with dense sub-canopies (below 10 m [33 ft]). In California, Yellow-billed Cuckoo pairs required a minimum of 10 ha (25 ac) of broadleaf forest at least 100 m (330 ft) wide with at least 1 ha (2.5 ac) of dense nesting habitat. Marginal habitat was described as a minimum of 4 ha (10 ac) of broadleaf forest at least 50 m (165 ft) wide with at least 0.5 ha (1.25 ac) of dense nesting habitat (Gaines and Laymon 1984). Multiple pairs of cuckoos may be found in larger patches > 25 ha (62 ac) and wider strips (> 100 m) of habitat (Laymon pers. comm.). In Arizona, pairs are usually distributed approximately every 0.8 km (0.5 mi) in large blocks of contiguous habitat (Krueper pers. comm.). In the absence of large stands of contiguous riparian habitat, cuckoos in Arizona will occasionally occupy heavily vegetated rural areas adjacent to riparian, and mesquite bosques (Krueper pers. comm.). Gaines and Laymon (1984) stressed that dense, low-level (< 10 m [33 ft]) vegetation is an important factor in selection of nesting areas. They also stated that cuckoos use both areas where trees are developing (3-10 m [6-33 ft] tall) and areas where trees have matured (10-27 m [33-90 ft] tall).

HABITAT AND/OR POPULATION OBJECTIVES:

1. Maintain and increase multi-layered riparian habitats, with dense sub-canopies (< 10 m [33 ft]) at low to middle elevations (750-1820 m [2500-6000 ft]); habitats should consist mainly of native plant species identified in the lowland and/or Mountain Riparian habitat descriptions, particularly cottonwoods and willows. Conserve all suitable habitat in areas where cuckoos are found.
2. The habitat should be at least 250 linear miles (400 km) of the above described habitat in at least 0.8 km (0.5 mi) segments, distributed over the following river drainages: Bear, Ogden, Weber, Provo, Jordan, Strawberry, Duchesne, Green, White, Colorado, Sevier, Beaver, Virgin and smaller streams along the entire Wasatch Range and in the Grand Staircase-Escalante National Monument area.
3. Increase population to at least 50 pairs within 10 years, 100 pairs within 25 years, and 500 pairs within 50 years, distributed as follows: Bear/Ogden/Weber 70 pair, Provo River 40 pair, Green/White/Duchesne River 150 pair, Colorado River 150 pair, Sevier River 20 pair, Virgin River 20 pair, with the remaining 50 pair distributed among the other drainages and associated tributaries and watersheds identified above.

ASSUMPTIONS:

1. 500 pairs of Yellow-billed Cuckoos distributed across Utah's riparian areas is a viable population.
2. Yellow-billed Cuckoos can be reliably detected for inventory and monitoring purposes.
3. Riparian areas at low to middle elevations can be maintained or restored to provide suitable Yellow-billed Cuckoo breeding habitats.
4. Yellow-billed Cuckoo requirements for suitable breeding habitat are correctly identified.
5. Cuckoo populations will have long-term stability if 400 km (250 linear mi) of suitable habitat are provided in 0.8 km (0.5 mi) segments.
6. The population can be increased in 10 years; the population can reach 500 pairs in 50 years.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Yellow-billed Cuckoos are listed as threatened on the Utah State Sensitive Species list and the western population of the cuckoo is classified as a Candidate for federal listing. Riparian habitat loss is the primary reason for decline of this species and riparian habitats support a greater variety of birds than any other habitat type in Utah. As much as 80-95% of Utah's riparian habitats have probably been lost or altered in the last 150 years. And, the absence of dense shrub layers (riparian shrubs and regenerating trees) is a common feature of most existing riparian zones in the state. Causes of riparian loss and alteration include agriculture encroachment, urban encroachment, overgrazing, water development (reservoirs and in-stream flow depletions), channelization, road construction, and recreational impacts. The use of pesticides, particularly larvicides, could reduce the availability of insect prey in and adjacent to riparian habitats. Long periods of extremely hot temperatures may also effect food availability. Repeated disturbance of cuckoo nests may cause abandonment (Krueper in press). Riparian habitat corridors are important for dispersal and migration even where habitats are not suitable for nesting. Large contiguous blocks of wide cottonwood-willow riparian forests are more valuable than smaller, fragmented patches of habitat.

Yellow-billed Cuckoo management issues (in italics) and recommendations are listed below:

Habitat Loss and Modification

1. Establish a "no net loss" policy for riparian habitats.
2. Eliminate destruction of existing native cottonwood-willow dominated riparian forests (Patten 1998) and restore riparian habitats where possible.
3. Eliminate loss of dense shrub layers in existing riparian areas and restore shrub layers where absent.
4. Encourage the use of buffer zones to insure connectivity between riparian habitats and adjacent uplands.
5. Establish corridors between patches of suitable habitat.
6. Manage for large, contiguous blocks of habitat (> 10 ha) in conjunction with removal of competing exotic species (i.e., salt cedar) (Laymon and Halterman 1987).
7. Design developments, i.e., roads, trails, pipelines, housing, etc., to avoid or minimize impacts to riparian habitats.
8. Mitigate all riparian losses at 2:1 ratio.

Lack of Habitat Recruitment (cottonwood-willow forests)

1. Closely monitor grazing, recreational, and other impacts on cottonwood and willow seedlings in riparian systems and reduce or remove sources when seedlings are being impacted.
2. Initiate or maintain flow regimes that mimic natural flow regimes to allow accumulation of sediments and establishment of seedlings.
3. Reestablish proper function in streams and rivers that are not currently functioning properly.
4. Reestablish native vegetation with planting and by promoting natural regeneration (> 10 ha) (Laymon and Halterman 1987).

Pesticide Use

1. Avoid use of pesticides in riparian habitats and areas adjacent to riparian areas. If used, avoid drift and apply nonpersistent pesticides with low bioaccumulation potential.

Demographics (low colonization potential due to fragmented breeding localities)

1. Establish riparian corridors and "stepping stone" habitats to allow dispersal and colonization of suitable habitats.
2. Focus efforts on areas with high potential for successful riparian restoration.
3. Establish high priority target areas near existing suitable habitat, particularly occupied areas, for restoration.

Human Disturbance

1. Eliminate intense and repeated human disturbance of nesting areas from 20 May through 15 August.

Implementation Opportunities

1. Increase cooperation between state and federal agencies, tribal governments, and private organizations regarding Yellow-billed Cuckoo (riparian) habitat inventory, conservation and management.

2. Increase public awareness of riparian habitat importance to Yellow-billed Cuckoos.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

1. Annually, over a 5-year period, survey (inventory) all areas where cuckoos have been recorded, including historical sites, and determine current habitat suitability and presence/absence and breeding status of cuckoos.
2. Inventory all riparian habitats at or below 1820 m (6000 ft) to determine extent and distribution of suitable and restorable habitats; all suitable habitats should then be surveyed for presence of cuckoos as in number 1 above.
3. Monitor cuckoo populations annually for density, site occupancy, nesting success, productivity and if possible adult and juvenile survival (recruitment) and return rate to determine current population trends and assess if a captive breeding program is necessary.
4. Monitor quality of presently suitable habitat and restored habitats, to determine effectiveness of management in preservation and reestablishment of riparian habitat.
5. Monitor restored habitats to determine occupancy and density of Yellow-billed Cuckoos in response to management.
6. Determine demographic and genetic characteristics of Yellow-billed Cuckoo populations, particularly adult and juvenile survival, dispersal potential, and whether cuckoo populations function as metapopulations (cooperate with other western states).
7. Determine the habitat (riparian and adjacent upland) characteristics that effect prey base abundance and availability.
8. Determine whether translocation or reintroduction of cuckoos is feasible based on cuckoo behavior and availability of suitable but unoccupied habitat (cooperate with other western states).
9. Determine whether other non-riparian habitats, e.g., scrub oak, orchards, residential, parks, are being used by cuckoo.
10. Determine the effects of pesticides on Yellow-billed Cuckoos including indirect effects of prey reduction in riparian and adjacent habitats
11. Determine whether breeding habitat requirements differ on a regional basis (cooperate with other western states).
12. Determine effects of impacts of activities such as grazing and recreation on maintenance and recruitment of Yellow-billed Cuckoo habitat.
13. Determine whether food supplementation increases productivity and survival of young Yellow-billed Cuckoos.

OUTREACH NEEDS

Riparian habitats are critical to the majority of bird species in Utah as well as a wide variety of other animal and plant species. These habitats, particularly Lowland Riparian, are threatened by a large number of human activities. The importance of riparian habitats should be the primary focus of outreach efforts; these should be targeted toward the general public as well as state and federal land managers, tribal governments, and private land owners. Identifying and assessing the condition of riparian habitats is a critical step in managing this resource in Utah. Suggestions for conducting a statewide riparian inventory are provided in the Other Considerations-Riparian Inventory section below.

Considerable cuckoo habitat occurs on private and tribal lands in Utah. Outreach efforts should focus on informing these land owners of the importance of and threats to riparian habitats. These efforts should describe management practices and private land stewardship programs (e.g., NRCS) which can benefit both land owners and riparian habitats. While some cuckoo habitats occurs on public lands, private land owner conservation efforts will be critical to recovering the Yellow-billed Cuckoo in Utah.

Several documents regarding management of riparian habitats and assessment of riparian condition are available from state and federal agencies (see Stevens et al. 1999 and its literature cited; available from UDWR). These are primarily for professional land managers, but can be utilized by private land owners with some professional consultation (e.g., UDWR, NRCS, BLM). There are also a variety of web sites that discuss the importance, management, and assessment of riparian habitats.

We recommend creating a Utah riparian web page (possibly as part of the PIF web site) which illustrates the importance of riparian habitats and provides references to available riparian materials and links to riparian web sites.

BLACK-THROATED GRAY WARBLER
(*Dendroica nigrescens*)

Conservation Priority Score of 32

Mike Danzenbcaker www.avesphoto.com

The Black-throated Gray Warbler was first discovered in Oregon and described by Townsend in 1837 (A.O.U. 1998). The species is closely related to both the Townsend's Warbler and Hermit Warbler. Recent mitochondrial DNA analysis indicates that Townsend's Warbler and Hermit Warbler form sister species with the Black-throated Gray Warbler being the basal species in the group. The Black-throated Gray Warbler has a distinct coloration in that the definitive plumage is black, white and grey with a small yellow spot occurring on the lores. Adult males are black on the head and throat with very broad white areas above and below the eye which creates a striped appearance. Upperparts are dark grey streaked with black, and the lower underparts are white with black streaks on the flanks. The wings have two white wing bars. Females and first-year non-breeding males show the same pattern, but the black of the head is replaced largely by dark grey and the throat is mottled with whitish coloration. The small yellow spot on the lores is the only yellow color on the bird. At least two races have been described: *D. n. nigrescens* breeds on the Pacific coast and in the coastal mountain ranges from southern British Columbia to northern California; *D. n. halseii* breeds over most of the range of the species, except for the northwest region occupied by nigrescens. Behle (1985) indicated, however, that according to the detailed descriptions of the range of the two races that halseii does not occur in Utah and most likely should not be recognized. Winter range is incompletely known, although the species has been recorded in western Mexico including Baja California (Bent 1953, Curson et al. 1994, Guzy and Lowther 1997).

ASSOCIATED SPECIES: In Utah, the primary breeding habitat for Black-throated Gray Warbler is Pinyon-Juniper with secondary breeding habitat as Lowland Riparian. Lowland Riparian is also used substantially during migration. At least 18 additional species are commonly found in Pinyon-Juniper habitat in Utah to include Common Bushtit, Cedar Waxwing, Common Nighthawk, Juniper Titmouse, Cassin's Kingbird, Common Raven, Loggerhead Shrike, Bewick's Wren), Mountain Chickadee, Blue-gray Gnatcatcher, Black-billed Magpie, Pinyon Jay, Virginia's Warbler, Black Phoebe, Gray Flycatcher, Western Bluebird, Ash-throated Flycatcher, and White-breasted Nuthatch. At least 57 additional species are commonly found in Lowland Riparian habitat in Utah to include American Crow, American Goldfinch, American Kestrel, American Redstart, American Robin, Bald Eagle, Bank Swallow, Barn Swallow, Bell's Vireo, Belted Kingfisher, Bewick's Wren, Black Phoebe, Black Swift, Black-billed Magpie, Black-headed Grosbeak, Blue Grosbeak, Broad-tailed Hummingbird, Brown-crested Flycatcher, Bullock's Oriole, Cassin's Kingbird, Cliff Swallow, Common Black-Hawk, Common Grackle, Cooper's Hawk, Eastern Kingbird, Gray Catbird, Green Heron, Hooded Oriole, House Finch, Inca Dove, Indigo

Bunting, Lark Sparrow, Lazuli Bunting, Lesser Goldfinch, Lewis's Woodpecker, Long-eared Owl, Lucy's Warbler, MacGillivray's Warbler, Merlin, Mourning Dove, Northern Rough-winged Swallow, Northern Red-shafted) Flicker, Phainopepla, Red-tailed Hawk, Song Sparrow, Summer Tanager, Veery, Warbling Vireo, Western Kingbird, Western Wood-Pewee, White-winged Dove, Wild Turkey (Rio Grande), Willow Flycatcher, Yellow Warbler, Yellow-billed Cuckoo, Yellow-breasted Chat (Partners in Flight 1999).

DISTRIBUTION: The breeding range of the Black-throated Gray Warbler lies almost entirely within the western United States and extending into southern British Columbia, including Vancouver Island. It is a common breeder in mountains and foothills, open juniper or pinyon or Pinyon-Juniper woodlands from southwestern British Columbia, western Washington, western and central Oregon, southern Idaho, all of Utah, central and southern Wyoming, northwestern and central Colorado south to northern Baja California, south-central and eastern California, all of Nevada, central and southeastern Arizona, extreme northeastern Sonora, in New Mexico except for the southeast, and possibly extreme western Texas. Preferred breeding habitat includes dry oak slopes, pinyon, junipers, and Pinyon-Juniper woods, open mixed woods, and dry coniferous and mixed woods with a brushy under story, and in chaparral. The species is found from sea level to at least 1,800 m (southern Rocky Mountains) The species seems to prefer open areas as occur in secondary growth, forest edges, or dry hillsides or canyons (A.O.U. 1998, Bent 1953, Curson et al. 1994, Guzy and Lowther 1997, Kaufman 1996, Ryser 1985).

The Black-throated Gray Warbler winters primarily in Baja California Sur, and on the Pacific slope and interior of Mexico from southern portions of Sonora, Durango, Zacatecas, and Coahuila south to central Oxaca. It is found singly or in small groups in winter mainly in dry, open woodlands and tall scrub. Often the species forms with mixed species feeding flocks. Casual records have been reported along the Gulf coast to southern Florida. The lower slopes of the Sierra Madre Occidental in Mexico is one area where considerable numbers of Black-throated Gray Warblers can be found in winter (A.O.U. 1998, Bent 1953, Curson et al. 1994, Guzy and Lowther 1997, Kaufman 1996, Ryser 1985).

Even though some early ornithological records failed to mention Black-throated Gray Warbler, the species occurs statewide in Utah as a common summer resident. Earliest occurrence date for the state is 1 May (Green River area) and the latest is mid-late September. No current estimates are available as to the number of breeding pairs occurring in Utah. Historical nesting records for Utah include Salt Lake (1869, 1902, 1911, 1913) and Summit County (1869), Carbon County (1936), Uinta County (1937), Kane County (1937), Utah County (1940 and 1944), Garfield County (1958), Beaver County (1964), Zion National Park (1964), and the Upper Colorado Basin (1967).

Elevation for nesting in Utah ranges from 1,220 m(4,000 ft) in the Salt Lake Valley to at least 2,133 m (7,000 ft) in Summit County. Nests are typically placed 2-10 m above ground and 1 - 3 m from the trunk of a conifer or large shrub. The nest consists of a neat, open cup made of weeds, dry grass, and plant fiber and is built by both sexes. Typically the inside of the next cup is lined with feathers, fur, hair, and moss. Typical clutch size is 3-4 eggs which are incubated by the female only (males not known to develop a brood patch). However, both sexes feed the young. Dense oak and mountain mahogany areas within Pinyon-Juniper woodlands are preferred habitats. From early May through mid-late September the species is fairly common in suitable habitat (Behle and Perry 1975). As in other portions of the range, Black-throated Gray Warbler is an above-ground nesting species in Utah Pinyon-Juniper and montane communities.

ECOLOGY: Little detailed migration data are available. Likely the Black-throated Gray Warbler is a short- to long-distance nocturnal migrant which apparently joins and migrates with mixed species flocks. Typically individuals leave the breeding grounds by late-August to early September. Return migration begins in early-March. Birds arrive on the breeding grounds in Utah by late-April to early-May.

Individuals follow mountain valleys and foothills at night during both fall and spring migration periods. Black-throated Gray Warbler uses a variety of semi-open habitats on migration, especially riparian areas. The species is casual on the Gulf coast in Spring and autumn, and the species is a vagrant to eastern North America from Quebec and Nova Scotia south to Florida.(A.O.U. 1998, Bent 1953, Curson et al. 1994).

The Black-throated Gray Warbler winters mostly in habitat similar to that selected for while the species is in the breeding range. In central Oxaca, Mexico, preferred habitat during winter is arid sub-tropical scrub, oak scrub, and lower reaches of arid pine-oak forests. In western Mexico, thorn scrub and willow along dry washes, riparian gallery forest, mangrove, second-growth areas, tropical evergreen forests, thorn forests, tropical deciduous forests, oak and pine-oak woodlands, and pine-oak-fir woodlands are preferred. Vagrants in Florida select scrubby oak communities. The species occurs singly or in small groups in winter and may occasionally join mixed-species feeding flocks foraging on insects. Diet consists primarily of insects (Curson et al. 1994, Kaufman 1996, Rappole et al. 1995).

The earliest recorded nesting of Black-throated Gray Warbler was a nest found near Salt Lake City, Utah, on 23 June 1869 at Parley's Park near Snyderville at an elevation of 2133 m (7,000 ft) (Ridgway 1875). Although nesting of the species in Utah has been known for quite a long time, the breeding behavior is not well understood.

Black-throated Gray Warbler is a single brood species that begins its breeding cycle in early to mid-May. Pairs begin nesting by mid-May, and nests are typically placed above-ground and can be very difficult to find. The nest is probably built by both sexes and consists of a well-defined cup lined with hair and grasses which is placed 1 - 3 m out from the trunk of the tree or shrub selected. Usual clutch size is 4 eggs (range 3-5). No information on incubation and the onset of brooding is available for the species. Only the female develops a brood patch and so incubation likely is carried out by the female alone. Young are altricial and tended by both parents (Baicich and Harrison 1997, Kaufman 1996, Curson et al. 1994, Bent 1953). The percentage of the total breeding population of Black-throated Gray Warbler that occurs in Utah is unknown. Preferred breeding habitat is Pinyon-Juniper woodlands. Breeding may also occur in shrubby areas in mountainous terrain with scattered tall trees, or coniferous or deciduous scrub (Baicich and Harrison 1997, Curson et al. 1994).

North American Breeding Bird Survey (BBS) data indicate a decreasing but non-significant population trend for Black-throated Gray Warbler populations in Utah. In addition, Arizona, Colorado, New Mexico, and Oregon also show a downward trend, although none of these trends are statistically significant. On the other hand, in other portions of the range the trend is mixed and generally positive. No information is available that would enable a pre-settlement estimation of populations or whether the species has likely increased or decreased since that time. Overall BBS trend estimates indicate a steady or slightly increasing trend over the past 30 years (Sauer 1996).

Threats are largely unknown. More data on breeding and wintering ecology is needed. Greatest documented threats appear to be from removal of over story trees in Pinyon-Juniper to enhance pasture lands. Black-throated Gray Warbler can and will occupy areas that have been severely altered. However, there have been no long-term detailed studies of breeding or long-term monitoring to address changes in density or breeding success in areas that have been altered. Continued alteration and loss of habitat could have cumulative effects, but there is insufficient information available to assess habitat-related population changes either locally or regionally. The species is an occasional cowbird host although little information on parasitism of the species is known. Most records are of adult Black-throated Gray Warblers feeding young cowbirds rather than reports of finding cowbird eggs in nests. The relatively low occurrence of cowbird parasitism may result from a preference by Black-throated Gray Warblers for somewhat higher elevation areas for nesting which are above the usual range for the cowbird.

Environmental or human-induced effects likely pose the greater threat to Black-throated Gray Warbler throughout its range including Utah. Breeding distribution is typically localized, although threats to breeding habitat in Utah are moderate. Factors affecting population size and distribution are unknown, and considerable data is needed for wintering areas. The species has a high ranking for conservation priority in Utah (32).

HABITAT REQUIREMENTS: In addition to the habitat preferences listed above, the Black-throated Gray Warbler typically breeds in Pinyon-Juniper communities in Utah. The species prefers more densely wooded areas over areas where trees are more widely spaced, and the more open areas are extensively used for foraging. Lower slopes with mountain mahogany or scrub oaks are also inhabited during breeding but to a much lesser extent typically than Pinyon-Juniper.

HABITAT AND/OR POPULATION OBJECTIVES: To date, no habitat or population parameters have been established for the Black-throated Gray Warbler in Utah as a management objective. Specific data such as density and territory size for the species in Pinyon-Juniper in Utah are sparse, although life history requisites are likely similar in appropriate habitat throughout most of the species' range.

During the breeding season, home range and breeding territory are likely the same. Territories are defended by males; females likely do not defend the nesting area. Actual territory size data are not available. The Black-throated Gray Warbler is a relatively common species in appropriate habitats, but threats to habitats and to the species are poorly understood. Black-throated Gray Warblers are monogamous breeders. Males are intra specifically territorial on breeding grounds and likely defend territories more aggressively that are non-overlapping.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Management requirements for the Black-throated Gray Warbler are unknown. Activities that remove preferred habitats (e.g , chaining, fire, livestock grazing, campground construction, mining, hiking trails in ravines and along stream sides, road construction, off-road vehicle use, urbanization) are likely detrimental but effects on the species are unstudied.

Timber Harvest—Timber management which removes pinyon, juniper, oaks, or tall shrubs may negatively affect breeding populations on a local level. Removal of over story trees on pasture lands may result in an increase of brood parasitism by Brown-headed cowbirds.

Fire Management—Response of Black-throated Gray Warbler to fire effects is also poorly understood. Likely declines occur immediately after fires that remove Pinyon-Juniper woodlands and associated habitats, whereas controlled burns that promote regeneration of preferred nesting habitat are likely beneficial. Controlled burns in Arizona that removed the combustible under story and thereby reduced the number of potential nest sites and foraging opportunities resulted in declines of some species (Horton 1987). Fire management practices have changed markedly in Pinyon-Juniper, mountain mahogany, scrub oak, and Ponderosa Pine habitats due to suppression for grazing, timber harvest, and other activities (Horton 1987, West 1988, Fule et al. 1997). The effects on Black-throated Gray Warbler from changes in fire management practices is unknown.

Livestock Grazing—Grazing practices that reduce the volume of Pinyon-Juniper cover or that remove young shrubs suitable for nest sites are likely detrimental. Livestock grazing occurring in Pinyon-Juniper, mountain mahogany/scrub oak, and Ponderosa Pine habitats has altered vegetation composition, age structure, and fire patterns with unknown consequences for Black-throated Gray Warbler.

Brood Parasitism—Brood parasitism by Brown-headed Cowbirds occurs rarely, although the full extent of cowbird parasitism on the species is unknown. Raptors, corvids, and reptiles have a much greater influence on the outcome of breeding attempts that do cowbirds.

Black-throated Gray Warbler management issues for Utah are listed below. Management issues and recommended conservation actions have not been identified in the past, and the issues and recommendations presented below represent an initial effort at identifying these parameters for Black-throated Gray Warbler in Utah.

Management Issues with Conservation Recommendations

Habitat Loss/Alteration

1. Survey target areas for Black-throated Gray Warblers prior to initiating habitat alteration activities.
2. Discourage clearing of large mature tracts of habitat.
3. Encourage small-scale openings of habitat and maintain over story trees.
4. Avoid use of herbicides and insecticides in areas used by Black-throated Gray Warbler for nesting.
5. Limit seasonal pinyon collection (May through July), and limit larger size pinyon collection overall.
6. Manage for Pinyon-Juniper forests with a 50%-to-50% pinyon to juniper ratio or higher (higher pinyon percentage) and maintain at least a 15% canopy cover (15-25% canopy).

Livestock Grazing

1. Grazing in areas of high Black-throated Gray Warbler concentration should not be allowed until after 31 July.

Implementation Opportunities

Pinyon-Juniper is a major component of the Colorado Plateau (Utah portion) physiographic region. While some annual threats naturally occur to Pinyon-Juniper forests in the Colorado Plateau and other portions of the state, Pinyon-Juniper is limited in availability in the state. Habitat and resource managers should be sensitive to the needs of Black-throated Gray Warbler in areas of known occurrence and to conserve ecological processes and functions to accommodate prolonged use. Considering that a substantial number of avian species co-occur with Black-throated Gray Warbler in both its primary and secondary breeding habitat, prudent conservation actions would help to insure long-term richness and diversity in those areas where multi-species suites of birds occur.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

Recommended Research

Black-throated Gray Warbler represents a Neotropical migratory species that has been little studied and consequently much of the species' ecology and general life history data are lacking for Utah and other portions of the breeding range. Dispersal, site fidelity, average patch size, edge effects, sensitivities to management activities, population size, population trend, size of range, territory size, up-slope dispersal patterns, home range, and distribution trend data are all currently lacking for Black-throated Gray Warbler in Utah and throughout the species' range. BBS data indicate a decreasing but non-significant trend for the species in Utah, which may reflect few detections being recorded on routes in the state or that routes are not established extensively in the preferred habitat for the species. Perhaps existing BBS routes are below the preferred elevational range or by chance occur in habitats not typically used by the species.

Short of graduate-level research addressing the Black-throated Gray Warbler in Utah, point count transects should be established in Pinyon-Juniper habitat at multiple locations statewide. Each point count transect should contain 10 points and follow established protocol for point count surveys in Utah developed by the Utah Division of Wildlife Resources. Each of these 10 points should be placed 250 meters apart within each transect, Management agencies with potential habitat occurring within their lands should jointly cooperate in establishing a minimum number of point count transects statewide necessary to establish baseline population data. The USFS and BLM likely contain the majority of Black-throated Gray Warbler breeding habitat, and tracts of Pinyon-Juniper within their lands should be considered as a primary locations for establishing point count transects.

A statewide, broad-scale assessment of Black-throated Gray Warbler habitat in the Basin and Range, Utah Mountains, and Colorado Plateau physiographic regions should be undertaken. Based on the results of the statewide assessment, a long-term monitoring program should be established. Pinyon-Juniper habitat is not typically associated with riparian zones within the state, although in some areas the two may border each other to provide areas of high benefit to Black-throated Gray Warblers. Habitat objectives listed below are recommendations that should improve the knowledge of Black-throated Gray Warbler in Utah and thereby increase the potential for effective management.

Broad-scale assessment of Black-throated Gray Warbler habitat, particularly in Pinyon-Juniper, in the Basin and Range, Utah Mountains, and Colorado Plateau physiographic regions of the state using GAP analysis and the UDWR Critical Habitat Evaluation database is recommended. Use results of the broad-scale assessment to develop a statewide breeding range map for Utah which highlights Pinyon-Juniper.

Statewide Population Estimate: Critically evaluate existing BBS routes and their effectiveness at monitoring for Black-throated Gray Warbler. Establish new BBS routes or point count survey transects in appropriate habitat to augment existing BBS data and results of the statewide riparian assessments. Establish a statewide database for Black-throated Gray Warbler using BBS and point count data, federal and state agency files, historical and more recent literature, and other sources as appropriate. Use the Statewide Population Estimate to identify those areas with appropriate habitat that show a high, moderate, or low population size.

Identify Management Focus Areas: Using the results of the Statewide Habitat and Population Assessments, identify those areas of suitable habitat that may be in need of revised management or conservation action. Identify those areas that were once Pinyon-Juniper habitat but are now irretrievably lost for use by Black-throated Gray Warbler and its associated species. Discourage clearing of large mature tracts of habitat; encourage small-scale opening of habitat, while maintaining over story trees.

Establish Target Population Densities in Selected Areas: In Arizona, a target population density of 12 pairs/ha (8 - 15 pairs/40 ha) was established as a target for maintaining the species in certain portions of the state.

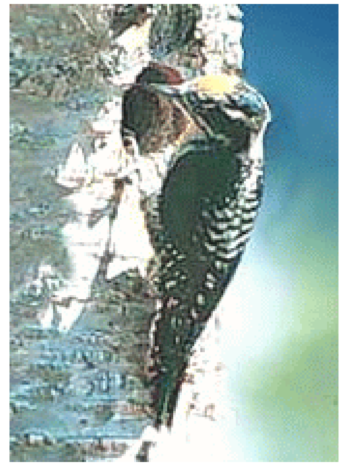
Evaluate Potential Threats: Overlay results of the statewide assessments with proposed development scenarios to determine those areas of potential or existing Black-throated Gray Warbler habitat that are likely to experience alteration or loss. If possible, establish population trend estimates based in part on loss or alteration of existing or potential habitat that is known to occur and establish time lines associated with population trend estimates. This additional evaluation should provide for a more accurate assessment of the results of the BBS surveys and possibly better explain the indication of a decline.

OUTREACH NEEDS

Inform agency personnel and the general public as to the results of the statewide assessments and results of the recommended habitat objectives. Educate agency personnel and the public on the importance of Pinyon-Juniper habitat to birds and the economic and cultural values of that habitat. Provide information about habitat requirements of Pinyon-Juniper birds to woodcutters and agency personnel. Solicit their assistance in reducing impacts resulting from their activities. Further educate agency personnel and public users that all Pinyon-Juniper is not the same. Encourage agencies to consider the needs of the Black-throated Gray Warbler in their management plans and objectives.

THREE-TOED WOODPECKER
(*Picoides tridactylus*)

Conservation Priority Score of 32



Ulf T. Runesson

The Three-toed Woodpecker occurs uncommonly in boreal forests of Utah and is dependent on recent burns and spruce bark beetle (*Dendroctonus rufipennis*) infestation for foraging (Hill et al. 2001). Individuals are often silent as they carefully fleck bark off trees to reach bark beetles for food. In spring and early summer it drums frequently, which can be identified by its accelerating cadence. It is found at high elevations in coniferous forests, particularly spruce. Cedar Breaks National Monument has been a well-known location to observe Three-toed Woodpeckers, and birders from California, Arizona, and Nevada visit the monument for this species. Normally, Three-toed Woodpeckers are found in low numbers, but due to a spruce bark beetle infestation, this species is nearly as common as Hairy Woodpeckers in many parts of Utah.

The plumage of this woodpecker is similar to the Black-backed Woodpecker, which generally prefers mountain forests at lower elevations, and is not found in Utah. The barred back and the male's yellow crown is diagnostic to distinguish this woodpecker from others in Utah. The top of the head is black and flecked variably with white.

ASSOCIATED SPECIES: Other bird species that are found in this habitat and may respond similarly to habitat components used by the Three-toed Woodpecker include: Hairy Woodpecker, Gray Jay, Clark's Nutcracker, Red-breasted Nuthatch, Mountain Chickadee, Brown Creeper, Pine Grosbeak, Red Crossbill, Ruby-crowned Kinglet, Northern Goshawk, and Northern Flicker.

DISTRIBUTION: Three-toed Woodpeckers range across North America from tree line south to southern Oregon and through Idaho and Utah to New Mexico. In eastern North America they are found south to Minnesota, southern Ontario, New York, and northern New England. They also occur across northern Europe and Asia (Spahr et al. 1991, Clark et al. 1989).

They are found in Engelmann spruce, sub-Alpine fir, Douglas fir, grand fir, Ponderosa Pine, tamarack, Aspen, and Lodgepole Pine forests (Gabrielson and Jewett 1940, Farner 1952, Larrison and Sonnenberg 1968, Marshall 1969, Hill et al. 2001).

In Utah, this woodpecker nests and winters in coniferous forests, generally above 2400 m (8,000 ft) elevation (UDWR 1998, Hill et al. 2001). They stay on their territories year-round, though insect outbreaks, such as spruce bark beetle infestations, may cause irregular movements (Yunick 1985, USDA 1975, Sphar et al. 1991).

ECOLOGY: Three-toed Woodpeckers breed in May, June, and July. The male attracts the female by drumming, then performs a head swaying and calling display (Ehrlich et al. 1988). Both sexes excavate a new nest cavity each year 0.9 - 15 m (3-50 ft) (usually 1.5 m - 3.7 m [5-12 ft]) high in a dead or live tree where they incubate an average of four eggs for 11-14 days (Ehrlich et al. 1988, Spahr et al. 1991, Stokes 1996, DeGraaf et al. 1991). Young fledge at 22-26 days and remain with the parents for another month (Spahr et al. 1991).

Where food is abundant they may nest in loose colonies (Ehrlich et al. 1988, Stokes 1996). Tree species used for nesting are spruce, tamarack, pine, cedar, and Aspen trees, but Lodgepole Pine, balsam fir, and poles are also used (Goggans et al. 1988, Ehrlich et al. 1988, DeGraaf 1991). A pair bond is maintained all year and in successive years, and they exhibit strong breeding site tenacity (Ehrlich et al. 1988). The male roosts nightly in the nest throughout incubation; both adults brood the young. Family cohesion lasts well into the summer months after the young have fledged (ibid.).

Three-toed Woodpeckers forage on scaly-barked trees such as spruce, hemlock, Lodgepole Pine and tamarack (Stokes 1996, Spahr 1991, Beal 1911). In burned areas they have been documented foraging on moderately burnt spruces in and immediately under the bark predominantly on bark beetle larvae (Murphy and Lehnhausen 1998). Greater than 75% of their diet consists of wood-boring insects, mostly beetle larvae (61%), but they also eat wood-boring lepidoptera (mainly moth) larvae (14%), and occasionally fruit and sap at sapsucker pits (Spahr et al. 1991, Ehrlich et al. 1988). Spruce beetles comprise approximately 65% of their annual diet, and 99% of their winter diet (DeGraaf 1991).

Numbers and densities of Three-toed Woodpeckers respond numerically to bark beetle infestations. Populations can increase as much as 85 fold during Engelmann spruce beetle outbreaks (Koplin 1969). Baldwin (1960) recorded 60-90 individuals on 2 ac in Utah during an insect infestation. In 1998, an estimated 30 pair of adult Three-toed Woodpeckers were found on approximately 8 ha (40 ac) in spruce heavily infested with bark beetles, at the north end of Monroe Mountain (Wilkerson 1998). These periodic fluctuations in population size may maintain the vitality of the species (USDA 1975 Goggans et al. 1988).

They are major predators of the spruce bark beetle and may contribute to its control (Spahr et al. 1991). Koplin (1972) estimated that 20 percent of an endemic, 84% of an epidemic, and 59% of a pan-epidemic Engelmann spruce beetle population were consumed primarily by Three-toed Woodpeckers (but also Hairy and Downy).

Three-toed Woodpeckers roost at night in holes throughout the year (Goggans et al. 1988). In the fall, they generally excavate fresh holes. They have been documented flying as far away as 0.8 k (0.5 mi) to roost during periods of abundant food (Baldwin 1960).

HABITAT REQUIREMENTS: Three-toed Woodpeckers depend on live and dead trees for both nesting and foraging. They require soft wood for excavation because of morphological adaptations associated with three toes on each foot, therefore presence of heartrot is important. Trees with scaly bark remaining on the tree are important to support their foraging technique. Three-toeds require trees infested with bark- and wood-boring insects for foraging. Three-toed Woodpeckers may require occasional forest insect epidemics (USDA 1975, Goggans et al. 1988).

Use of snags after stand replacing fires is also important for Three-toed Woodpecker foraging. Murphy and Lehnhausen (1988) found that Three-toed Woodpeckers foraged heavily on moderately charred spruce trees the first three years after a fire, and population densities increased from less than 0.1 - 0.2 per ha. After three years, densities declined to previous levels.

Goggans and others (1988) found that Three-toed Woodpeckers preferred mature and over-mature forests in Lodgepole Pine plant communities for nesting and foraging. In Oregon home ranges have been documented at 304, 142, and 53 ha (751, 351, and 131 ac) during a mountain pine beetle epidemic in Lodgepole Pine habitat (Goggans et al. 1988). The average breeding territory in Utah was 43 ha (106 ac), also during a beetle infestation (USDA 1975). In Utah, Three-toed Woodpeckers use Aspen for nesting where intermixed or adjacent to coniferous forests (Hill et al. 2001).

HABITAT AND/OR POPULATION OBJECTIVES: No habitat or population objectives have been identified. Because populations of this species are irruptive, it is difficult to identify one population objective. A range of populations, depending upon the abundance of food, with objectives to occasionally reach the higher portion of the range may be more appropriate. Accordingly, maintaining habitat to provide for irruptions of food to support Three-toed Woodpeckers will also be important.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES:

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Because this species requires snags for feeding, perching, nesting, and roosting, it is threatened by activities such as logging and fire suppression which remove or eliminate snags (UDWR 1998, Spahr et al. 1991). Salvage logging in beetle infested areas also reduces both food and nesting sites for Three-toed Woodpeckers (USDA 1975). Salvage logging after a fire reduces or eliminates high quality foraging habitat (Murphy and Lehnhausen 1998). Fire suppression that eliminates fire-killed trees are also a threat (Spahr et al. 1991).

Leaving snags in harvest areas has traditionally been in more or less equally distributed individual trees. Goggans and others (1988) suggests that traditional methods of leaving snags individually in harvest units may be ineffective because:

1. Individual snags left for foraging are insufficient to provide adequate feeding substrate [in the territory.
2. Land managers do not have the information necessary to manipulate habitat and insure that the complex interrelationships of an old growth or mature/overmature ecosystem, and the species associated with it will be maintained.

These factors regarding snag distribution may be particularly important for Three-toed Woodpeckers. Three-toed Woodpecker management issues are listed below in italics. Below each issue are Utah Partners in Flight Conservation Recommendations.

Habitat Loss

1. Encourage leaving burned over areas intact for the first three to five years after a stand replacing fire.
2. In salvage areas leave clumps of snags rather than individual trees.
3. Snags with a majority of their bark present and trees with heartrot should be available.
4. Aspen should be maintained throughout the landscape to provide nesting sites.
5. Goggans and others (1988) have recommended establishing management areas 214 ha (528 ac.) per pair in Lodgepole Pine habitats where salvage logging or commercial harvest would not be permitted.
6. Select areas to become future management areas to insure habitat in the future.
7. Plan and implement a fire management plan that allows fires to burn in areas where acceptable to other resources.
8. Insect infestations should be interpreted in terms of a landscape scale rather than in terms of the loss of wood fiber on individual sites.

Implementation Opportunities

1. Consider habitat needs in agency plans and projects, including stewardship projects.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

1. Identify habitat use in areas without insect epidemics.

2. Identify estimates for breeding and non-breeding home range sizes under a range of conditions (i.e., food availability).
3. Identify the flexibility of three-toed woodpeckers to adjust to managed forest habitats.
4. Study juvenile dispersal and habitat needs.
5. Study the relationship of habitat quality and fragmentation to home range size.
6. Test the success of recommendations for management areas (above) to maintain habitat components for Three-toed Woodpeckers.
7. Identify wintering habitat requirements and how they differ from breeding requirements.

OUTREACH NEEDS

1. Educate agency and public of the importance of three-toed woodpeckers in preventing insect epidemics from reaching pan-epidemic size.
2. Inform and work with state and federal agencies regarding the importance of dead trees and large tracts of dead trees in the ecosystem.
3. Educate agencies and public of the role of disturbances such as fire and insects in the ecosystem.
4. Educate agencies and public in viewing disturbances at a landscape scale and in the context of ecosystem functioning.

SAGE SPARROW
(*Amphispiza belli nevadensis*)

Conservation Priority Score of 32

Frank Howe

ASSOCIATED SPECIES: Shrubsteppe-obligate species (Braun et al. 1976): routinely observed in similar habitats with Sage Thrasher, Black-throated Sparrow, and Brewer's Sparrow. Associated with species often occurring in shrub steppe but are not restricted to it; Northern Mockingbird, Northern Shrike, Green-tailed Towhee, and Vesper Sparrow. Other species that may benefit from specific Shrubsteppe conservation or management strategies are Ferruginous Hawk, Golden Eagle, Prairie Falcon, Burrowing Owl, Common Nighthawk, and Ash-throated Flycatcher.

DISTRIBUTION: (interior-Great Basin environs, including western Washington to Wyoming south to Arizona and Texas, eastern California, Utah, Nevada, i.e., bulk of North American distribution). Other subspecies include: *A. b. belli* (coastal California); *A. b. clementaea* (San Clemente Island, California); *A. b. cinerea* (Baja California); *A. b. canescens* (interior California). Oberholser (1946) described *A. b. campicola* for southern and central Idaho, eastern Washington, eastern Oregon, Nevada, and western Utah, but this subspecies remains unrecognized (A.O.U. 1957, 1983, Behle 1985).

Breeding Range: western North America, including; west-central Washington, Oregon east of the Cascade Mountains, southeastern. and extreme southwestern. Idaho, portions of central, western and northeastern (locally) Wyoming, all but southern Nevada, mesas of western Colorado and in the San Louis Valley in south-central Colorado, northwestern New Mexico, and northeastern Arizona. In California breeds in extreme northeast south to Sierra County, Mono County south around the western rim of the Mojave Desert to the Upper Kern River Basin, foothills of the western Sierra Nevada from El Dorado County south to Mariposa County, San Clemente Island, western California along inner Coast Range from Trinity and Shasta Counties, south to coastal Marin County, south through San Joaquin Valley to southern California west of the eastern deserts, and south through Baja California (except east coast) to about 26^{o}N. Rare during the breeding season in western Washington, western Oregon, Montana and British Columbia. Found locally throughout Utah (Rising and Beadle 1996, Martin and Carlson 1998).

Winter Range: Found throughout year in southern California and Baja areas where overlaps with breeding range except, in northernmost portion of inner Coast Range and in east-central California where species does not typically winter. Otherwise winters locally from southern Nevada, southwestern Utah, all but northeastern Arizona, west-central and southeastern New Mexico; east to western Texas; south to central Chihuahua, northwest Sonora to Kino Bay, southeastern California, and eastern Baja California Norte (Martin and Carlson 1998, Russell and Monson 1998). Also winters near Pyramid Lake and Fallon in western Nevada. Rare in winter north to southern Oregon.

Utah: Uncommon permanent resident statewide to 2400 m (8000 ft) elevation; more common in migration; common winter resident in southern Utah (Behle et al. 1985). Migratory populations (summer breeders) occur from late 2 March - 30 September (Woodbury et al. 1949).

ECOLOGY:

Migration—Considered a short-distance migrant; 3 non-migratory subspecies (*A. b. belli, A. b. clementaea, A. b. cinerea*); 2 migratory subspecies (*A. b. canescens and A. b. nevadensis*). Some populations observed moving up slope after breeding early in spring. In late summer and fall they descend from the mountain valleys moving south and east toward wintering grounds (Johnson and Marten 1992).

Fall migrants of *A. b. nevadensis* peak mid-Sep in Oregon with stragglers to mid-Nov; depart western Colorado by mid-October with stragglers to early November but depart San Luis Valley, Colorado, by early October. Some *A. b. nevadensis* individuals may be resident but displacement by more northern individuals could account for year-round occurrence (Weathers 1983).

Both *A. b. nevadensis* and *A. b. canescens* on wintering grounds in September and remain until February or early March in Arizona along Colorado River Valley (Meents et al. 1982). In southern California *A. b. canescens* withdraw from higher elevations into deserts during winter. Based on specimen evidence, *A. b. nevadensis* wintering in this area arrive later and depart earlier (early October to mid March) than *A. b. canescens*. In New Mexico, first observed late September at Ojo Caliente, 1 October further south at Lake Burford and late October at Silver City. Wintering birds recorded in northern Mexico by October (Howell and Webb 1995).

Migratory and wintering—*A. b. nevadensis* observed in small flocks of 3 to 10 individuals, frequently in sagebrush (*Artemisia* spp.) or foraging between widely spaced creosote bush (*Larrea tridentata*) in desert scrub (Weathers 1983). Often flocks with other species; Black-throated, White-crowned, Vesper and/or Brewer's sparrows (Cody 1971).

Breeding—Some populations move in pairs all year, but the pairs are not always the same individuals throughout year or from one year to the next. In southern latitudes, males singing on territory as early as late-January or early-February. Some *A. b. nevadensis* arrive on the breeding grounds already paired which is unusual for most migratory songbirds (Rich 1980a). No information on actual pairing time; males are singing on territory by late March.

A. b. nevadensis recorded as arriving on breeding grounds on the Eastern Sierra escarpment around Mono Lake, Sagehen Summit, and Cedar Hill, California, by mid-March; early May, with some as early as mid-March; in western Colorado and late April in San Luis Valley, Colorado; mid-March in Idaho (Rich 1980a); early March in northern Nevada (Alcorn 1988); late February in Oregon peaking in mid-March; and early March in Utah (Green 1981). *A. b. nevadensis* latest arrival observed early April near the Mexican border and late April in Organ Mountains, New Mexico. Nesting activities observed in mid-March for *A. b. nevadensis* in Benton County, Washington and Morrow County, Oregon. Few nests are built after mid-June.

Nesting Habitat—Nests mainly in shrubs, but also in bunch grass (Poaceae) and occasionally on the ground under a shrub. Microhabitat preference is probably based more on structure and density of shrubs rather than specific shrub species. Winter and Best (1985) found that shrub height and nest microclimate may influence location of nests. Nests built in grasses on ground under small shrubs, provided better cover than in the shrubs themselves. Ground nests provided more warmth, beneficial early in breeding season only. Sage Sparrows prefer taller shrubs with larger canopies providing more cover (Petersen and Best 1985). Nests placed in the canopies would benefit from increased air circulation and convective heat loss (Winter and Best 1985). Populations of Sage Sparrow subspecies that use fewer shrub species nest in habitats with less shrub diversity, i.e., cold northern desert (Great Basin) v.s. hot desert (Mojave)(Wiens 1985).

Shrubs used depend on geographical location. *A. b. nevadensis* uses big sagebrush (*A. tridentata*) in Idaho (Petersen and Best 1985). Additionally, bitterbrush (*Purshia tridentata*), rabbitbrush (*Chrysothamnus* spp.), greasewood (*Sarcobatus vermiculatus*), tumbleweed (*Salsola iberica*), or bunch grasses are used in Oregon and Nevada (Wiens and Rotenberry 1981, Wiens 1985) and Bonneville Basin, UT (Martin and Carlson 1998). One study in the Uinta Basin, UT, observed 11 nests over 2 yr: above-ground shrub nests included 3 in rabbitbrush, 2 in hopsage (*Grayis spinosa*), 1 in saltbush (*Atriplex* spp.), and 1 in big sagebrush; the remaining ground-nests were in depressions beneath rabbitbrush (Green 1981).

Populations in other locations may use brittlebush (*Encelia farinosa*), black sage (*Salvia mellifera*), California buckwheat (*Eriogonum fasciculatum*), California sagebrush (*Artemisia californica*), bush mallow (*Malocothamnus fasciculatum*). Chamise (*Adenostoma fasciculatum*), white sage (*Salvia apiana*), valley cholla (*Opuntia parryi*), ceanothus (*Ceanothus* spp.), or willow (*Salix* spp.)(Martin and Carlson 1998).

Nest shrub is generally higher than average height of surrounding vegetation (Green 1981, Petersen and Best 1985). Where sagebrush coverage is sparse, nest sites are selected where shrubs clumped. The birds also prefer shrubs with at least 75% live material. Nests are typically placed away from the southwest side of the shrubs, perhaps to avoid strong southwesterly winds or afternoon solar radiation. Most nests are placed in densest portion of nest site vegetation profile (Rich 1980b, Petersen and Best 1985). Nests are built nearer main stem than the edge of shrub (Reynolds 1981).

In the Uinta Basin, UT, shrub nests were 26 cm, ranging from 24-27 cm (N=7), above ground and primarily in the northeast quadrant of the shrub (Green 1981).

Nest—Nest is open cup. Outer shell of small twigs or coarse grasses, lined with fine grasses and weed bark and completed with inner lining of softer material such as feathers, tufts of wool, rabbit fur, and cow hair (Martin and Carlson 1998), although in Utah only dried grasses and forbs were used (Green 1981). In Utah, nests were constructed in 1-2 da entirely by female (Green 1981).

Clutch Size, Incubation, and Fledging—Most *A. b. nevadensis* attempt 2 and occasionally 3 clutches each year. New nests are built for subsequent clutches.

Mean clutch size for *A. b. nevadensis* is 3.28 eggs (SD ± 0.61, range 1-4, n = 61; unpublished data, Western Foundation of Vertebrate Zoology).

Egg dates for *A. b. nevadensis* from 6 April-16 June. Incubation about 12-16 days from completion of clutch. In one instance, the first egg was laid 8 days after nest was complete (Martin and Carlson 1998). Females of all subspecies lay usually one per day until clutch complete. Although adults remain in general proximity they are inattentive to nest. No information on replacement of individual eggs. When a clutch is depredated, the nest is abandoned and another built nearby.

First chick dates for *A. b. nevadensis* 6 April. Young typically fledge in about 9-11 days. By day 2 young can lift heads with mouths open wide for food This response occurs when shrub moved slightly and occurs only during first few days. Eyes open at 4-5 days. After eyes open, young do not respond to shrub movements. Lifts heads only to feed when adult at nest itself. When shrub disturbed they huddle down into nest. Begging calls begin about 6-7 days. Young are usually in nest for 9-10 days (Petersen and Best 1986).

Adult feeding of young begins shortly after hatching and continues for duration of nestling period and for 2+ wk after nest departure. Both parents feed young. Nestling food items are small with 73% < 0.05 cm (Petersen and Best 1986). Nestlings fed a broad range of arthropods with 59% of diet consisting of spiders, butterflies and moths (Lepidoptera), true bugs (Hemiptera), and leafhoppers (Homoptera). Flies (Diptera), grasshoppers (Orthoptera), bees and wasps (Hymenoptera), beetles (Coleoptera), and psocids

(Psocoptera) also fed to nestlings (Petersen and Best 1986). As nestlings grow, they are fed fewer spiders, a pattern found in Brewer's and Vesper sparrows (Best 1972). Diet composition does not differ significantly among broods of 2, 3, and 4. Nestlings receive larger food items as they grow in all brood sizes, especially with broods of 4 (Petersen and Best 1986). In a prescribed mosaic burn, vegetation altered by fire did not significantly affect composition of nestling diet or mean size of food items (Petersen and Best 1986).

Nesting Success—In *A. b. nevadensis*, mean number of young/nest is 2.6 (SD ± 0.7, range 1-3, n = 11 (Reynolds 1981). The mean number of young fledged/successful nest in *A. b. nevadensis* is 1.3 (SD ± 1.3, range 0-3, n = 15) (Reynolds 1981). Reynolds observed high fledgling success during the first year of study but Loggerhead Shrikes depredated nearly all nests the second year.

Breeding Parameters—Assumed that both sexes attempt to breed at 1 year. Normally breeds each year.

Diet and foraging—Sage Sparrows are categorized as a ground-foraging omnivore during the breeding season, and a ground-gleaning granivore during the nonbreeding period (DeGraaf et al. 1985, Polis 1991). Foods taken during breeding season include adult and larval insects, spiders, seeds, small fruits, and succulent vegetation. Fall, winter, and early spring foods include small seeds, plant material, and insects when available.

Primarily forages opportunistically on the ground picking up seeds and miscellaneous prey, usually near or under edges of shrubs within sage scrub or chaparral, or gleaning prey from lower main stems of shrubs, occasionally from leaves. Gleans arthropods from low annuals and lower stems and leaves of shrubs. Opportunistically exploits temporarily abundant foods (Wiens and Rotenberry 1979).

Diet varies depending on the season. Seeds including grasses (Poaceae), pigweeds (Chenopodiaceae), and mustards (Brassicaceae) are heavily ingested in April, then again in July and August (Rotenberry 1980). At the Arid Lands Ecology Reserve, Benton County, WA, breeding adults in sagebrush-bunch grass (*Agropyron* spp.) take a wide variety of arthropods in May and June, including coleopterans (Curculionidae, Tenebrionidae, Scarabaeidae, and Carabidae); hymenopterans, lepidopteran larvae, orthopterans (Wiens and Rotenberry 1979, Rotenberry 1980). Larger prey items were consumed early in the season and gradually declined in size, April-August (Rotenberry 1980).

Diet shifted from 44% animal and 56% seed and plant in fall to 13% animal and 87% seed and plant material in wintering A. b. nevadensis and A. b. canescens along the lower Colorado River. Fall insects came from beetles (Coleoptera), true bugs (Hemiptera), leafhoppers (Homoptera), grasshoppers (Orthoptera), and ants (Formicidae). Winter insects in the diet was similar to Fall except it did not include grasshoppers. The only identifiable seeds were from the pigweed family (Meents et al. 1982).

Predation—Both young and eggs are removed from nests by Common Ravens typically taking calling nestlings when adults are away from nests. Unsuccessful and successful attacks on adult Sage Sparrows by Loggerhead Shrikes have been observed (Reynolds 1979). An adult was chased by a Merlin (Martin and Carlson 1998). Bones were found in a Great Horned Owl pellet in Lincoln County, Nevada. Adults chip loudly when Greater Roadrunner near nest. When approached while on nest at beginning of incubation period, female usually quietly slips off and runs on ground.

Lifespan and Survivorship—Few data on survivorship. A 6-year old A. b. nevadensis was found in one study by Wiens (1985). For A. b. belli, a 7-year and 2.5-year old color-banded males were recorded. Life spans of 3 year is not uncommon for males and 2 year for females (Martin and Carlson 1998).

HABITAT REQUIREMENTS: Considered obligate shrub steppe species by Braun et al. (1976), Rotenberry and Wiens (1980), Reynolds (1981), and Wiens and Rotenberry (1981).

Breeding Sage Sparrows prefer semi-open habitats with evenly-spaced shrubs 1-2 m high. Vertical structure, habitat patchiness, and vegetation density may be more important in habitat selection than specific shrub species, however; Sage Sparrows are closely associated with big sagebrush throughout most of their distribution (Rich 1978, Rotenberry and Wiens 1978, Wiens and Rotenberry 1981, Smith et al. 1984, Wiens 1985). Sage Sparrows are often missing from what appears to be suitable habitat, so other unknown habitat characteristics may be important (Rich 1978).

A. b. nevadensis prefers big sagebrush whether pure stands or interspersed with bitterbrush, saltbush, shadscale (*Atriplex confertifolia*), rabbitbrush, or greasewood. Rarely in mixed sagebrush-juniper (*Juniperus* spp.), except in ecotones adjacent to shrub steppe habitat. Usually breeds below 1700 m but has been found over 2400 m (Rich 1980a, Wiens and Rotenberry 1981, Petersen and Best 1985). Found breeding in creosote bush during wet years but not during dry years (Hill 1980).

In the northern portion of wintering range *A. b. nevadensis* favors big sagebrush. Further south, fairly common to uncommon during winter in desert washes, big sagebrush, creosote bush (*Larrea tridentata*), sparse cactus scrub, arid Grasslands and arboreal yucca (*Yucca* spp.) mixed with greasewood (Russell and Monson 1998). Along the Colorado River, honey mesquite (*Prosopis glandulosa*) with high densities of inkweed (*Suaeda torreqana*) had higher densities of Sage Sparrows than honey mesquite without inkweed (Meents et al. 1982).

HABITAT AND/OR POPULATION OBJECTIVES:

To the knowledge of the authors, no habitat or population parameters have ever been established for the Sage Sparrow as a management objective. However, the following density and territory data may assist in developing local management strategies.

Density—Range-wide estimates in optimal habitats, 57-145 individuals/km^2 (Rotenberry and Wiens 1980, Wiens and Rotenberry 1981).

Territoriality—Size variable, some of the largest for any sparrow species; at higher densities, territories at minimum size, but at lower densities territory sizes are at maximum (Martin and Carlson 1998).

Territories for *A. b. nevadensis* varied in size and shape: Idaho, 4.43 ha (1.86:8) 1.06-7.06 ha (Rich 1980b); 0.81 ha (21:16)(Reynolds 1981); Nevada and Oregon, 0.65-5.81 ha (Wiens and Rotenberry 1985); and Utah, 1.53 ha (0.23:7) 1.21-1.79 ha (Green 1981). Territories with grass and sagebrush are smaller than those in heterogeneous vegetation dominated by spinescent shrubs. Territory size did not increase significantly over the short term in areas where vegetation was removed (Wiens et al. 1986). Territory fidelity or tenacity may be a factor for the first one or two years after vegetation removal. In addition, if insular islands of vegetation are left within territories Sage Sparrows may adjust to removal without significant density changes. Where Sage Sparrows are less abundant, they appear to increase territory size with no apparent upper limit except they do not completely saturate the available habitat (Wiens and Rotenberry 1985, Wiens et al. 1985). At this point the Sage Sparrow may be selecting "optimal habitat." Habitat characteristics differed little between territories shifted from one year to the next, but subsequent territories were on the average significantly larger than previous ones (Petersen and Best 1987a, 1987b). Furthermore, larger territories were positively correlated with a greater number of fledglings.

Males occupy breeding territories that are essentially non-overlapping. However, territory boundaries can change slightly from day to day. Territory shifting seems adaptive to increasing territory size (Petersen and Best 1987b). Male establishes territory in spring by singing from perches with occasional conflicts. Fighting, visual display, or chasing occurs in different frequencies in different populations (Wiens 1982, Rich 1980a). Intensity of territorial defense may be affected by the differences in population densities, with more defense occurring at higher densities.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS:

Habitat Degradation—Due to the Sage Sparrow's close association with sagesteppe habitats (Great Basin specifically but including other shrub-dominated ecosystems) throughout its range (Wiens 1985) and the broad scale efforts to control big sagebrush via chemical and mechanical methods, conversion of native mixed shrub-grass communities to exotic annuals largely through increasing intensity and frequency of rangeland fires, livestock grazing disturbances, and natural shrub die-off, overall sparrow distribution has most likely been altered from pristine conditions (Young et al. 1975, Braun et al. 1976, Nelson et al. 1989).

Alteration to native vegetation by removal of shrubs, brought no immediate change in Sage Sparrow densities in the first year after removal, possibly due to lag time related to site fidelity or tenacity (a common problem in short-term avian studies). During the second and third years following sagebrush treatment, significant declines were observed (Wiens 1985, Wiens and Rotenberry 1985, Rogers et al. 1988).

Compounding any consideration of direct habitat impacts is fragmentation (urbanization, agricultural conversion, road and power line right-of-ways, etc.) with typically associated increases in brown-headed cowbird brood parasitism. Associated with increasing human densities increases likelihood of secondary predation by feral cats. The introduction of pigs, goats, and other grazing animals on San Clemente Island, CA, has significantly impacted habitat, which in turn has greatly reduced local Sage Sparrow numbers (Everatt et al. 1994). Only with removal of exotic animals and the subsequent recovery of native habitats have A. b. clementaea numbers stabilized and increased. However, fragmentation, brood parasitism, and predation are only qualitatively recognized and further study is necessary to quantify these threats and develop management actions.

Fire Management and Exotic Weed Invasion—Long-term fire suppression in some locations alters the pattern of natural plant succession, allowing communities to grow into dense stands, which probably reduce available Sage Sparrow habitat for breeding.

Increasing frequency and intensity of range fires in the Great Basin poses a significant threat to native grasses and shrubs. Historically fires were infrequent and perennial grasses and shrubs were not adversely affected. With increased fire frequency, native plants are killed and seed-reservoirs of grasses and shrubs are depleted and replaced with exotic annuals, such as cheatgrass (*Bromus tectorum*). Sage Sparrows abandon former habitats once invaded by cheatgrass (Wiens 1985, Rogers et al. 1988).

Brown-headed Cowbird Parasitism—Nests have been parasitized by Brown-headed Cowbirds in Idaho (Rich 1978, Reynolds 1981). Some parasitized nests were abandoned by Sage Sparrows (Reynolds 1981, Friedmann and Kiff 1985). Sage Sparrows have fledged or attempted to raise cowbirds (Gaines 1988). Most records of parasitism are correlated with human disturbance such as removal of big sagebrush for crops or increase Grassland for livestock grazing. Cowbirds rarely intrude into large tracts of big sagebrush.

Management Protection (Administrative) Actions—*A. b. clementeae* was listed as "threatened" by USFWS in 1977. A recovery plan developed by the USFWS in 1984 recommended protection, enhancement, and restoration of plant populations by removal of feral animals and prevention of their reintroduction, replanting native plants, and controlling erosion where necessary (Everatt et al. 1994). *A. b. belli* is listed as Species of Special Concern in California, which means that the species may be declining but supporting biological evidence has not been published.

Management Actions—Conservation management strategies for the Sage Sparrow are just being considered and developed by the Western Working Group of Partners in Flight. In the interim, general recommendations are provided by Braun et al. (1976).

Implementation Opportunities

One of the major floristic characteristics of the Great Basin is the large expanses of seemingly continuous biotic communities, whether Shrubsteppe (greasewood, shadscale, or sagebrush) or pygmy forests (Pinyon-Juniper or juniper). The loss of these habitats is no less important than pristine Wetlands, riparian corridors, or high-elevation forests. Land and resource managers should endeavor to conserve the ecological processes and functions, including large manageable tracts of shrub habitats essential to the Sage Sparrow and a variety of similar species which it represents.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

A cursory review of the literature gives the impression that Sage Sparrows have been studied intensively. Many of the direct observations are anecdotal or derived from community-based studies where Sage Sparrows were component members of a larger investigation. Even in studies where the Sage Sparrow was a focal species, more questions were raised than resolved (Wiens 1985). Because the Sage Sparrow is closely associated with big sagebrush and other similar shrub habitats (a habitat generally considered poorly studied within North American ornithology), its presence or absence, density and distribution, and productivity could be used as an indicator of habitat quality. Shrub vegetation is difficult to measure from year-to-year due to subtle changes that are not as readily detectable as in grasses or forbs.

Research should focus on:

1. Species-specific life history and ecology in long-term contexts (i.e., longer than 1-2 years, due to lag time related to site fidelity or tenacity), inclusive of migrating, breeding, and wintering periods.
2. Improved methods for measuring shrub vegetation parameters useful to avian studies.
3. Options for management of Shrubsteppe bird species for long-term conservation, which includes determination of the significance of human-related and natural changes to Sage Sparrow population parameters and their habitats.

OUTREACH NEEDS

Increased awareness through public education is critical to promoting public support for the Utah Partners in Flight habitat and species conservation objectives. Much of the public at large is unaware that there is even an issue regarding avian conservation. At a minimum, it is suggested for the Sage Sparrow (and all the Utah conservation priority species), information fact sheets (front and back 8.5x11 in card stock) be prepared similar to those already prepared for some Utah species (i.e., Bald Eagle, Utah Prairie Dog, etc.). A picture of the species, distribution map, and general life history information should be included sufficient for classroom use.

The recent focus on status of Sage-grouse has elevated awareness of the importance of Shrubsteppe habitats to birds. However, further outreach efforts need to focus on the importance of managing Shrubsteppe habitats for a diversity of bird species. Most Shrubsteppe habitats are under federal and state land management in Utah; thus land managers should be a primary target of outreach efforts. These efforts should include incorporation of bird diversity into Sage-grouse management plans and Conservation Agreements.

Public awareness of the importance and uniqueness of Shrubsteppe habitats is extremely limited. Preparation of a Shrubsteppe bird Wildlife Notebook suitable for classroom use would provide a vehicle for increased public awareness. This notebook would feature Priority Species (Sage-grouse, Sage Sparrow, Brewer’s Sparrow) and other associated Shrubsteppe birds.

GAMBEL'S QUAIL
(*Callipepla gambelii*)

Conservation Priority Score of 32

Jim Parrish

ASSOCIATED SPECIES: Other bird species that may respond similarly to habitat components used by Gambel's Quail are Mourning Dove, Yellow-billed Cuckoo, Western Screech-Owl, Black-chinned Hummingbird, Ladder-backed Woodpecker, Willow Flycatcher, Black Phoebe, Bell's Vireo, Bewick's Wren, Crissal Thrasher, Lucy's Warbler, Yellow Warbler, Yellow-breasted Chat, Summer Tanager, Song Sparrow, Black-headed Grosbeak, Blue Grosbeak, Bullock's Oriole, and Lesser Goldfinch in Lowland Riparian habitat, and Greater Roadrunner, Lesser Nighthawk, Costa's Hummingbird, Ladder-backed Woodpecker, Ash-throated Flycatcher, Loggerhead Shrike, Verdin, Cactus Wren, Black-tailed Gnatcatcher, Northern Mockingbird, Bendire's Thrasher, Le Conte's Thrasher, Black-throated Sparrow, Scott's Oriole, and House Finch in Low Desert Scrub habitat.

DISTRIBUTION: The Gambel's Quail is a permanent resident of Sonora, Mexico; Arizona south of the Mogollon Rim and west along the Colorado River through the Grand Canyon; the deserts of southeastern California; extreme southern Nevada; southern Utah along the Colorado River drainage; western Colorado along the Colorado and Gunnison rivers; southwestern New Mexico; and the Rio Grande valley of New Mexico and extreme west Texas (Brown et al. 1998). Gambel's Quail has been widely introduced outside of its native range, but most of those introductions have failed. It was formerly common in northeastern Utah and the adjacent Four Corners region, but introductions of southern birds apparently diluted the cold-tolerating abilities of those populations and most have disappeared. In Utah, Gambel's Quail are found in Washington County below about 1,525 m (5,000 ft), in western Kane County, and along the Colorado River in Grand County. Introductions elsewhere in Utah appear to have failed.

ECOLOGY: Gambel's Quail is a permanent resident throughout its range. Its primary foods are seeds of forbs, grasses, shrubs, trees, and cacti, which are eaten on the ground (Hungerford 1962). Nesting begins in early April through the first week in May (Brown et al. 1998). The nest site is located on the ground and usually under a shrub. There is a strong positive correlation between Gambel's Quail breeding success and the preceding winter-spring precipitation in desert habitats (Hungerford 1960), but quail in riparian and irrigated agricultural areas are not as dependent upon rain-induced vegetation (Gullion 1958). Water developments may concentrate quail populations near those sites, but have little effect on either quail survival or reproductive success (Smith and Gallizioli 1963). Habitat quality is the primary factor determining Gambel's Quail abundance at any given time (Brown et al. 1998). Hunting mortality is inversely dependent on quail population density and is compensatory to natural mortality (Gullion 1954, Gallizioli and Webb 1961).

HABITAT REQUIREMENTS: Gambel's Quail are year-round residents of the Sonoran Desert where they inhabit brushy and thorny vegetation, particularly mesquite and other leguminous shrubs, acacia, and cacti, in river valleys and drainages and desert mountain foothills (Brown 1989). In southeastern Utah and western New Mexico Grasslands, Gambel's Quail utilize brushy drainages and Grasslands invaded by mesquite and other shrubs. In the Mojave Desert region of eastern California, southern Nevada, and southwestern Utah, Gambel's Quail prefer riparian habitat and brushy washes, but avoid creosote bush habitat (Rosenberg et al. 1991). Quail also use shrubby fence rows and irrigation ditches along the edges of agricultural fields.

HABITAT AND/OR POPULATION OBJECTIVES:

Gambel's Quail has a limited distribution within Utah. The species is hunted during upland game seasons, and a few hunters dedicated to pursuing upland game harvest a moderate number of individuals annually. Currently no density estimates are available for the species in Utah, and an initial objectives is to determine current population densities within each Utah physiographic region. Harvest data can be used to determine initial areas of occurrences within respective BCAs that can then be surveyed for more detailed population data.

IMPLEMENTATION RECOMMENDATIONS AND OPPORTUNITIES

MANAGEMENT ISSUES WITH CONSERVATION RECOMMENDATIONS: Habitat loss and modification has occurred over a small portion of Gambel's Quail range through the removal of riparian habitat for house and road construction and other urban developments, and wildfires. Clean farming along fence rows and field edges has eliminated much quail habitat in agricultural area. Livestock grazing is suspected of having a slightly negative effect on quail populations (Brown 1989). In Utah, there has been a loss of riparian habitat in portions of the Virgin River valley as a result of urban developments. The effect of livestock grazing on Gambel's Quail in Utah is unknown.

Habitat Loss

1. Discourage the clearing of riparian habitat.

Livestock Grazing

1. Manage grazing practices to promote the growth of native grasses and forbs.

Implementation Opportunities

1. Consider habitat needs in agency plans and projects, including stewardship projects.

EVALUATION OF ASSUMPTIONS: RESEARCH AND MONITORING

RECOMMENDED RESEARCH

1. Determine the effects of livestock grazing on Gambel's Quail populations.
2. Determine the effects of range fires on Gambel's Quail populations.

OUTREACH NEEDS

1. Educate agency and public of the importance of riparian habitat to birds as well as the economic values.

HABITATS IN UTAH MOST IN NEED OF CONSERVATION

HABITAT DESCRIPTION OF UTAH

Habitat [e.g., being the ecological sum of the vegetative, physical, and topographic features associated within a given area (Odum 1971)] can greatly influence the persistence of birds and other wildlife. Habitat selection by a species is closely associated with its behavioral, morphological, and life-history traits, and studies aimed at addressing habitat requirements have formed the framework for many of the conservation efforts aimed at preserving species diversity (Cody 1985, Probst and Crow 1991). Conservation of species in the wild would not be possible without an appreciation and understanding of habitat and habitat requirements. Likewise, at least a basic understanding of the influence of climatological factors on habitat is useful in understanding cause and effect of habitat and habitat-related issues.

The climate of continents is greatly influenced by latitude, physical configuration, and the arrangement and height of mountain ranges that may be present. In North America there are latitudinal climatic belts that vary from cold, frigid conditions in the extreme north to mild, hot conditions in the extreme south. The western United States with its high mountains and plateaus effectively blocks the influx of Pacific moisture that would ordinarily dominate the continent, much the same way as Atlantic moisture dominates Europe. Typical western patterns consist of cool, moist mountain climates alternating with warm, dry lowland climates, conditions which also characterize climate in Utah. Northerly flowing patterns during the winter give way to less vigorous flow during the summer. This north-south circulation of climatic patterns results, for instance, in more low pressure systems initiating in June and more high pressure systems initiating in December in the Great Basin than any other region in the Northern Hemisphere for any month (Harper et al. 1994). In addition to the influx of Pacific moisture, Utah climate is secondarily influenced by influx from the Gulf of Mexico.

The total area of Utah is approximately 219,881 km^2 (136,546 mi^2) occurring entirely within the Intermountain floristic region. The largest landowner (and land manager) in Utah is the U. S. Bureau of Land Management (BLM), which manages approximately 92,173 km^2 (57,239 mi^2; 42%) of the total area of the state. Of this, approximately 129 km^2 (80 mi^2) consists of land designated as Wilderness. Private Lands comprise approximately 47,011 km^2 (29,194 mi^2; 21%) of the state's total area. The U. S. Forest Service (USFS) owns approximately 32,750 km^2 (20,338 mi^2; 15%) of the total area with 313 km^2 (194 mi^2) of USFS lands designated as National Recreation Area lands and an additional 2,987 km^2 (1,855 mi^2) of USFS lands designated as Wilderness.

Utah is a land that reflects the results of seismic activity, water, and wind erosion. The state is crisscrossed with active faults that have produced a relief resulting from uplift and crustal formation within the fault zones. The state is divided approximately into two halves by the mountain-plateau axis (northeast to southwest trend) formed by the mountains of the Wasatch Range and the plateaus of central and southern Utah.

West of the mountain and plateau system lies the Great Basin, a portion of the Basin and Range physiographic province, whose drainages have no outlet to the sea. The easternmost portion of the Great Basin forms the western one-third of the state and contains mountain ranges which vary in elevation from approximately 7,000 - 10,500 ft. The highest peak in the Great Basin occurs in the Deep Creek Mountains at 12,088 ft near the Utah-Nevada border. The mountains in the Great Basin are the youngest in the state. All are formed along a north-south line and ostensibly appear almost identical. Ranges in the Great Basin are separated by nearly identical wide-expanse basins characterized by sagebrush, shad scale, or creosote bush communities.

East of the mountain-plateau axis, water flows ultimately to the Colorado River through a large number of tributaries. The Colorado drainage on the other hand is an open system where water flows eventually to the sea. Ecology as well as habitat differs between the two halves. The Colorado Plateau is characterized by an exposed geology of rock spires, arches, Anasazi cliff dwellings, desert rivers, and vast unpopulated areas (Behle 1985, Welsh et al. 1987).

Utah climate is typical for a semi-arid desert biome, with the exception being the northern part of the state which experiences variations caused by the presence of the Great Salt Lake and the Wasatch and Uinta Mountain Ranges. The Wasatch Mountains are an outlier of the Rocky Mountains and separate the Great Basin landscape of Utah from the Uinta Basin and the Colorado Plateau drainages which form most of the easternmost one-third of the state. The Wasatch Mountains contain most of the state’s forested habitat in a landscape that is part of a massive uplift that extends north and south for over 400 miles. Some peaks extend higher than 12,000 ft in elevation. Along the western face of the Wasatch Mountains occurs an abrupt fault escarpment known as the Wasatch Front. Portions of the Wasatch Front are approximately 1,800 m (6,000 ft) high. Approximately two-thirds of the state’s human population resides along the base of the Wasatch Front, principally in the Salt Lake City, Ogden, and Provo/Orem metropolitan areas. The Wasatch Mountains also contain meadows of wildflowers, groves of spruce, Douglas-fir, Aspen, Ponderosa Pine, pinyon pine, and juniper, and streams that provide high value wildlife habitat (Harper et al. 1994, Behle 1985).

The Uinta Mountains in northeastern Utah are the oldest and highest mountains in the state, and they are also the longest east-west extending range of mountains in the contiguous United States. King’s Peak in the Uinta’s is the highest peak in the state at 4,123 m (13,528 ft) elevation, and the Uintas contain more than 400 km^2 (248 mi^2) of landscape with an elevation above 3,048 m (10,000 ft). The Green River extends through the eastern portion of the range near the Utah-Colorado border. The Uinta and Wasatch Mountains both show evidence of glaciation, and the Uintas in particular contain hundreds of tiny lakes that are the result of advancing/receding glaciers.

South of the Uinta Mountains lies the Uinta Basin with an elevation of about 1,520 - 1,830 m (5,000-6,000 ft). The Uinta Basin is rich in agricultural lands and mineral resources and is bordered on the south by the Tavaputs Plateau extending southward to an elevation of about 2,740 m (9,000 ft). This area in the southern portion of the state forms the red-rock canyonlands and exposed geologic formations that are typically thought of as being characteristic of Utah. Elevation in the red-rock country ranges from 1,219 - 1,676 m (4,000-5,500 ft). The LaSal Mountains occurring in the southeastern portion of the Uinta Basin are the second highest mountains in the state (Behle1985, McIvor 1998).

Extremes in elevation above sea level in Utah vary more than 3,350 m (11,000 ft). The Virgin River Valley in extreme southwestern Utah occurs at the lowest elevation in the state at approximately 685 m (2,250 ft). The valley is part of an extension of the Mojave Desert that extends into Utah, and avifaunas here are quite distinct from other portions of the state. -The occurrence of extensive mountains and high plateaus over most of the remainder of Utah results in much of the landscape occurring above 2,100 m (7,000 ft) (Cronquist et al. 1972, Welsh et al. 1987, Behle 1985, Harper et al. 1994).

Precipitation varies tremendously throughout the state. Average annual precipitation is about 33 cm (13 inches), but rainfall ranges from as little as 10 - 13 cm (4 - 5 inches) in the west desert areas to 100 cm (40 inches) or more in the mountains. Precipitation not only varies from place to place within the state but also varies at each place from year to year. Wet and dry cycles occur irregularly, and the combination of typically low humidity, low precipitation, and high evaporation maintains the desert portions of the state. Extreme southwestern Utah consists of a warm southern desert, while in the Great Basin and Colorado Plateau portions of the state consist of a more extensive cold northern desert landscape. The cold northern desert conditions also occur in the red-rock canyonlands of southeastern Utah and in parts of the Uinta Basin and Tavaputs Plateau in the northeastern part of the state.

Approximately 6,640 km^2 (4,123 mi^2) of the total area of Utah consists of perennial or intermittent water bodies. Perennial and ephemeral drainage systems occur throughout the state. Perennial streams are few in the Great Basin, whereas springs overall in the region are relatively numerous but small. The drainage for most of western Utah is the Great Basin. Some large lakes in the Great Basin, such as the Great Salt Lake, tend to be more saline, while others such as Utah Lake are fresh water. The closed hydrologic system of the Great Basin results in a substantially different vegetative structure when compared to the Colorado Plateau. The Virgin River in southern Utah was formerly a tributary of the Colorado River but now drains into Lake Mead in Nevada. Central Utah is largely served by the Sevier River which originates as two forks in the high plateau region of south-central Utah, runs north, west, and then turns south to empty into an intermittent, brackish sink known as Sevier Lake.

Temperature, like precipitation, also varies throughout Utah. Average annual temperature has been about 11EC (52EF) for the past 20 years. Temperatures as high as 47EC (116EF) and as low as -45EC (-50EF) have been recorded. Monthly average temperature for the state has also not varied substantially in the past 20 years. March, April, May and October average temperatures were approximately 1.3 - 2.2°F warmer during 1977-1986, while December average temperature has been approximately 1.5°F warmer during 1987-1996 then during the previous ten-year period. Typical summer day-time high temperatures are 27-32EC (80-90EF) in the valleys and 18-24EC (65-75EF) at higher elevations. The difference between day and night temperatures can be dramatic, and Utah temperatures can vary considerably with local weather conditions and location within the state (UDWR 1998).

In Utah as well as elsewhere, physiography largely determines climatic conditions. The climate of Utah can be characterized as having small annual rainfall amounts in the valleys and deserts, heavy snowfall amounts typically in the mountains, and great seasonal and diurnal ranges in both precipitation and temperature. Climatic conditions prominently influence plant distributions, and avian distributions are generally correlated with plant communities which form a characteristic habitat on both a local and larger scale within the state. Utah climate can be considered as typical for a semi-arid desert biome, with the exception being the northern part of the state which experiences variations caused by the presence of the Great Salt Lake and the Wasatch and Uinta Mountain Ranges. Thus, climate can be said to determine the presence and absence of birds in a given area. In fact, the climatically determined vegetation belts occurring on many of the mountains in Utah are largely responsible for the variety of bird life occurring in the state (Welsh et al. 1987, Behle 1985, Harper et al. 1994).

HABITAT IDENTIFICATION PROCESS

Habitat types seldom conform to geopolitical boundaries such as State or County borders, etc., with the exception of occasional portions of a river corridor. In fact, many of the states within the Western Working Group (WWG) of Partners in Flight share particular habitat types.

Habitat identification criteria were developed within the WWG and UPIF based on several sources. To facilitate planning and implementation of biological objectives for shared species, the WWG developed habitat headings (e.g., Riparian, Shrublands, Grassland, Forest, and Additional Habitat Categories). Within each of those habitat headings, UPIF has developed habitat categories that fall under the WWG headings and also address habitat specifics occurring within the state. Utah contains 5 Physiographic Regions developed by Partners in Flight (Figure 1) which were considered in assessing avian habitat in Utah (see Physiographic Regions of Utah). Habitat associations included both primary and secondary breeding habitats used by species for nesting and foraging. Additional habitat associations were included for those species that overwinter in Utah.

Within each Physiographic Region, further delineation of habitat was accomplished using the Geographic Approach to Planning (GAP) habitat categories for Utah developed in cooperation with the Utah Division of Wildlife Resources (Edwards et al. 1995). GAP Analysis provides a systematic approach for determining the protection afforded biological diversity in given areas using four primary geographic information system (GIS) layers: (1) the distribution of actual vegetation cover types delineated from satellite imagery and ancillary data; (2) land ownership; (3) land management status (responsible agency); and (4) terrestrial vertebrate distributions based on vegetation distributions and known observations (Edwards et al. 1995).

Each of the GAP habitat categories were evaluated by the UPIF Rankings Committee as to their accuracy in terms of known habitat preferences of birds and their distribution within the state. Accordingly, some of the basic GAP categories were revised by the Committee. Those that were revised are indicated below as part of the overall description of each category. Where appropriate, the revised GAP habitat categories were assigned a grouping within the WWG major habitat headings (see Table 14 below). These revised GAP habitat categories were then mapped to give an approximate extent of occurrence of each type within the physiographic regions of Utah (Figures 3-24).

UTAH PARTNERS IN FLIGHT HABITAT GROUPS

RIPARIAN/WETLANDS

In the West, riparian habitat covers less than 1% of the land, yet the role of riparian habitat in the landscape is substantial. Within Utah, 66-75% of all bird species use riparian habitats during some portion of their life history. Typically, diversity and abundance of birds dramatically increases in western riparian habitat compared with other habitat types, and numerous avian species are now considered as riparian obligates.

Lowland Riparian

The GAP Lowland Riparian habitat category was essentially unchanged for use in the UTACS process. Lowland Riparian habitat occurs generally lower than 1,670 m (5,500 ft) in elevation and consists primarily of Fremont cottonwood dominant landscapes with varying densities of shrubby understory vegetation (Table 14). Approximately 511 km^2 (317 mi^2) of Lowland Riparian habitat exists within Utah, comprising 0.23% of the total area of the state. Of this total area, approximately 43,823 ha (108,207 ac) occur within the Basin and Range (23,770 ha/58,736 ac) and Colorado Plateau (20,053 ha/49,551 ac) physiographic regions (Figure 3). Surprisingly, only about 9% (4,457 ha/11,013 ac) of Lowland Riparian habitat occurs within the Utah Mountains physiographic region.

Of all habitat types characterized for the UTACS, Lowland Riparian is unquestionably the habitat used most by Utah's avifauna. At least 42% of Utah's b avian species use Lowland Riparian as either breeding habitat (n=98 species; Table 1) or in winter (n=11 species; Table 1). In addition, Lowland Riparian is the habitat used most by the priority species. At least 9 priority species, Abert's Towhee, Bell's Vireo, Black Swift, Black-throated Gray Warbler, Broad-tailed Hummingbird, Gambel's Quail, Lewis's Woodpecker, Lucy's Warbler, and Yellow-billed Cuckoo select Lowland Riparian as primary or secondary breeding habitat. Abert's Towhee, Bell's Vireo and Lucy's Warbler select only Lowland Riparian habitat for breeding and/or wintering activities in Utah (Table 1).

Mountain Riparian

The GAP Mountain Riparian habitat category was essentially unchanged for use in the UTACS process. Mountain riparian occurs generally above 1,670 m (5,500 ft) in elevation and consists primarily of narrowleaf cottonwood and thinleaf alder dominant landscapes with varying densities of shrubby understory vegetation (Table 14). Approximately 38,807 ha(95,892 ac) of mountain riparian habitat exists within Utah. Of this total area, approximately 35,376 ha (87,414 ac; 91%) occur within the Utah Mountains (26,283 ha/64,945 ac; 68%) and Basin and Range (9,093 ha/22,469 ac; 23%) physiographic regions (Figure 4).

Mountain Riparian habitat makes up only 0.18% of the total landscape of Utah, but at least 20% of Utah's avian species use Mountain Riparian as either breeding habitat (n=44 species, Table 1) or in winter (n=2 species; Table 1). However, only 1 priority species, Broad-tailed Hummingbird, selects Mountain Riparian as a secondary habitat for breeding activities (Table 1).

Wetlands

The GAP Wetland habitat category was essentially unchanged for use in the UTACS process. Wetland habitat consists primarily of low elevation marsh and Wetland areas (<1,670 m/5,500 ft; Table 14). Approximately 53,778 ha (132,885 ac) of Wetland habitat exists within Utah of which 44,236 ha (82%) occur within the Basin and Range physiographic region (Figure 5). Wetland habitat makes up only 0.24% of the total landscape of Utah, and at least 14% of Utah's avian species use Wetlands as breeding habitat (n=33 species; Table 1). Wetland habitat is not selected for in winter in Utah, likely due to snow cover being common statewide during the winter season.

Three priority species, American Avocet, Black-necked Stilt, and Long-billed Curlew select Wetland as a primary breeding habitat, and one additional priority species, American White Pelican selects Wetland as a secondary breeding habitat (Table 1).

Wet Meadow

The GAP Wet Meadow habitat category was essentially unchanged for use in the UTACS process. Wet Meadow habitat consists of water saturated meadows containing mostly grasses and sedges at elevations ranging from approximately 1,000 - 3,000 m (3,300 - 9,800 ft; Table 14). Approximately 5,764 ha (14,283 ac) of Wet Meadow habitat exists within Utah occurring mostly (77%) within the Utah Mountains physiographic region (4,434 ha/10,956 ac) (Figure 6).

Wet Meadow habitat makes up only 0.03% of the total landscape of Utah and is used by approximately 5% of the state's avian species as breeding habitat (n=13; Table 1). Of these, one priority species, the Bobolink, selects Wet Meadow as a primary breeding habitat. Wet Meadow habitat is not selected for by birds wintering in Utah (Table 1)

SHRUBLANDS

In Utah, shrublands or shrubby habitats represent a dominant feature of the statewide landscape. Species composition within Utah typically varies according to elevation from the mountain mahogany and Gambel oak communities at higher latitudes to the black brush, creosote bush, and shrub live oak assemblages at lower elevations.

Shrubsteppe

The GAP Shrubsteppe habitat category was revised to include both the Sagebrush and Sagebrush/Perennial Grass categories for use in the UTACS process. Shrubsteppe habitat in Utah consists primarily of sagebrush communities with a variety of associated shrubs and grass species (Table 14). Approximately 2,942,680 ha (7,271,362 ac) of Shrubsteppe habitat exists within Utah making Shrubsteppe the third most common habitat type in the state. Of this total area, approximately 1,492,694 ha (3,688,447 ac; 51%) occur within the Basin and Range, and an additional 1,084,822 ha (2,680,595 ac; 37%) within the Colorado Plateau physiographic Region. The remaining hectares of Shrubsteppe habitat is almost equally distributed within the Utah Mountains (6.3%) and Wyoming Basin (6.1%) physiographic regions. While Shrubsteppe is the third most common type, it is the most widely distributed habitat that occurs in Utah (Figure 7). Shrubsteppe habitat in Utah ranges from approximately 750 - 3,500 m (2,500 - 11,500 ft) in elevation. However, Shrubsteppe occurring within approximately 1,220 - 2,600 m (4,000 - 8,500 ft) elevation likely encompasses the highest distribution of birds within this habitat type.

Although very widespread throughout Utah (13.4% of the total land area), Shrubsteppe habitat is only sparsely used by Utah's birds. Only 6 avian species use Shrubsteppe habitat for breeding and an additional 2 species select Shrubsteppe habitat in winter (Table 1). Those species that do use Shrubsteppe are highly adapted and tend to be dependent on Shrubsteppe or similar shrubland habitats such as High Desert Scrub and Low Desert Scrub habitats (see below).

Three of the 6 species that consistently select Shrubsteppe habitat are priority species (Sage-grouse, Sharp-tailed Grouse, and Sage Sparrow). All three select Shrubsteppe as a winter habitat as well, and the

Sage-grouse uses Shrubsteppe habitat year-round. The Sharp-tailed Grouse selects Shrubsteppe as a primary breeding habitat and the Sage Sparrow uses Shrubsteppe as a secondary breeding habitat in Utah (Table 1).

Mountain Shrub

Mountain Shrub habitat in Utah consists primarily of mountain mahogany and Gambel oak communities, or Rocky Mountain maple dominant landscapes which are often associated with various other higher elevation shrubs within conifer forests at 1,000 - 3,000 m (3,300 - 9,800 ft) elevation (Table 14). At least 295,680 ha (730,625 ac; 1.3% of the total land area) of Mountain Shrub habitat exists within Utah, mostly occurring within the Utah Mountains (219,494 ha/542,370 ac; 74%) physiographic region. The remaining Mountain Shrub areas are almost equally distributed within the Basin and Range (30,503 ha/75,373 ac) and Colorado Plateau (39,178 ha/96,809 ac) physiographic regions (Figure 8).

Mountain Shrub communities in Utah are selected for breeding or wintering use by at least 16 avian species in Utah. Of these, 15 species select Mountain Shrub as breeding habitat. Mountain Shrub was not identified as breeding or wintering habitat for any of Utah's priority species (Table 1). Even so, Virginia's Warbler and Broad-tailed Hummingbird are known to frequently occur in Mountain Shrub habitat during the breeding season.

High Desert Scrub

High Desert Scrub is the most common habitat community in Utah, consisting primarily of greasewood, Atriplex, and halogeton dominant landscapes associated with various grasses, forbes, and other shrubs (primarily sagebrush) at 670 - 3,150 m (2,200 - 10,300 ft) elevation (Table 14). At least 5,534,850 ha (13,676,614 ac; 25.2% of the total land area) of High Desert Scrub habitat exists within Utah which occurs primarily within the Basin and Range and Colorado Plateau physiographic regions. Approximately 3,022,815 ha (7,469,376 ac; 55%) occur within the Basin and Range, and an additional 2,440,089 ha (6,029,460 ac; 44%) within the Colorado Plateau physiographic Region. The remaining hectares of High Desert Scrub habitat is about equally distributed within the Utah Mountains (0.73%)and Mojave Desert (0.57%) physiographic regions (Figure 9).

High Desert Scrub ranks fourth in terms of the number of avian species that use this habitat type for breeding or wintering activities. At least 27 (12%) avian species use High Desert Scrub habitat for breeding and an additional 2 species select this habitat in winter (Table 1).

Five priority species, Brewer's Sparrow, Ferruginous Hawk, Mountain Plover, Gray vireo, and Sage Sparrow select High Desert Scrub as breeding habitat. Brewer's Sparrow and Mountain Plover select High Desert Scrub as both a primary and secondary breeding habitat, while Gray Vireo only selects High Desert Scrub as its secondary breeding habitat. None of the priority species select High Desert Scrub for use during winter (Table 1).

Low Desert Scrub

Low Desert Scrub habitat in Utah consists primarily of black brush and creosote dominant landscapes associated with various other warm desert shrubs at 670 - 1,830 m (2,200 - 6,000 ft) elevation (Table 14). At least 1,002,796 ha (2,477,909 ac; 4.6% of the total land area) of Low Desert Scrub habitat exists within Utah which occurs primarily within the Colorado Plateau 868,804 ha (2,146,815 ac; 87%) physiographic region. An additional 126,852 ha (313,451 ac; 12%) occurs within the Mojave Desert physiographic region (Figure 10).

Low Desert Scrub ranks sixth in terms of the number of avian species that use this habitat type for breeding or wintering activities. At least 23 (11%) avian species select Low Desert Scrub as breeding habitat and an additional 2 species select this habitat in winter (Table 1). Gambel's Quail, a priority species, uses Low Desert Scrub as both a breeding and wintering habitat (Table 1).

Oak

The GAP Oak habitat category was divided into two categories (Northern Oak and Desert Oak) for the UTACS process to better reflect associations with avian species. Northern Oak consists of the Gambel oak portion of the GAP Oak category. Desert Oak consists of the remaining oak habitat types in the original GAP Oak category. Oak communities in Utah consist primarily of three species, Gambel oak (*Quercus gambelii*), wavy-leaf oak (*Q. undulata*), shrub live-oak (*Q. turbinella*), and shinnery oak (*Q. havardii*). Numerous relic and modern hybrids also exist within certain areas of the state, particularly in the southeastern and southwestern counties.

Northern Oak—Northern Oak habitat in Utah consists of one oak type, Gambel oak, with associated maples and sagebrush (Table 14). With the exception of Daggett (in part) and Rich Counties, Northern Oak communities occurs statewide in Utah at elevations ranging from 1,150 - 2, 750 m (3,700 - 9,000 ft). Only one portion of extreme northeastern Daggett county is known to contain Gambel oak habitat, and the species is completely absent in Rich county.

Approximately 608,473 ha (1,503,537 ac; 2.8% of the total land area) of Northern Oak habitat exists within Utah occurring primarily in the central and northern portions of the state. The Utah Mountains physiographic region contains most of the Northern Oak habitat (409,823 ha/1,012,673 ac; 67%). An additional 117,649 ha (290,711 ac; 19%) occurs within the Colorado Plateau, and an additional 80,235 ha (198,261 ac; 32%) occurs within the Basin and Range physiographic Region. (Figure 11).

Four avian species, California Quail, Steller's Jay, Virginia's Warbler, and Wild Turkey (Rio Grande form) select Northern Oak habitat for breeding. The California Quail and Virginia's Warbler select Northern Oak as a primary breeding habitat, and the remaining 2 species select it as a secondary breeding habitat (Table 1). Of these, the Virginia's Warbler is the only priority species which selects Northern Oak as a primary breeding habitat. Northern Oak is not selected by those species that overwinter in Utah.

Desert Oak—Deseret Oak habitat in Utah consists of, Gambel oak, shrub live-oak, and shinnery oak, and related hybrid forms (wavyleaf oak and shrub live-oak) co-occurring with various shrubs (Table 14). Desert Oak communities are limited in distribution to Emery, Garfield, Grand, Kane, San Juan, Washington, and Wayne counties at elevations ranging from 820 - 2,150 m (2,700 - 7,000 ft). At elevations ranging from 1,150 - 2,150 m (3,700 - 7,000 ft) Desert Oak and Northern Oak communities co-occur.

Approximately 182,023 ha (449,779 ac; 0.8% of the total land area) of Desert Oak habitat exists within Utah occurring primarily in the Colorado Plateau physiographic region (136,651 ha/337,665 ac). An additional 43,138 ha (106,594 ac) occurs within the Basin and Range, and an additional 2,233 ha (5,518 ac) occurs within the extreme southern portions of the Utah Mountains physiographic region (Figure 12).

In the southwestern portion of Utah, the predominant nominate oaks are Gambel oak and shrub live-oak. In addition, these two forms have hybridized in the area to form what is known as *Q. pauciloba*. This hybrid form is commonly referred to as the Great Basin hybrid oak which is distributed more or less discontinuously. The distance separating clones also varies from <1.6 km (<1 mi) to as much as 48-80 km (30-50 mi). Typically, these hybrid oak communities in southwestern Utah are confined to the usual south to west exposures of foothills within Kane, San Juan, and Washington Counties at 820 - 1,700 m (2,700 - 5,600 ft) elevation. At lower elevations, these forms occur in generally in open areas, and at upper elevations hybrids are generally in or near limestone cliffs or coves which provide high thermal value necessary for their existence.

In the southeastern Utah, the predominant nominate oaks are Gambel oak and shinnery oak. These forms have also hybridized to form wavy-leaf oak (*Q. undulata*) which is distributed only in Emery, Garfield, Grand, Kane, San Juan, and Wayne counties at 1,150 - 2,150 m (3,700 - 7,000 ft) elevation. Shinnery oak originated in Texas and has expanded it's range into Utah from northern New Mexico where other hybrid forms also occur. In addition, some portions of southeastern Utah also contain communities of *Q. pauciloba* which have expanded eastward. Wavy-leaf oak communities are not currently known to exist in southwestern Utah. At elevations between 1,150 - 2,150 m (3,700 - 7,000 ft), Desert Oak species such as wavy-leaf or shinnery oak co-occur with Gambel oak.

While several avian species are known to use Desert Oak habitat, only the Acorn Woodpecker, uses Desert Oak habitat for breeding. While the Acorn Woodpecker is not currently a priority species for conservation action in Utah, the species selects Desert Oak year-round as primary and secondary breeding habitat and as a wintering habitat (Table 1).

GRASSLAND

The GAP Grassland habitat category was divided into two categories [Grassland (e.g., Grassland and Dry Meadow GAP categories combined) and Alpine (e.g., Alpine GAP category)] for the UTACS process. Grassland communities in Utah exist basically in two forms, perennial and annual grasses/forbes (i.e., Grassland) and high elevation tundra (i.e., Alpine) habitat. Plant species composition in these areas within Utah typically varies according to elevation from primarily grass-dominant communities at 640 - 3,570 m (2,200 - 11,700 ft) to the sedge assemblages at 1,140 - 3,960 m (3,740 - 13,000 ft) and aven (perennial herbs; Geum sp.) assemblages at 1,280 - 3,500 m (4,200 - 11,500 ft). In occurring within the state in terms of elevational range. Various grass species occur from the lowest elevations in the state [approximately 640 m (2,100 m)] to as high as 3,5700 m (11,710 ft). Some grasses occur almost throughout this elevational range, while other forms are more restricted. The predominant elevations at which Grassland habitat occurs, however, is approximately 640 - 2,740 m (2,200 - 9,000 ft). In addition, Grassland habitat is almost equally distributed across the three predominant physiographic regions within the state, Colorado Plateau (259,794 ha/641,951 ac; 34% of total Grassland habitat), Utah Mountains (254,785 ha/629,574 ac; 33% of total Grassland habitat), and Basin and Range (236,642 ha/584,742 ac; 30% of total Grassland habitat). An additional 22,435 ha/55,437 ac of Grassland habitat occurs within the Wyoming Plateau physiographic region. (Figure 13).

Sedges in Utah occur at an elevational range of 1,150 - 3,960 m (3,750 - 13,000 ft). Like grasses, some sedges are widely distributed both geographically and elevationally. The predominant elevation range for sedges is 1,150 - 3,500 m (3,740 - 11,400 ft) with most of the forms known for Utah occurring somewhere within that range. No attempt has been made to quantify sedges apart from grasses within the Grassland habitat type by physiographic region. However, sedges apparently do not commonly occur below 1,140 m (3,740 ft), and grasses are not common above 2,740 m (8,990 ft).

At least 11 avian species use Grassland as breeding habitat, and at least one additional species uses Grassland as winter habitat (Table 1). Of these, 2 species, Black Rosy-Finch and Sharp-tailed Grouse, are priority species. The Black Rosy-Finch uses Grassland habitat in winter only, and the Sharp-tailed Grouse selects Grassland as a secondary breeding habitat (Table 1). Overall, Grassland birds in Utah have been poorly studied in terms of statewide populations and ecological dynamics.

Alpine

Approximately 89,911 ha (222,170 ac; 0.4% of the total land area) of Alpine habitat exists within Utah, occurring mostly within the Utah Mountains (79,566 ha; 98%) physiographic area as Alpine tundra (Figure 14). An additional 1,338 ha (4,390 ac) of Alpine habitat occurs in the Colorado Plateau physiographic region in the LaSal and Abajo Mountains in the southeastern portion of the state.

At least 12 sedge species and two avens occur within the elevation range for Alpine habitat in Utah. Purple avens (*Geum trifolium*) has the broadest elevational distribution in the state occurring from 1,980 - 3,500 m (6,500 - 11,500 ft). However, the dominant Grassland species at higher elevations in the Uinta Mountains is Ross avens (*G. rossii*) where it occurs with russet sedge (*Carex pseudoscirpoidea*) and tufted hairgrass (*Deschampsia caespitosa*) as co-dominants (Welsh et al. 1987, Lewis 1970).

Alpine habitat is selected for by at least 5 avian species as breeding habitat. Of these, the Black Rosy-Finch is a priority species that selects Alpine habitat as a primary breeding habitat (Table 1).

FOREST

Approximately 5,631,977 ha (18,478,516 ac; 26% of the total land area) of forested habitat exists within the state, and with the exception of Pinyon-Juniper occurs mostly in more mountainous terrain. Distribution of the individual community types varies considerably according to elevation and occurrence within selected physiographic regions. Pinyon-Juniper is the only forested habitat that occurs in all physiographic regions in the state. Forested habitat in Utah also varies according to elevation with Pinyon-Juniper communities occurring at the lowest forested elevations [1,100 - 2,100 m (3,500 - 7,000 ft)] and Aspen, Ponderosa Pine/Lodgepole Pine/subalpine fir/Engelmann spruce communities occurring at the higher elevations [1,800 - 3,200 m (6,000 - 10,500 ft)]. At least 41% of Utah's birds use the individual groupings of the state's forested habitats for either breeding or wintering activities (Table 1).

Sub-Alpine Conifer

The GAP Spruce-Fir habitat category was renamed as Sub-Alpine Conifer for the UTACS process. Sub-Alpine Conifer in Utah and consists primarily of Engelmann spruce and/or subalpine fir dominant communities occurring between 1,830 - 3,400 m (6,000 - 11,200 ft) elevation (Table 14). Associated forested habitats occurring within Sub-Alpine Conifer vary with that range of elevation.

Approximately 497,122 ha (1,228,388 ac; 2.3% of the total land area of Utah) of Sub-Alpine Conifer habitat exists within the state. Of this total area, approximately 442,089 ha (89%) occurs within the Utah Mountains, and an additional 54,290 ha (11%) within the Colorado Plateau and Basin and Range physiographic regions; an additional 743 (0.15%) ha of Sub-Alpine Conifer habitat occurs within the Wyoming Plateau physiographic region (Figure 15).

At least 20 avian species use Sub-Alpine Conifer as breeding habitat, and one additional species selects Sub-Alpine Conifer habitat in winter (Table 1). One priority species, the Three-toed Woodpecker which occurs year-round in Utah, selects Sub-Alpine Conifer as both a breeding and winter habitat (Table 1).

Mixed Conifer

The GAP Mountain Fir habitat category was renamed as Mixed Conifer for the UTACS process. Mixed Conifer habitat in Utah consisting primarily of Douglas and white fir dominant communities occurring primarily between 1,500 and 3,050 m (5,000 - 10,000 ft) elevation (Table 14). Mixed Conifer habitat can be found in all counties within Utah, with the exception that blue spruce is limited only to Beaver, Box Elder, Carbon, Duchesne, Emery, Garfield, Grand, Kane, Iron, Paiute, Salt Lake, San Juan, Sanpete, Sevier, Summit, Uinta, Utah, Wasatch, and Washington counties, and subalpine fir is not known to occur in Davis and Millard counties.

Approximately 261,094 ha (647,775 ac; 1.2% of the total land area) of Mixed Conifer habitat exists within Utah. Of this total area, most occurs within the Utah Mountains physiographic region (176,837 ha; 68%). The Colorado Plateau physiographic region contains approximately 67,544 ha (26%) of Mixed Conifer habitat, Basin and Range contains 14,476 ha (5.5%), and Wyoming Basin approximately 2,236 ha (0.8%)(Figure 16).

As with Sub-Alpine Conifer, a total of 21 avian species select Mixed Conifer as breeding habitat (n=18; Table 1) or as winter habitat (n=3; Table 1). None of the 21 species selecting Mixed Conifer habitat are presently listed as priority species.

Ponderosa Pine

The Ponderosa Pine and Ponderosa Pine/Mountain Shrub GAP habitat categories were combined as Ponderosa Pine habitat for the UTACS process. Ponderosa Pine forests in Utah occur between 1,600 and 2,700 m (5,200 - 8,700 ft) elevation in all counties except Box Elder, Cache, Davis, Morgan, Rich, Salt Lake, and Wasatch. Habitat diversity changes according to elevation within Ponderosa Pine forests both in terms of shrub composition in the understory and association with other tree species (Table 14).

Approximately 275,163 ha (679,928 ac; 1.2% of the total land area) of Ponderosa Pine habitat exists within Utah, occurring mostly within the Utah Mountains (201,531 ha; 73%) and Colorado Plateau (69,453 ha; 25%) physiographic regions. An additional 4,178 ha (2%) occurs in the extreme southern portions of the Basin and Range physiographic region (Figure 17).

A total of 13 avian species select Ponderosa Pine as breeding habitat. One priority species, Lewis's Woodpecker, selects Ponderosa Pine as a secondary breeding habitat (Table 1).

Lodgepole Pine

The GAP Lodgepole habitat category was unchanged for use with the UTACS process. Approximately 229,175 ha (566,291 ac; 1.0% of the total land area of Utah) of Lodgepole Pine habitat occurs between 1,800 and 3,450 m (6,000 - 11,300 ft) elevation in Cache, Daggett, Duchesne, Summit, Uinta, and Wasatch counties in Utah, primarily within the Utah Mountains physiographic region (Figure 18). Lodgepole Pine is the most common conifer in the Uinta Mountains, and within 2,500 and 3,350 m (8,000 - 11,000 ft) elevation, lodgepole habitat becomes mixed with either blue spruce or subalpine fir, depending upon location. At least 201,382 ha (88%) of Lodgepole Pine habitat occurs within the Utah Mountains and an additional 27,793 ha (12%) occurs within the Wyoming Plateau physiographic regions.

Only 2 avian species select Lodgepole Pine as breeding habitat but none in winter. One priority species, Three-toed Woodpecker, selects Lodgepole Pine as a secondary habitat for breeding (Table 1).

Pinyon-Juniper

Three GAP habitat categories, Juniper, Pinyon, and Pinyon-Juniper, were combined into a single category as Pinyon-Juniper for use with the UTACS process. As such, Pinyon-Juniper represents the second-most common habitat within Utah consisting of approximately 4,259,792 ha (19.4% of the total land area). Pinyon-Juniper occurs in all physiographic regions of Utah between approximately 820 and 3,400 m (2,700 - 11,000 ft) elevation (Figure 19). However, community composition varies considerably with elevation within this broad statewide band.

Two species of pinyon occur in Utah between 820 and 2,750 m (2,700 - 9,000 ft) elevation, singleleaf pinyon (*Pinus monophylla*) and two-needle pinyon (*P. edulis*). Singleleaf pinyon occurs only in Beaver, Box Elder, Cache, Iron, Juab, Kane, Millard, Tooele, Utah, Wasatch, and Washington counties. Two-needle pinyon is more widespread in Utah, occurring in Beaver, Cache, Daggett, Duchesne, Emery, Garfield, Grand, Kane, Iron, Juab, Millard, Paiute, Rich, San Juan, Sanpete, Sevier, Uinta, Utah, and Washington counties.

Four species of juniper occur in Utah between 850 and 3,400 m (2,800 - 11,000 ft) elevation, common juniper (*Juniperus communis*), One-seed Juniper (*J. monosperma*), Utah juniper (*J. osteosperma*), and Rocky Mountain juniper (*J. scopulorum*). Juniper occurs in all counties in Utah with the exception of common juniper which is not known to occur in Davis and Rich counties. Thus, the extent of Pinyon-Juniper habitat in Utah varies both according to species and elevation, and uniform stands of pinyon as well as uniform stands of juniper can and do occur within the state in suitable areas.

At least 21 avian species select Pinyon-Juniper as breeding habitat. Three priority species, Black-throated Gray Warbler, Gray Vireo, and Virginia's Warbler, each select Pinyon-Juniper habitat. The Black-throated Gray Warbler and Gray Vireo each select Pinyon-Juniper as primary breeding habitat. The Virginia's Warbler selects Pinyon-Juniper as a secondary breeding habitat (Table 1).

Aspen

The GAP Aspen habitat category was unchanged for use with the UTACS process. Aspen occurs in all Utah counties within elevations between 1,400 and 3,200 m (5,600 - 10,500 ft) within the Utah Mountains physiographic region (Figure 20). In-most Utah counties, Aspen communities associate with Mixed Conifer species at appropriate elevations, and in the Uinta Mountains of northeastern Utah Aspen associates with Lodgepole Pine (Table 14).

Approximately 754,288 ha (1,863,846 ac; 3.4% of the total land area) of Aspen habitat exists within Utah. Of this total area, most occurs within the Utah Mountains physiographic region (631,508 ha; 84%). The Colorado Plateau physiographic region contains approximately 80,215 ha (10.6%) of Aspen habitat, Wyoming Basin contains an additional 27,481 ha (3.6%), and Basin and Range approximately 15,082 ha (1.9%) (Figure 20). Of the total ha of Aspen habitat, approximately 13,618 ha 33,650 ac; 1.8%) occur as Aspen/conifer mix occurring mostly within the Utah Mountains physiographic region. An additional

5,871 ha (14,500 ac; 0.8%) of Aspen/lodgepole mix occurs within the Uinta Mountains of northeastern Utah also within the Utah Mountains physiographic region.

At least 19 avian species select Aspen habitat for breeding, but none select Aspen as winter habitat (Table 1). None of the 19 species selecting Aspen habitat are presently listed as priority species.

Additional Habitat Categories

Water

The GAP Water habitat category remained unchanged for use in the UTACS process. A relatively small portion of the landscape of Utah consists of measurable open water habitat in the form of natural lakes, streams and rivers, and man-made reservoirs. The primary human uses of water are irrigation for agricultural crops, for livestock use, domestic landscaping, and for human consumption. Most of the natural water bodies and man-made reservoirs contain water year-round, although irrigation demands have a substantial influence on the volume of water available in any of these systems at one time. Typically, peak high volume periods are in the late spring following seasonal run-off and spring rains. Peak low volume periods typically occur in late August and/or September. In some portions of the state, water is made available for irrigation purposes through the entire month of October, and these extended periods of availability greatly reduce the volume of water available for birds and other wildlife.

At least 748,214 ha (1,848,837 ac; 3.4% of the total land area) of large-scale open water habitat exists within Utah. Most of the available water in the western two-thirds of the state occurs in the form of large lakes and reservoirs, whereas the eastern one-third contains mostly large river systems (Figure 21). The Great Salt Lake (682,631 ha/1,686,781 ac) located within the northwestern portion of the state is the largest single contiguous body of open water habitat in Utah, and the lake with its adjacent marshes and Wetlands has been designated as an Important Bird Area (IBA) by the American Birding Conservancy. The salinity of water within the Great Salt Lake varies but is approximately 5 - 8 times more salty than ocean water. Sizeable quantities of brine shrimp occur within the Great Salt Lake, and the lake margins and adjacent marsh areas are used extensively by migrant and resident shorebirds and waterfowl both for nesting and foraging.

In addition to the Great Salt Lake, two additional large-scale water bodies occur within the Basin and Range physiographic region, Utah Lake occurring southeast of the Great Salt Lake and consisting in part of brackish water, and Sevier Lake further to the south which is also salt water. Due primarily to the existence of these relatively large bodies of water in the western one-third of the state, the Basin and Range physiographic region contains 89% (764,851 ha) of the total open water habitat within the state (Figure 21). The Utah Mountains contain an additional 36,415 ha (4.2%) of open water habitat that also occurs mostly in the form of lakes and reservoirs, and the Colorado Plateau contains an additional 52,856 ha (6.2%) that occurs mainly within the Green and Colorado River drainages. Approximately 1,486 ha of the southernmost portion of Flaming Gorge National Recreation area occur within the Utah Mountains in extreme northeastern Utah. Likewise, the southernmost half of Bear Lake reservoir also occurs in the Utah Mountains in extreme northern Utah and extending on into southern Idaho (Figure 21).

Nineteen species, mostly water birds, select open water habitat in Utah as their breeding habitat (n=14; Table 1) or in winter habitat (n=5; Table 1). Only one priority species, the American White Pelican, selects water for use as a primary breeding habitat (Table 1). Nesting colonies of White Pelicans occur on selected islands annually within the Great Salt Lake, and the birds use the open water around the islands extensively for foraging and other breeding season activities. In addition, pelicans seasonally frequent other relatively large bodies of open water in central and southern Utah.

Rock

The extent of rock outcrops and rock dominant landscapes that currently exist within Utah is unknown. Virtually the entire state bears evidence to extensive volcanic, seismic, and associated depositional activity in the past, particularly in the Utah Mountains and within the Colorado Plateau.

A Rock habitat category does not exist within the current GAP product, with two exceptions. The Barren GAP category includes a rock component which includes the high elevation rock outcrops such as the Uinta Mountains, LaSal Mountains, Capitol Reef and Zion National Parks, the San Rafael Swell, and numerous other isolated peaks and rock formations within the state. The Lava GAP category includes the high elevation lava flows in southeastern Utah only. As a result of the limitations in mapping and quantifying rock habitat with GAP, we estimate approximately 673,181 ha (1,663,430 ac; 3.1% of the total land area) exists in Utah. Certainly several hundred or perhaps even thousands of hectares of rock habitat occur across all physiographic regions of Utah, and birds that select a rock habitat for breeding and/or foraging likely do not have difficulty in doing so.

Three avian species select rock habitat in Utah for breeding (Table 1). The Rock Wren uses rock as a primary breeding habitat, and the Canyon Wren and Rufous-crowned Sparrow use rock as a secondary breeding habitat. Unquestionably other avian species frequent rock and rocky-type habitats on occasion, but these three species are certainly the ones that are more closely associated with rock habitat in the state. None of the priority species identified thus far use rock habitat as primary or secondary breeding or primary winter habitat.

Playa

The Playa habitat category is the result of combining the Barrens and Pickleweed Barrens habitat types described in GAP. However, when combined, these two categories include rock habitat that occurs outside of what expected locales for playa habitat in Utah. Thus, for the UTACS process, playa habitat is the result of combining these two GAP categories without the rock components of each, but only within the Basin and Range physiographic region (Figure 22). Playa habitat represents the fifth largest landscape feature in Utah with 961,775 ha (2,376,546 ac; 4.4 % of the total land area), occurring only within the Basin and Range physiographic region at 1,280 m (4,200 ft) elevation or below.

At least 7 species of birds select playa habitat in Utah as breeding habitat (Table 1). Only one species, the Snowy Plover, selects playa as both primary and secondary breeding habitat. No species are known to select playa habitat during winter. The American Avocet and Black-necked Stilt, are priority species, and each select playa habitat as secondary breeding habitat mostly within the landscape immediately surrounding and adjacent to the Great Salt Lake.

Agriculture

The Agriculture habitat category in GAP remained unmodified for use with the UTACS process. Approximately 934,912 ha (2,310,167 ac; 4.2% of the total land area) of agricultural habitat exists within Utah occurring in all five physiographic regions of the state (Table 14). Of this total area, most (46%) occurs within the Basin and Range physiographic region (428,703 ha/1,059,325 ac). The Utah Mountains physiographic region contains approximately 275,639 ha (681,104 ac; 29%), and the Colorado Plateau contains an additional 189,604 ha (468,511 ac; 20%) of agricultural habitat in the state (Figure 23). Considerably lesser extent of agricultural habitat occurs in the Wyoming Plateau and Mojave Desert physiographic regions of the state.

The predominant agricultural feature within the Utah landscape is pastureland or hay fields. To a lesser extent, land is converted to production of row crops (mostly corn, wheat, barley, and other cereal grains). Agricultural land use in Utah requires considerable irrigation which can dramatically influence lands adjacent to agricultural production areas. Margins around agricultural fields are used for a variety of game and non-game birds, and these field margins and associated irrigation canals provide non-cultivated habitat strips for nesting and foraging activities. These field margins and orchards are extremely important to the species that use agricultural habitat in Utah.

A total of 26 avian species use agricultural habitat in Utah Table 1). Of these, 21 select agricultural habitat for breeding and an additional 5 species select agricultural habitat in winter. Five priority species, Yellow-billed Cuckoo, Bobolink, Long-billed Curlew, Ferruginous Hawk, and Mountain Plover, select agricultural habitat in Utah. The Ferruginous Hawk and Mountain Plover use pastureland, hay fields, and plowed cropland during winter, and the remaining species select agricultural land as secondary breeding habitat (Table 1). The Bobolink, and Long-billed Curlew are mainly associated with pastureland or uncut hay fields as well as adjacent irrigation canals and field margins in those agricultural landscapes which are selected for breeding activities. The Yellow-billed Cuckoo occasionally nests in orchards in Utah.

Urban

The urban habitat category refers to metropolitan areas, cities, towns, and landscapes developed mainly for residential and industrial purposes. Most of Utah's population resides in approximately the northern one-third of the state (Figure 24). One notable exception is the area in and around St. George, Utah, in the extreme southwestern corner of the state. On this basis, at least 144,620 ha (357,356 ac; 0.7% of the total land area) of urban habitat exists in Utah, of which 108,116 ha (267,155 ac; 75%) occurs along the Wasatch Front portions of the Basin and Range and extending from just north of Ogden, Utah, south to at least Spanish Fork, Utah. However, the extent of urban habitat in the state is rapidly expanding, not only along the Wasatch Front, but also within the northern portions of the Utah Mountains which currently contain approximately 30% of Utah's urbanized land areas. The Logan, Utah, and Park City, Utah areas have experienced rapid growth in recent years which is continuing, and the St. George, Utah area has also experienced substantial growth. Populated areas along the Wasatch Front have been expanding substantially for a number of years, and no noticeable indication of a declining growth trend is evident in the near future.

None of the priority species select urban habitat for breeding or winter activities (Table 1). Of those species that do select urban habitat, only 2 species, House Sparrow and Rock Dove, select urban environments for breeding activities. An additional 7 species, American Robin, Brown-headed Cowbird, Bullock's Oriole, California Gull, Common Grackle, House Finch, and Lesser Goldfinch use urban landscapes as both secondary breeding habitat and for winter activities.

Cliff

The extent of cliff dominant landscapes that currently exist within Utah is unknown. The "cliff" category was used initially as a descriptor for habitat preferred by the Black Swift. Typically, this species is closely associated with cliffs that are adjacent or nearby active waterfalls within selected portions of the state. However, none of the GAP categories adequately measure cliff habitat used by Black Swifts and other species, and thus the category was created to more effectively address species that select cliff habitats for breeding or during winter. As such, we estimate that approximately 673,181 ha (1,663,430 ac; 3.1% of the total land area) of cliff habitat exists within Utah.

At least 8 species, Canyon Wren, Common Raven, Golden Eagle, Peregrine Falcon, Prairie Falcon, Spotted Owl, Turkey Vulture, and White-throated Swift, select cliffs for breeding. Five additional species, Barn Swallow, Black Phoebe, Black Rosy-Finch, Black Swift, and Cliff Swallow select cliffs as secondary breeding habitat. Canyon Wren and Spotted Owl also select cliffs as winter habitat (Table 1). Of these, two species, Black Swift and Black Rosy-Finch, are priority species.

Table 14. Descriptions of Utah Partners in Flight Habitat Categories.

HABITAT	% OF TOTAL AREA OF UTAH	DESCRIPTION
RIPARIAN		
Lowland Riparian	**0.2%**	Riparian areas generally <1,670 m (<5,500 ft) elevation; Principal woody species include Fremont cottonwood (*Populus fremontii*), salt cedar (*Tamarix pentandra*), netleaf hackberry (*Celtis reticulata*), velvet ash (*Fraxinus velutina*), desert willow (*Chilopsis linearis*), willow (*Salix* spp.), and squawbush (*Rhus trilobata*).
Mountain Riparian	**0.2%**	Riparian areas generally >1,670 m (<5,500 ft) elevation; Principal woody species include willow, narrowleaf cottonwood (*Populus angustifolia*), thinleaf alder (*Alnus tenuifolia*), water birch (*Betula occidentalis*), black hawthorn (*Crataegus douglasii*), rocky mountain maple (*Acer glabrum*), red-osier dogwood (*Cornus stolonifera*), and wild rose (*Rosa woodsii*).
Wetland	**0.2%**	Low elevation marsh and Wetland areas <1,670 m (<5,500 ft) elevation; Principal species include cattail (*Typha latifolia*), bullrush (*Scirpus* spp.), and sedge (*Carex* spp.).
Wet Meadow	**<0.1%**	Water saturated meadows that include mostly grasses, forbs, sedges, and rushes at 1,000-3,000 m (3,300-9,800 ft) elevation. Principal species include sedges, rushes (*Juncus* spp.), reedgrass (*Calamagrostis* spp.), timothy (*Phleum* spp.), Alpine (*Poa* spp.), hairgrass (*Deschampsia cespitosa*), willowherb (*Epilobium* spp.), cinquefoil (*Potentilla* spp.), saxifrage (*Saxifraga* spp.), etc. Primary associated species include willow, honeysuckle (*Lonicera* spp.), and water birch.
SHRUBLANDS		
Shrubsteppe	**13.4%**	Shrub land principally dominated by big sagebrush (*Artemisia tridentata*), black sagebrush (*Artemisia nova*), low sagebrush (*Artemisia arbuscula*), or silver sagebrush (*Artemisia cana*); or dominate sagebrush shrub land and perennial Grassland at 750-3,500 m (2,500-11,500 ft) elevation. Principle associated grass species include bluebunch wheatgrass (*Agropyron spicatum*), needlegrass (*Stipa comata*), sand dropseed (*Sporobolus cryptandrus*), blue grama (*Bouteloua gracillis*), Thurber's needlegrass (*Stipa thurberiana*), western wheatgrass (*Agropyron smithii*), indian ricegrass (*Oryzopsis hymenoides*), galleta (*Hilaria jamesii*), and cheatgrass (*Bromus tectorum*). Primary associated shrub species include rabbitbrush (*Chrysothamnus* spp.), snakeweed (*Gutierrezia sarothrae*), winterfat (*Ceratoides lanata*), shadscale (*Atriplex confertifolia*), bitter brush (*Purshia tridentata*), and oak (*Quercus* spp.). Primary associated tree species include juniper (*Juniperus* spp.), pinyon (*Pinus* spp.), mountain mahogany (*Cerocarpus ledifolius*), and Ponderosa Pine (*Pinus ponderosa*).

SHRUBLANDS (CONT'D)		
Mountain Shrub	**1.3%**	Deciduous shrub land at 1,000-3,000 m (3,300-9,800 ft) elevation principally dominated by alder leaf mountain mahogany, cliff rose (*Cowania mexicana*), bitter brush, serviceberry (*Amelanchier utahensis*), and (*Amelanchier alnifolia*), buckbrush (*Ceanothus* spp.), chokecherry (*Prunus virginiana*), snowberry (*Symphoricarpos* spp.), pointleaf manzanita (*Arctostaphylos pungens*), and bearberry (*Arctostaphylos uva-ursi*); or deciduous shrub land principally dominated by bigtooth maple (*Acer grandidentatum*); forest principally dominated by mountain mahogany; or conifer forest or woodland with spruce-fir dominate/associate or co-dominate with Mountain Shrub; Primary associated shrub species include Gambel oak (*Quercus gambelii*), currant (*Ribes* spp.), ninebark (*Physocarpus* spp.), mountain lover (*Paxistima myrsinites*), blueberry (*Vaccinium* spp.), elderberry (*Sambucus* spp.), Oregon grape (*Mahonia repens*), and manzanita. Primary associated tree species include Rocky Mountain maple (*Acer glabrum*), Aspen (*Populus tremuloides*), Douglas fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), limber pine (*Pinus flexilis*), Alpine fir (*Abies lasiocarpa*), Engelmann spruce *(Picea engelmannii*), and Ponderosa Pine.
High Desert Scrub	**25.2%**	Shrublands at 670-3,150 m (2,200-10,300 ft) elevation principally dominated by greasewood (*Sarcobatus vermiculatus*), shadscale (*Atriplex confertifolia*), graymolly (*Kochia vestita*), mat-atriplex (*Atriplex corrugata*), castle valley clover (*Atriplex cuneata*), winterfat (*Ceratoides lanata*), budsage (*Artemisia spinescens*), four-wing saltbush (*Atriplex canescens*), halogeton (*Halogeton glomeratus*), Mormon tea (*Ephedra* spp.), horsebrush (*Tetradymia canescens*), snakeweed (*Gutierrezia sarothrae*) and rabbitbrush *(Chrysothamnus* spp.); or low elevation perennial Grassland co-dominate with shrub land. Principal Grassland species include galleta (*Hilaria jamesii*), indian ricegrass, three-awn (*Aristida glauca*) and sand dropseed (*Sporobolus airoides*). Primary associated forb species includes desert trumpet (*Eriogonum inflatum*). Primary associated shrub species include sagebrush, and black brush (*Coleogyne ramosissima*); Other associated species include seepweed (*Suaeda torreyana*).
Low Desert Scrub	**4.6%**	Shrub land at 670-1,830 m (2,200-6,000 ft) elevation principally dominated by black brush or creosote (*Larrea tridentata*), or white bursage (*Ambrosia dumosa*). Primary associated shrub species include spiny hopsage (*Grayia spinosa*), Mormon tea (*Ephedra* spp.), shadscale, snakeweed, turpentine bush (*Thamnosa montana*), dalea (*Dalea fremonti*), honey mesquite (*Prosopis glandulosa*), and brittlebush (*Encelia farinosa*); Other associated species include joshua tree (*Yucca brevifolia*), datil yucca (*Yucca baccata*), prickly pear (*Opuntia engelmannii*), and other cacti.
Northern Oak	**2.8%**	Deciduous shrub land principally dominated by Gambel oak at 1,125-2,750 m (3,700-9,000 ft) elevation. Primary associated shrub species include bigtooth maple (*Acer grandidentatum*) and sagebrush. Primary associated tree species include Aspen (*Populus tremuloides*) and mountain mahogany.

SHRUBLANDS (CONT'D)		
Desert Oak	**0.8%**	Deciduous shrub land principally dominated by wavyleaf oak (*Quercus undulata*) and shrub live oak (*Quercus turbinella*) at 820-2,100 m (2,700-7,000 ft) elevation. Primary associated tree species include juniper, pinyon (*Pinus* spp.), and Ponderosa Pine.
GRASSLAND		
Grassland	**3.5%**	Perennial and annual Grasslands; or herbaceous dry meadow, including mostly forbs and grasses occurring at 640-2,740 m (2,200-9,000 ft) elevation. Principle perennial grass species include bluebunch wheatgrass, sandburg bluegrass (*Poa secunda*), crested wheatgrass (*Agropyron cristatum*), basin wildrye (*Elymus cinereus*), galleta, needlegrass, sand dropseed, blue gramma, Thurbers needlegrass, western wheatgrass, squirreltail (*Sitanion hystrix*), timothy, poa (*Poa* spp.), spike (*Trisetum spicatum*), indian ricegrass, and some sedges. Principle annual grass species include cheatgrass. Principal forb species include yarrow (*Achillea millefolium*), dandelion (*Taraxacum officinale*), Richardson's geranium (*Geranium richardsonii*), (*Penstemon* spp.), mulesears (*Wyethia amplexicaulis*), golden aster (*Chrysopsis villosa*), arrowleaf balsamroot (*Balsamorhiza sagittata*), hawkbit (*Agoseris pumila*), larkspur (*Delphinium* spp.), and scarlet gilia (*Gilia pulchella*). Primary associated shrub species include sagebrush, shadscale, greasewood, creosote, rabbit brush, cinquefoil (*Potentilla fruticosa*), snowberry, and elderberry (*Sambucus caerulea*). Primary associated tree species include juniper.
Alpine	**0.4%**	Tundra vegetation at 1,980-3,500 m (6,500-11,500 ft) elevation, including sedges and avens. Principle species include Alpine avens (*Geum rossii, G. trifolium*), sedges, tufted hair grass, *Festuca ovina*, *Koeleria cristata*, *Trisetum spicatum*, *Silene acaulis*, *Paronychia pulvinata*, *Arenaria obtusiloba*, *Trifolium nanum, Kobresia myosuroides, Polygonum bistortoides, Eriophorum chamissonis*, and willow. Primary associated species include Engelmann spruce.
FOREST		
Sub-Alpine Conifer	**2.3%**	Conifer forest principally dominated by combinations of Engelmann spruce and Blue Spruce (*Picea pungens*) and sub-Alpine fir (*Abies lasiocarpa*) at 1,830-3,400 m (6,000-11,200 ft) elevation. Primary associated tree species include lodgepole (*Pinus contorta*), white fir, Douglas fir, limber pine, and bristlecone pine (*Pinus aristata*).
Mixed Conifer	**1.2%**	Conifer forest principally dominated by combinations of white fir and Douglas fir at 1,500-3,050 m (5,000-10,000 ft) elevation. Primary associated tree species include Engelmann spruce and blue spruce and subalpine fir.

FOREST (CONT'D)		
Ponderosa Pine	**1.2%**	Conifer forest or woodland at 1,600-2,700 m (5,200-8,700 ft) elevation with principally Ponderosa Pine dominate/associate or co-dominate with Mountain Shrubs. Principle Mountain Shrub associate species include manzanita, bitter brush, Gambel oak, snowberry, and curlleaf mountain mahogany. Primary associated tree species include juniper, pinyon (*Pinus* spp.), white fir and Douglas fir. Primary associated shrub species include sagebrush, and rabbitbrush.
Lodgepole Pine	**1.0%**	Conifer forest principally dominated by lodgepole (*Pinus contorta*) at 1,830-3,450 m (8,000-11,000 ft) elevation. Primary associated tree species include Engelmann spruce and subalpine fir.
Pinyon-Juniper	**19.4%**	Conifer forest at 820-3,400 m (2,700-11,000 ft) elevation principally dominated by Rocky Mountain juniper (*Juniperus scopulorum*), One-seed Juniper (*Juniperus monosperma*), and Utah juniper (*Juniperus osteosperma*); or conifer forest principally dominated by two-needle pinyon (*Pinus edulis*) or singleleaf pinyon (*Pinus monophylla*); or conifer forest principally co-dominated by *Pinus edulis* or *Pinus monophylla* and *Juniperus scopulorum*, *Juniperus monosperma* and *Juniperus osteosperma*. Primary associated tree species include mountain mahogany, Ponderosa Pine, white fir, and Douglas fir. Primary associated shrub species include sagebrush, black brush, and Gambel oak.
Aspen	**3.4%**	Deciduous forest principally dominated by Aspen at 1,400-3,200 m (5,600-10,500 ft) elevation. Primary associated conifer species include Engelmann spruce, blue spruce, subalpine fir, white fir, Douglas fir, Lodgepole Pine, and Ponderosa Pine. Primary associated shrub species include snowberry and serviceberry.
ADDITIONAL HABITAT CATEGORIES		
Water	**3.4%**	Open water; lakes, reservoirs, streams, rivers.
Rock	**<3.1%**	Rock and southern Utah high elevation lava flows.
Playa	**4.4%**	Sand flats and mosaics of sparsely vegetated and barren playa flats at 1,280-1,620 m (4,200-5,300 ft) elevation. Principal shrub species include pickleweed (*Allenrolfea occidentalis*). Primary associated species include samphire (*Salicornia* spp.), mound saltbush (*Atriplex faleata*), greasewood, saltgrass (*Distichlis stricta*), and seepweed.
Agriculture	**4.2%**	Row crops, irrigated pasture and hay fields, orchards, and dry farm croplands <1,830 m (<6,000 ft) elevation.
Urban	**0.7%**	Commercial land and high density residential areas <1,830 m (<6,000 ft) elevation.
Cliff	**<3.1%**	Vertical or near-vertical cliff facings

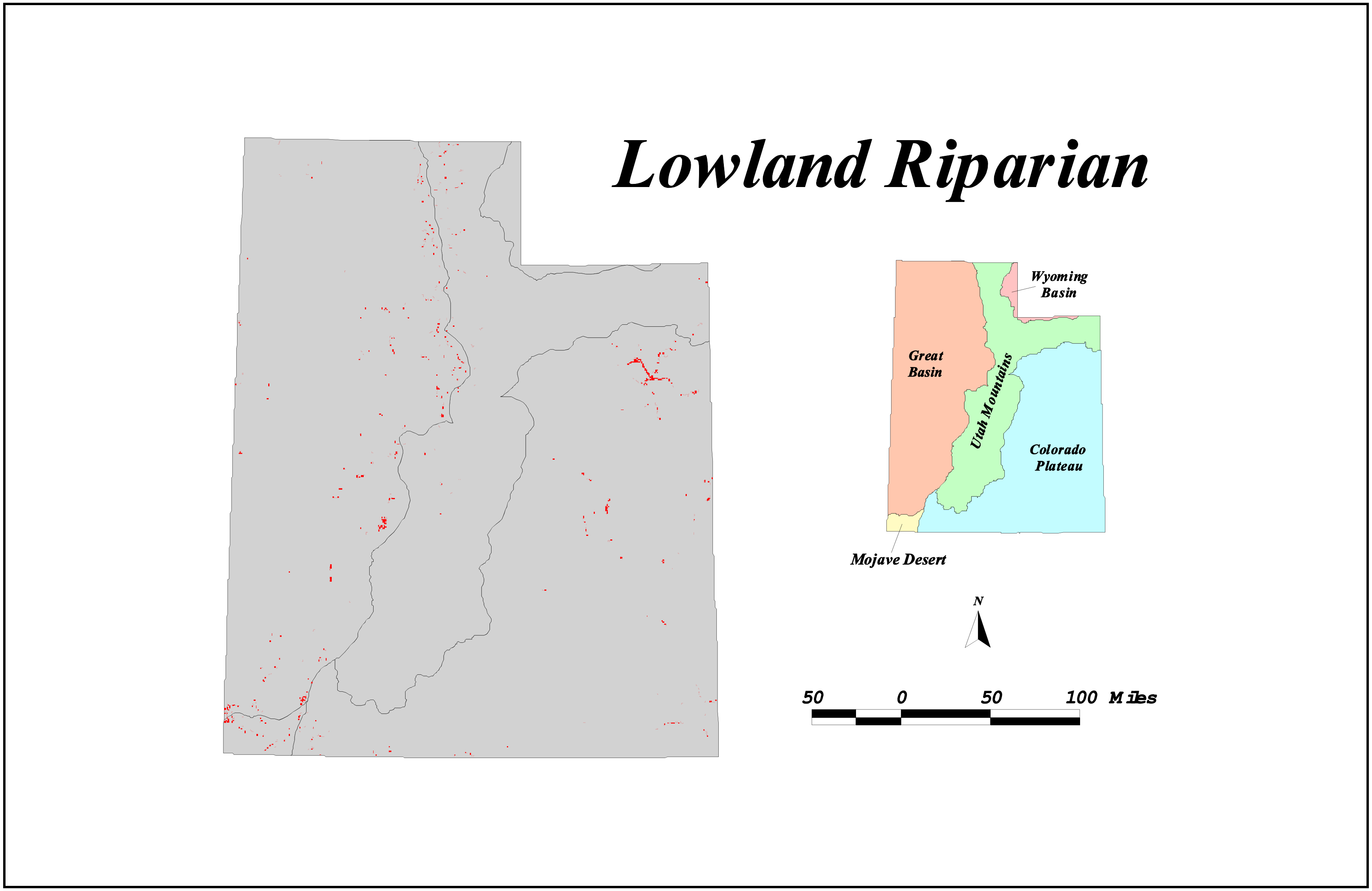


Figure 3. GAP Coverage Map for Lowland Riparian Habitat in Utah.

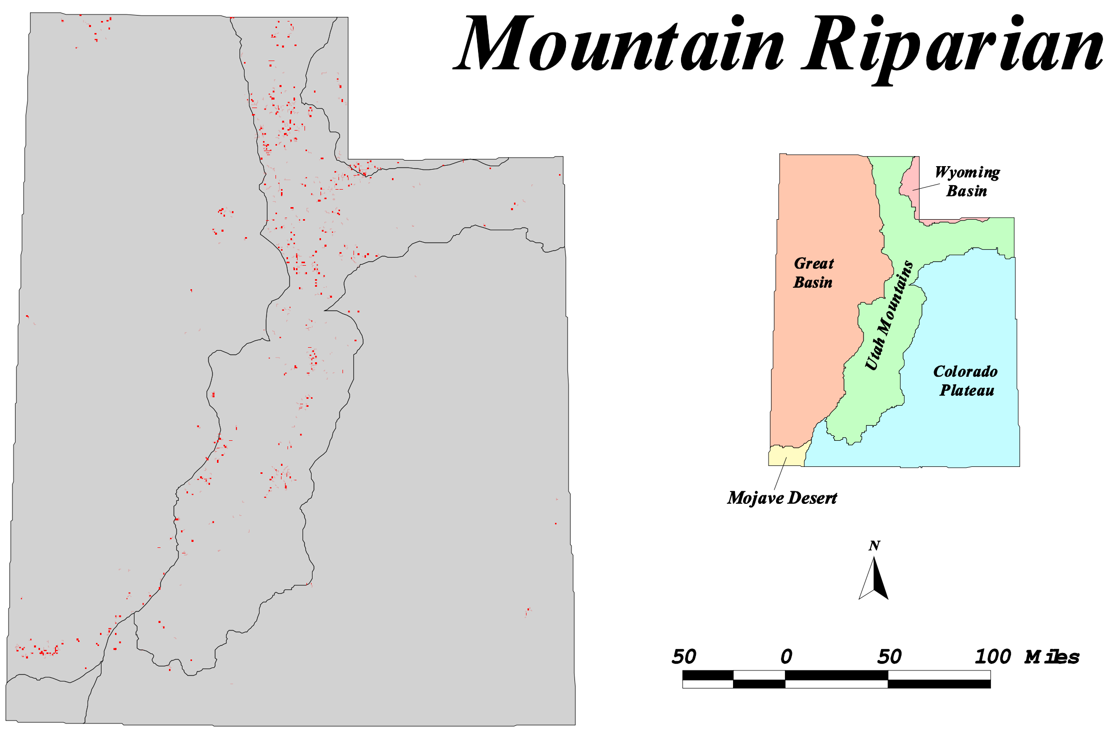


Figure 4. GAP Coverage Map for Mountain Riparian Habitat in Utah.

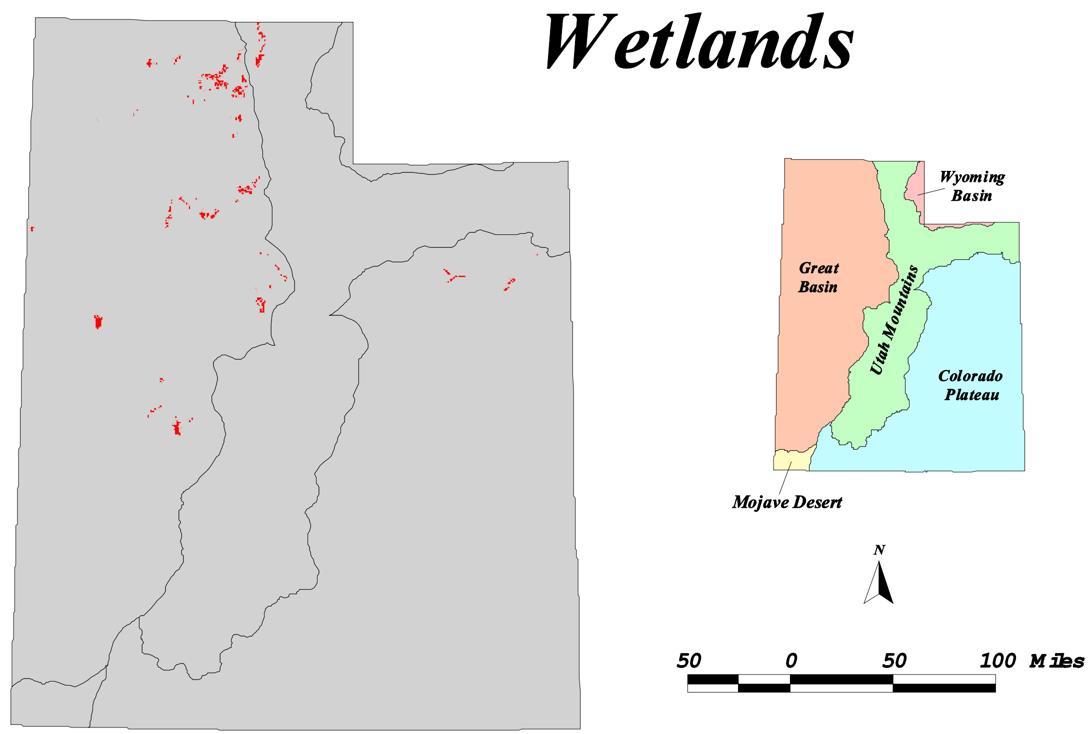


Figure 5. GAP Coverage Map for Wetlands Habitat in Utah.

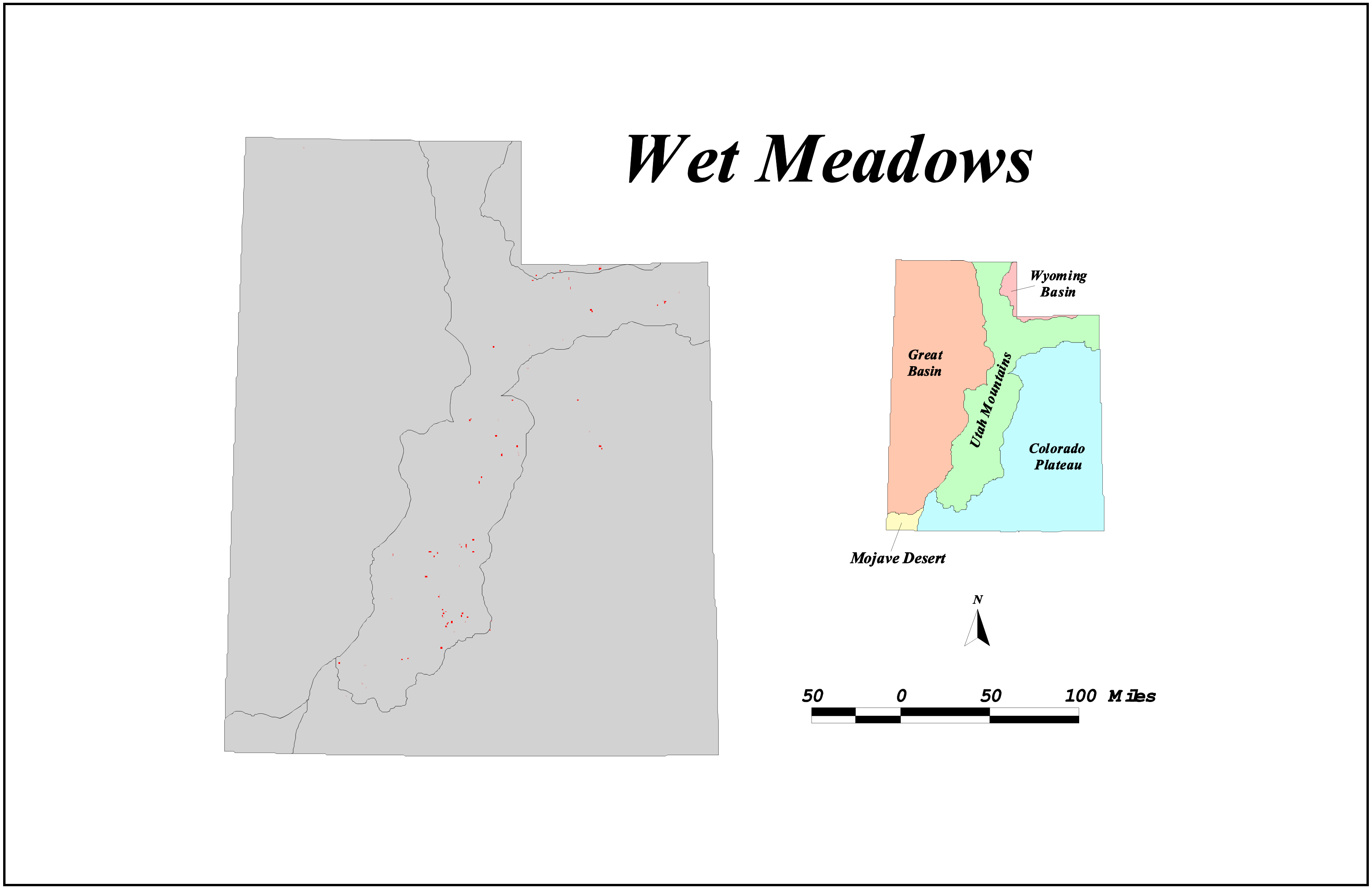


Figure 6. GAP Coverage Map for Wet Meadow Habitat in Utah.

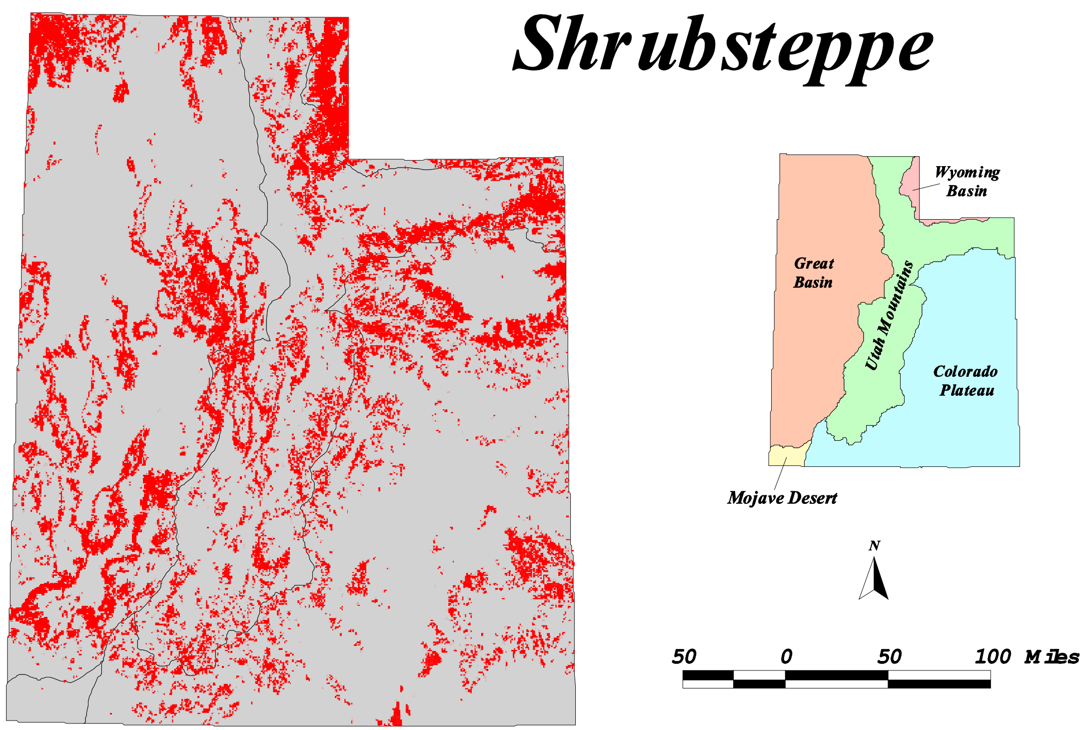


Figure 7. Revised GAP Coverage Map for Shrubsteppe Habitat in Utah.

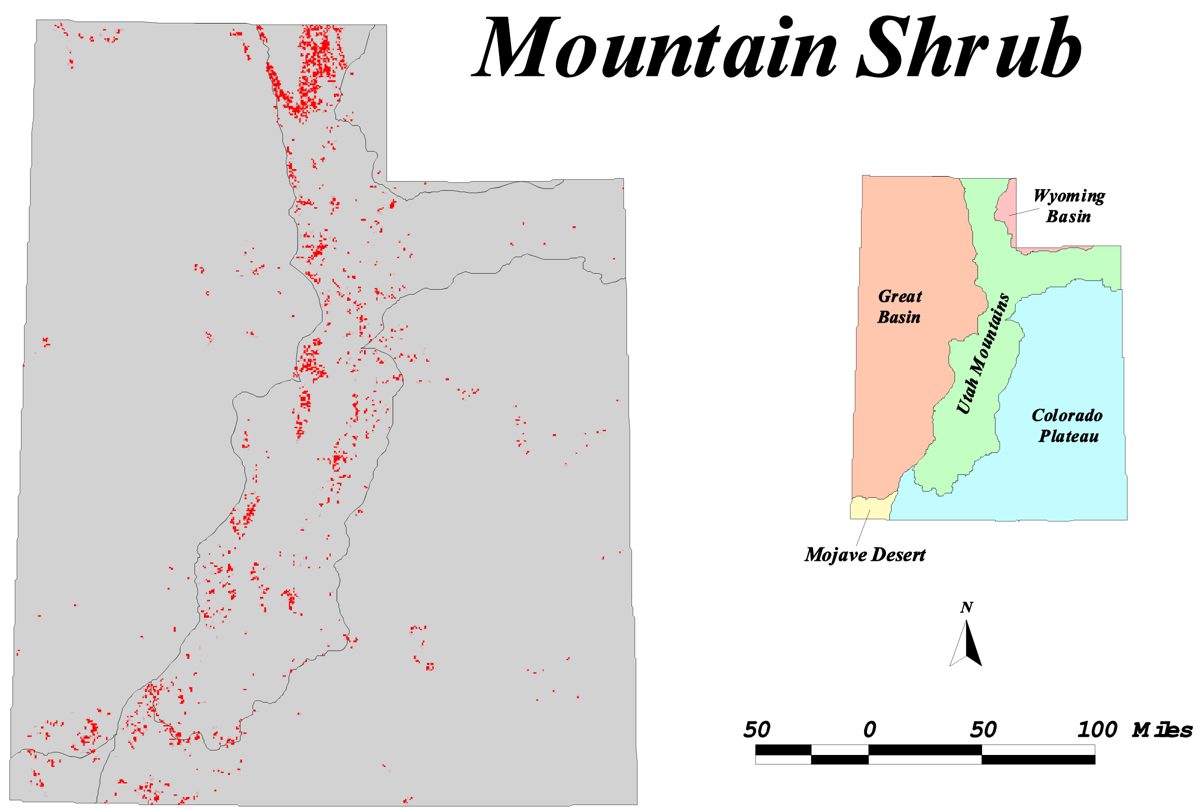


Figure 8. Revised GAP Coverage Map for Mountain Shrub Habitat in Utah.

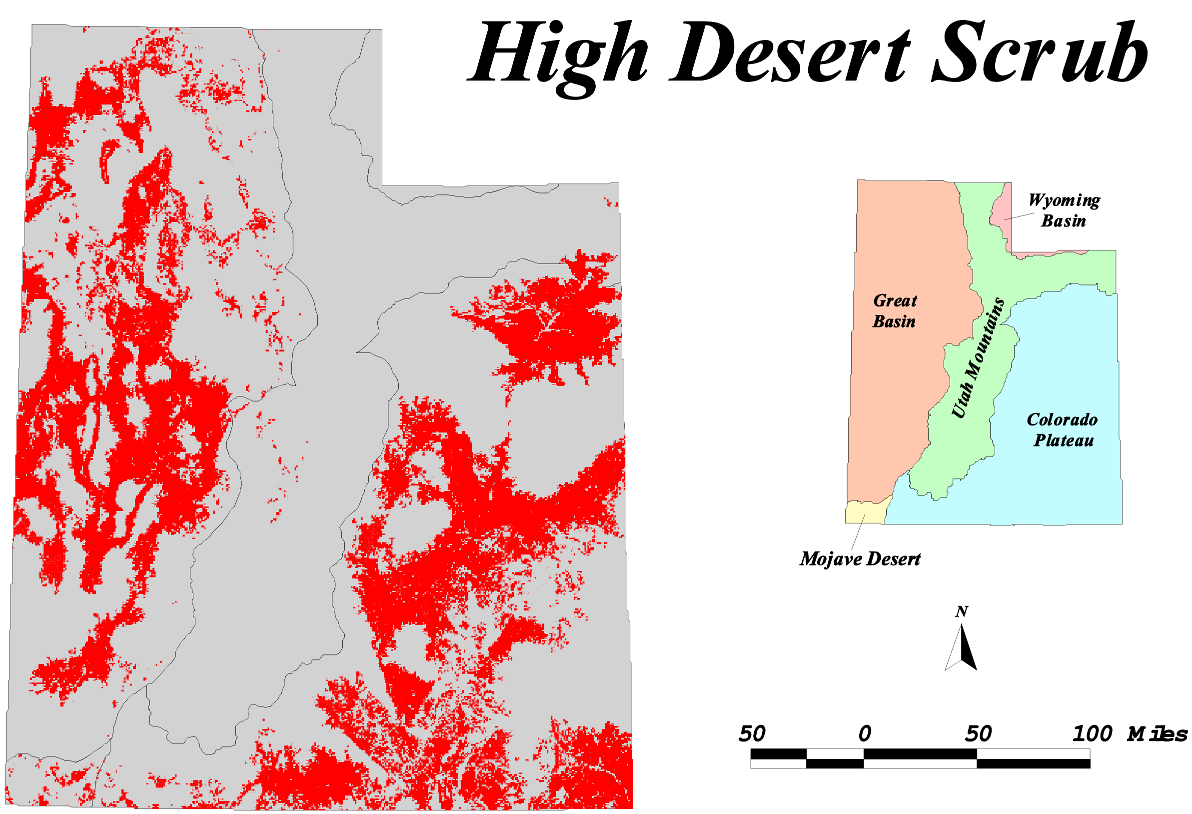


Figure 9. Revised GAP Coverage Map for High Desert Scrub Habitat in Utah.

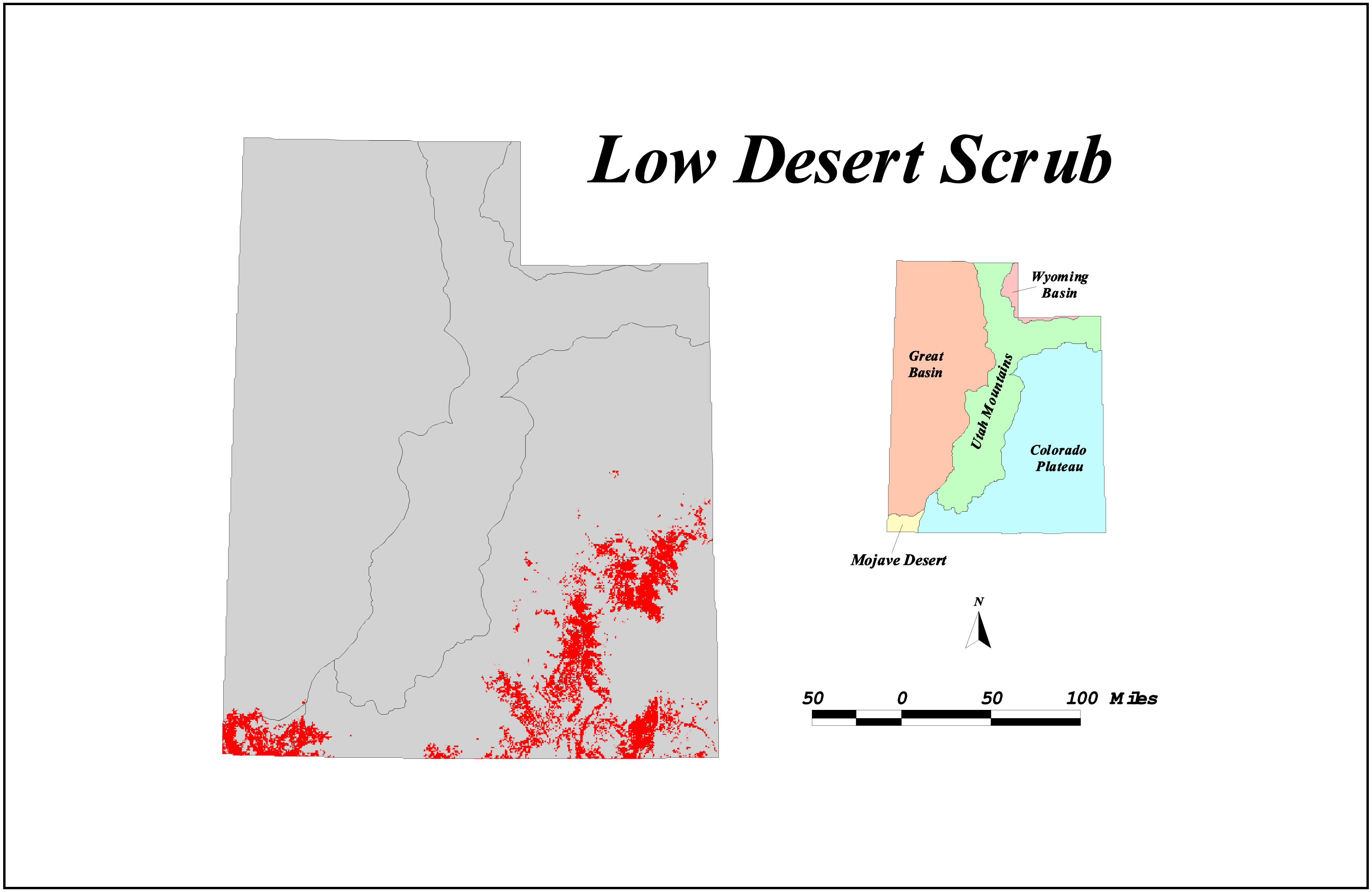


Figure 10. Revised GAP Coverage Map for Low Desert Scrub Habitat in Utah.

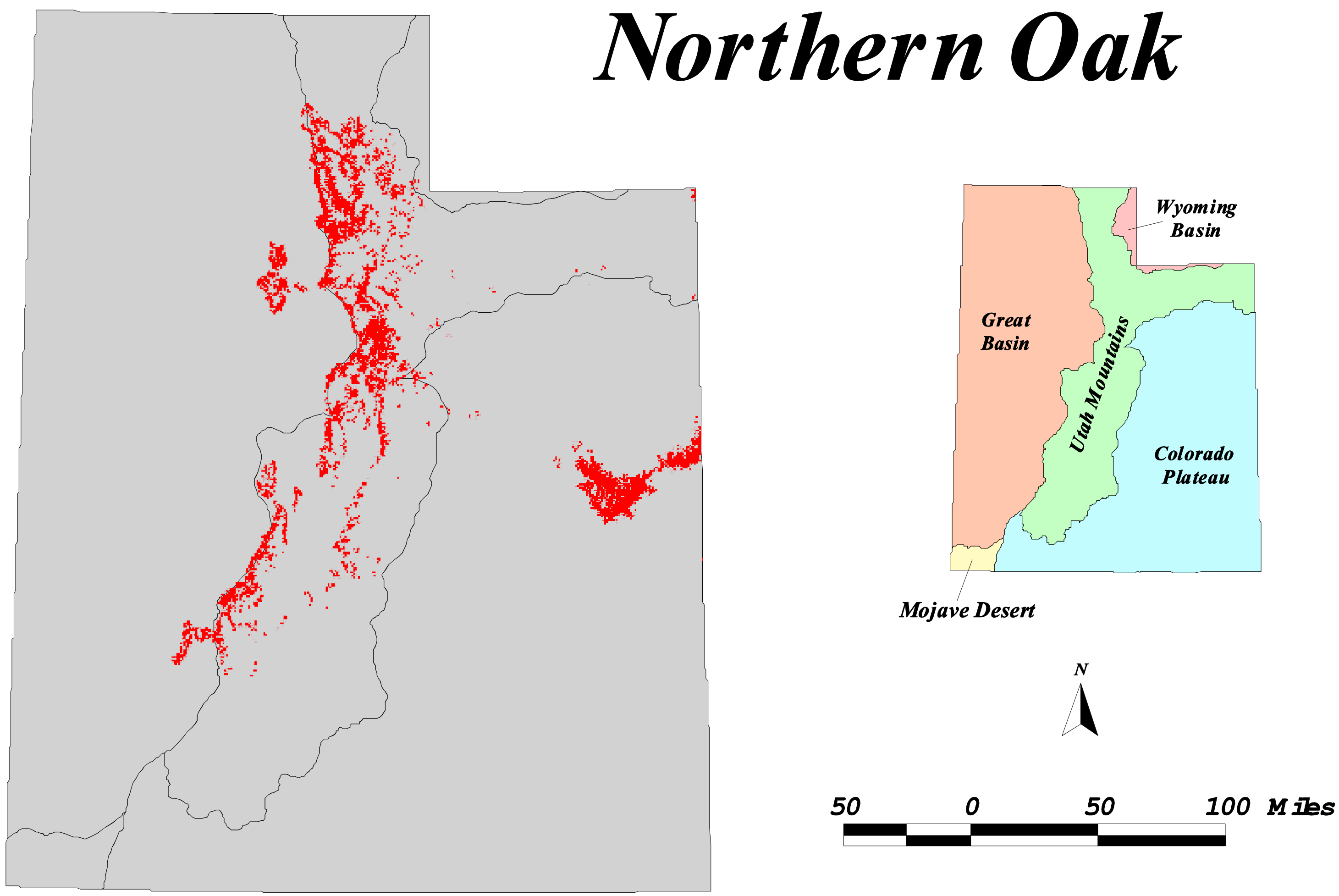


Figure 11. Revised GAP Coverage Map for Northern Oak Habitat in Utah.

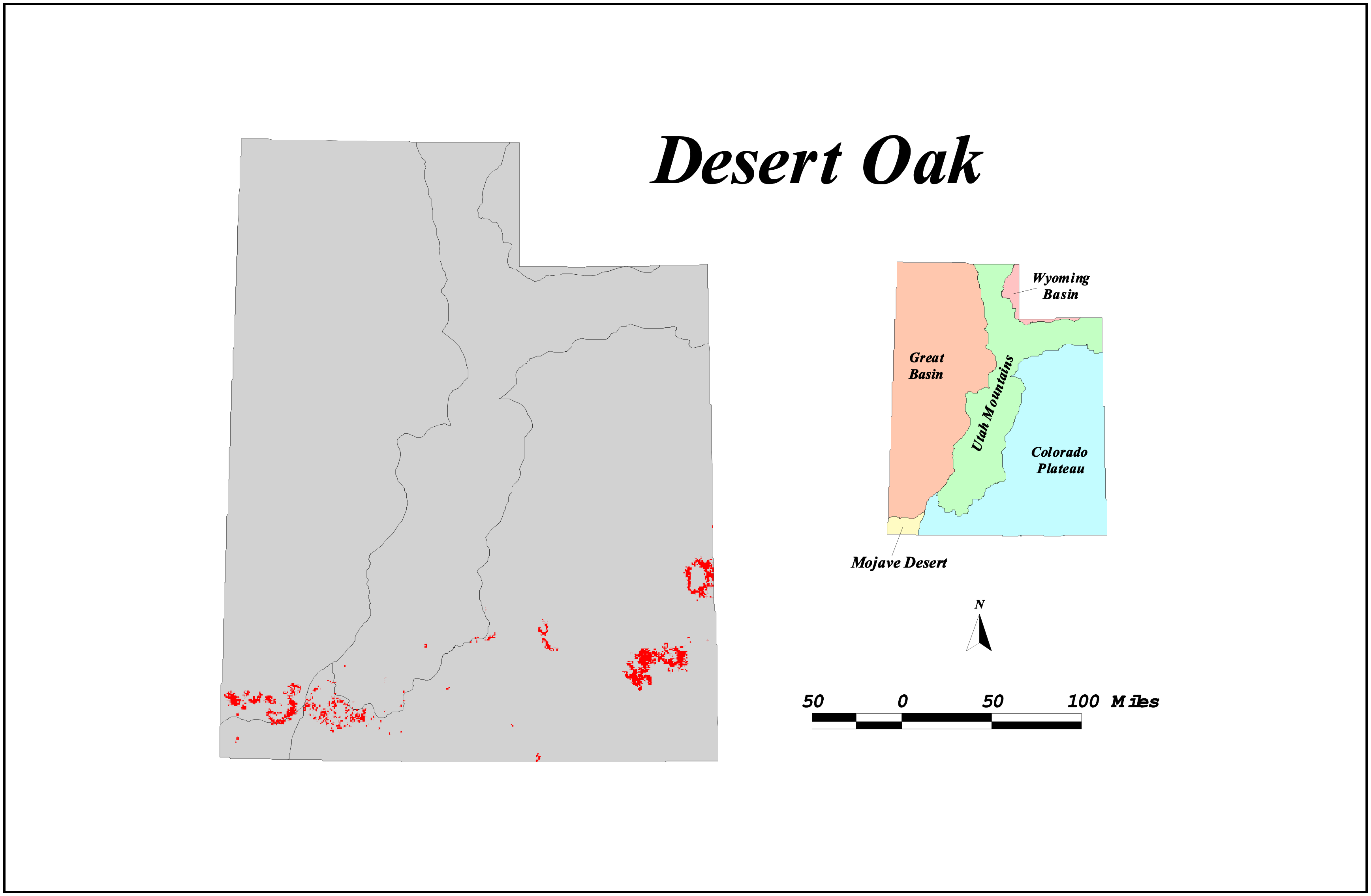


Figure 12. Revised GAP Coverage Map for Desert Oak Habitat in Utah.

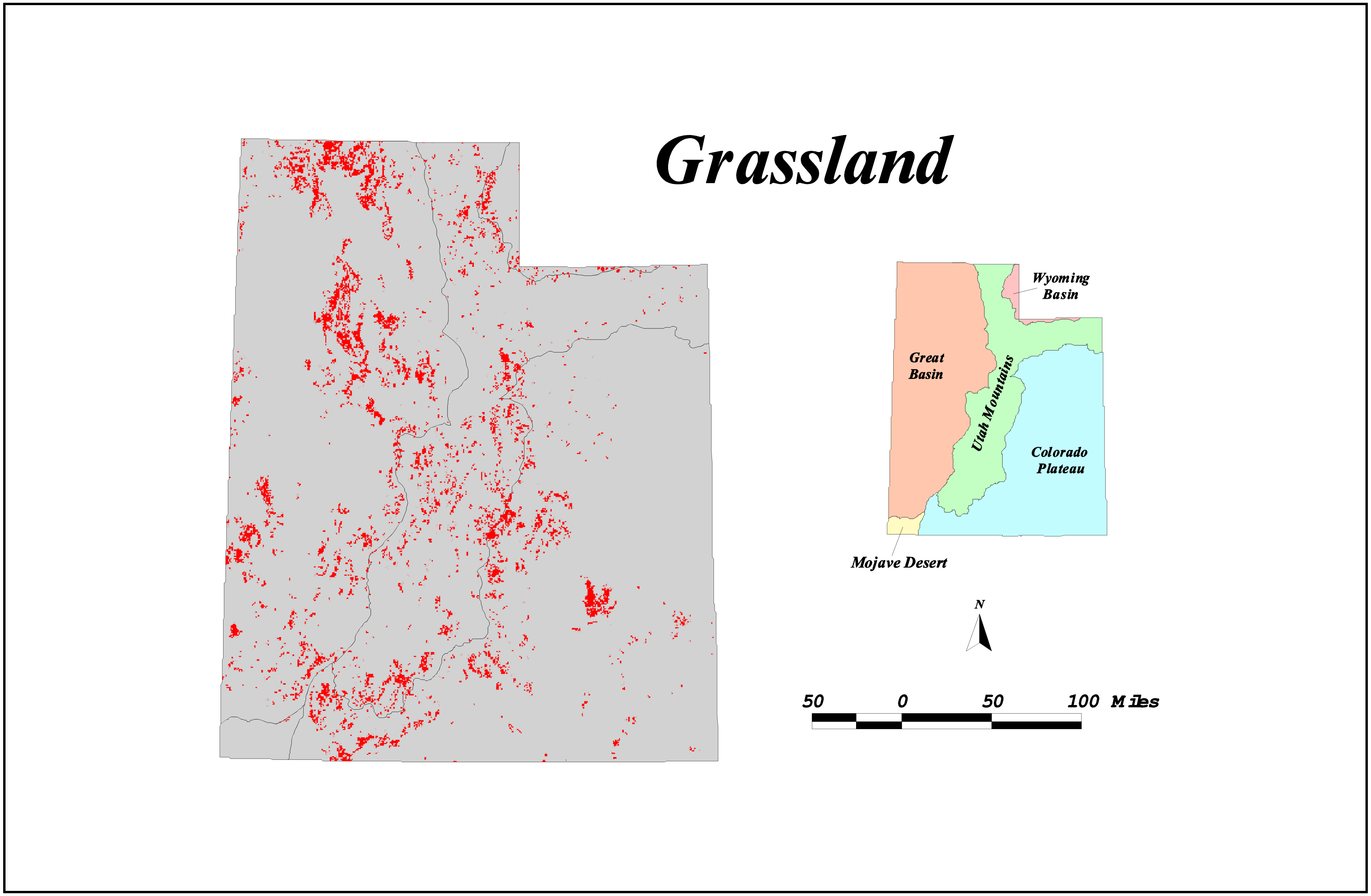


Figure 13. Revised GAP Coverage Map for Grassland Habitat in Utah.

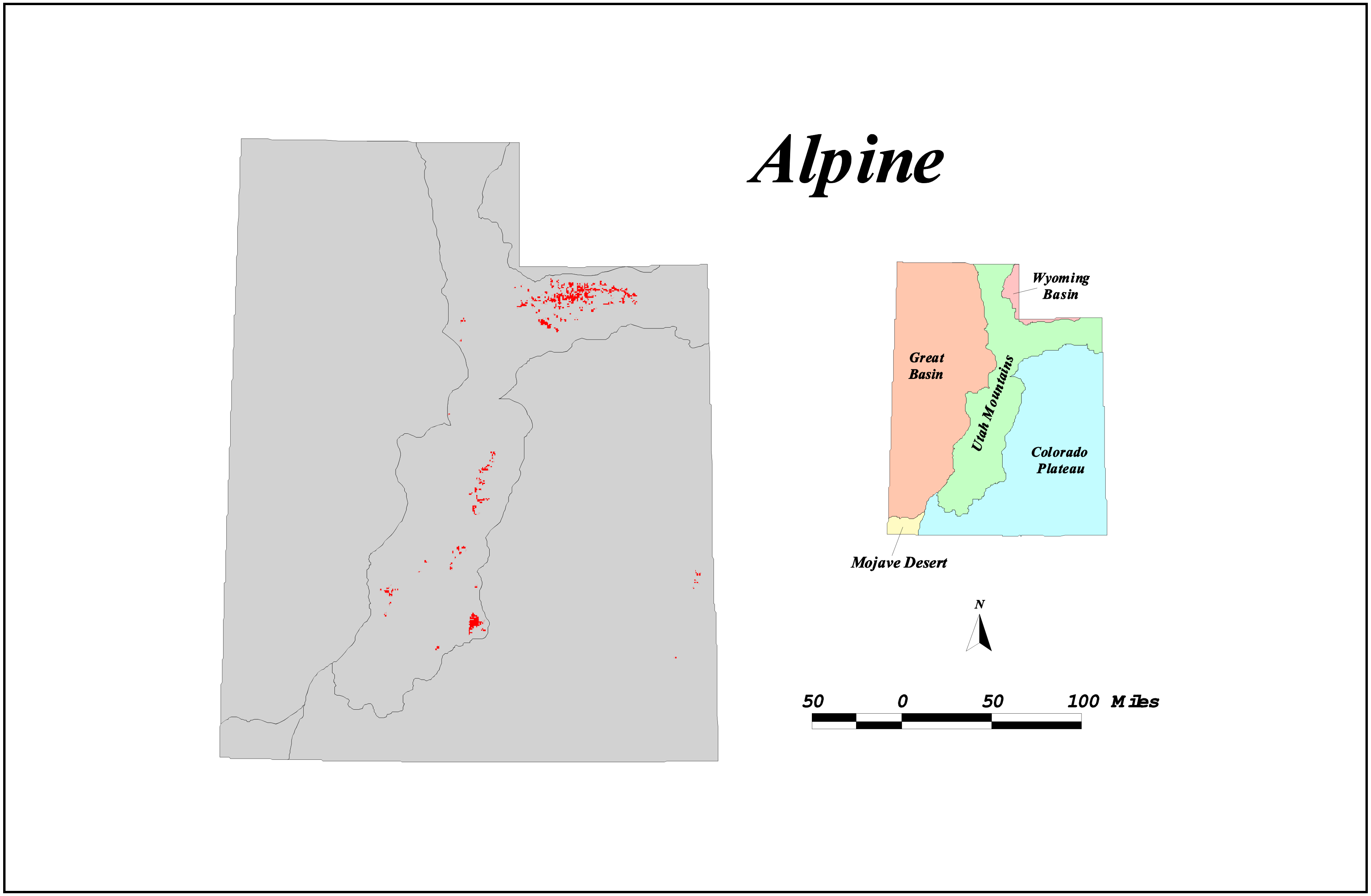


Figure 14. GAP Coverage Map for Alpine Habitat in Utah.

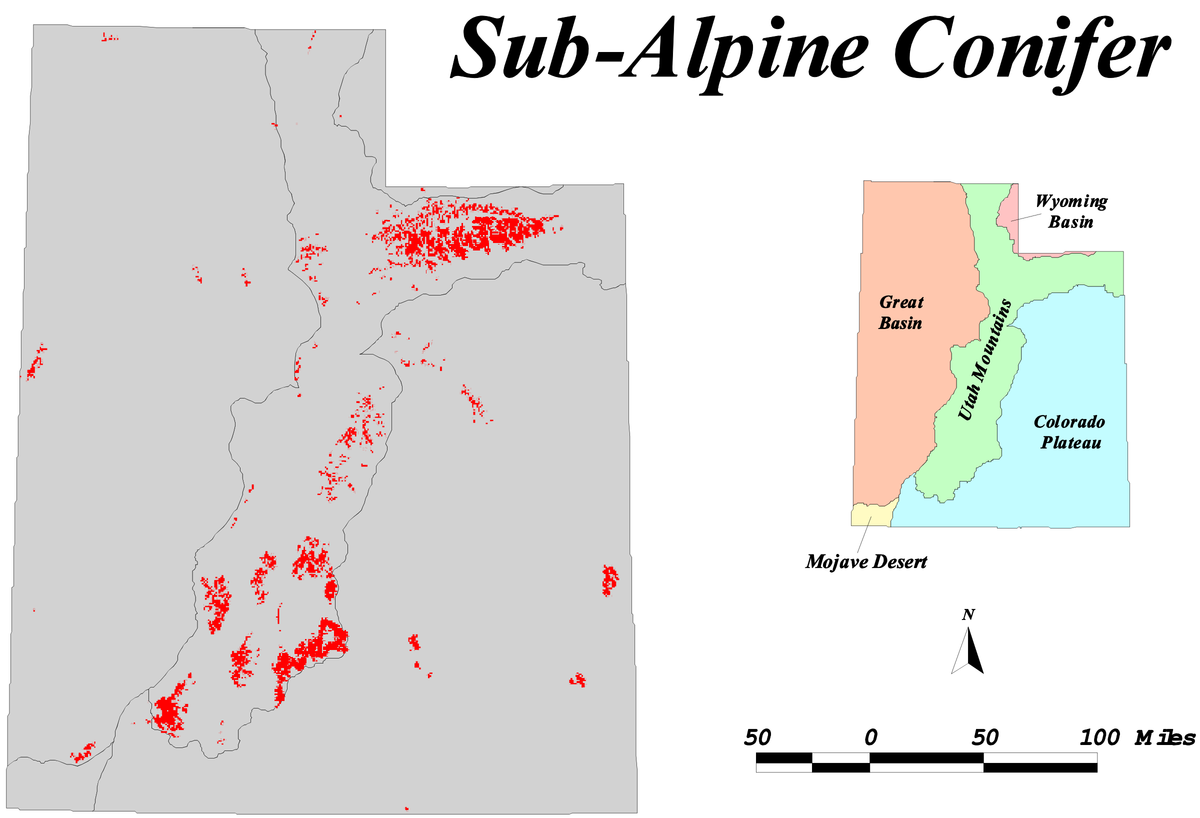


Figure 15. Revised GAP Coverage Map for Sub-Alpine Conifer Habitat in Utah.

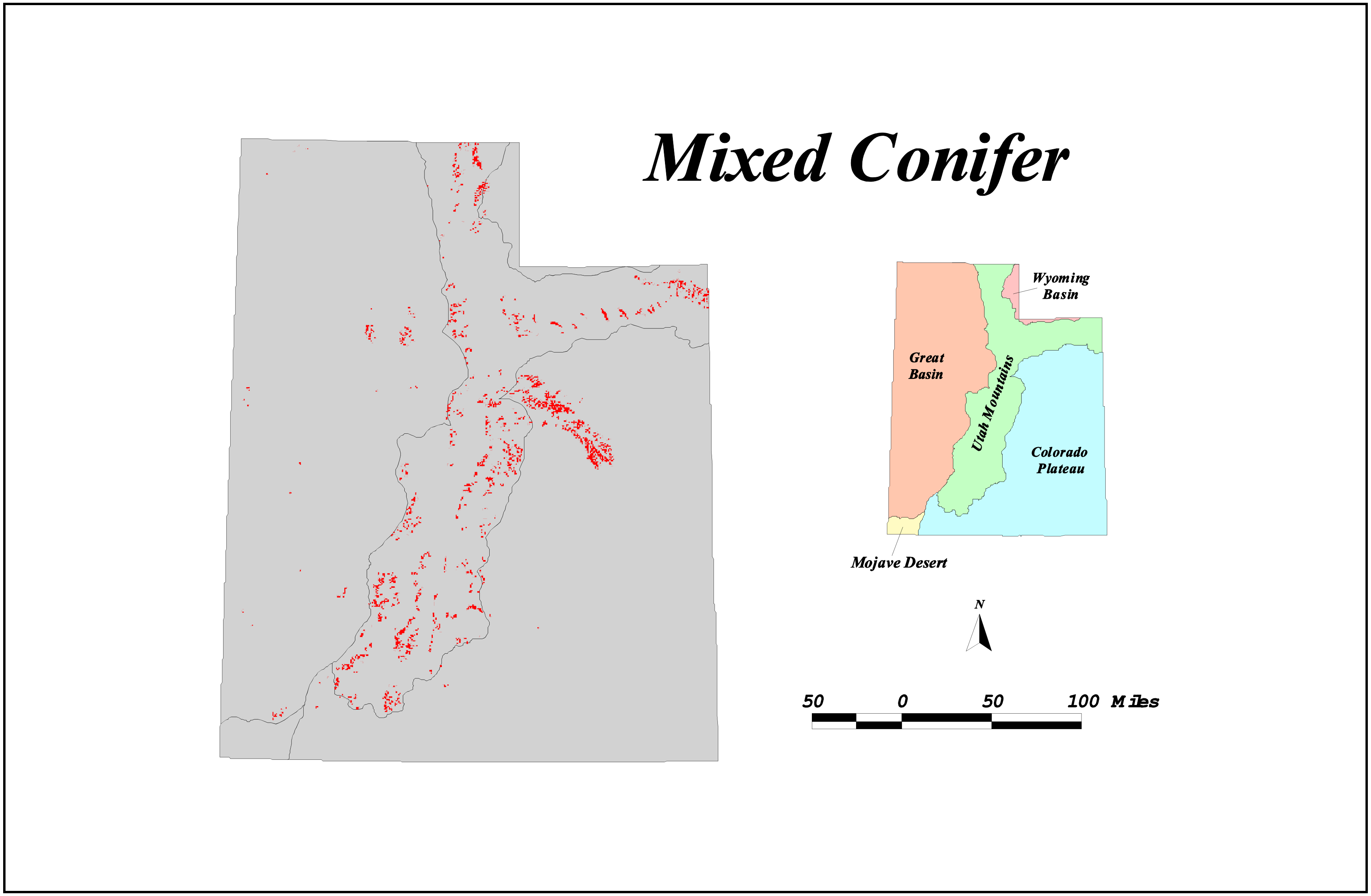


Figure 16. Revised GAP Coverage Map for Mixed Conifer Habitat in Utah.

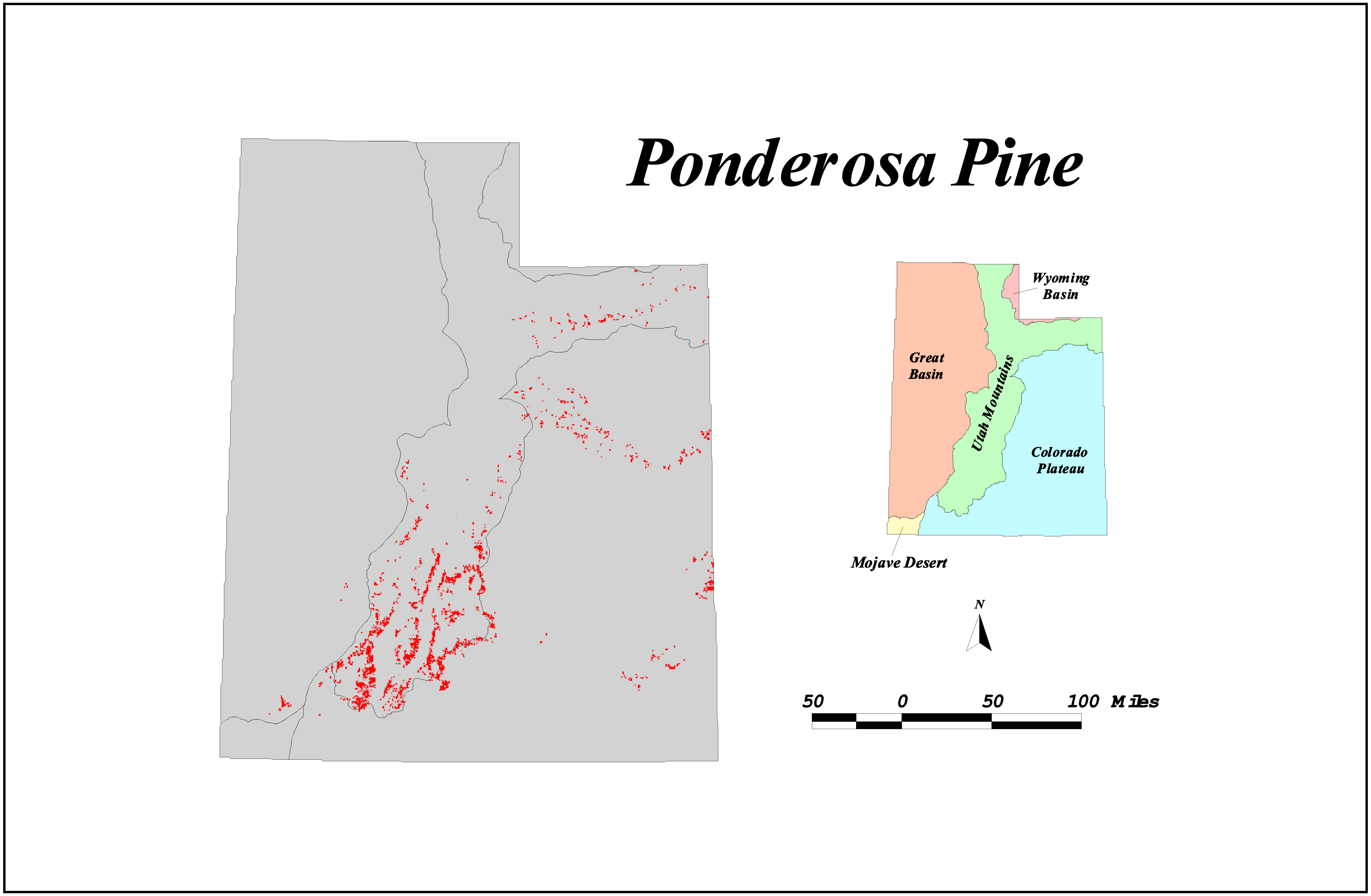


Figure 17. Revised GAP Coverage Map for Ponderosa Pine Habitat in Utah.

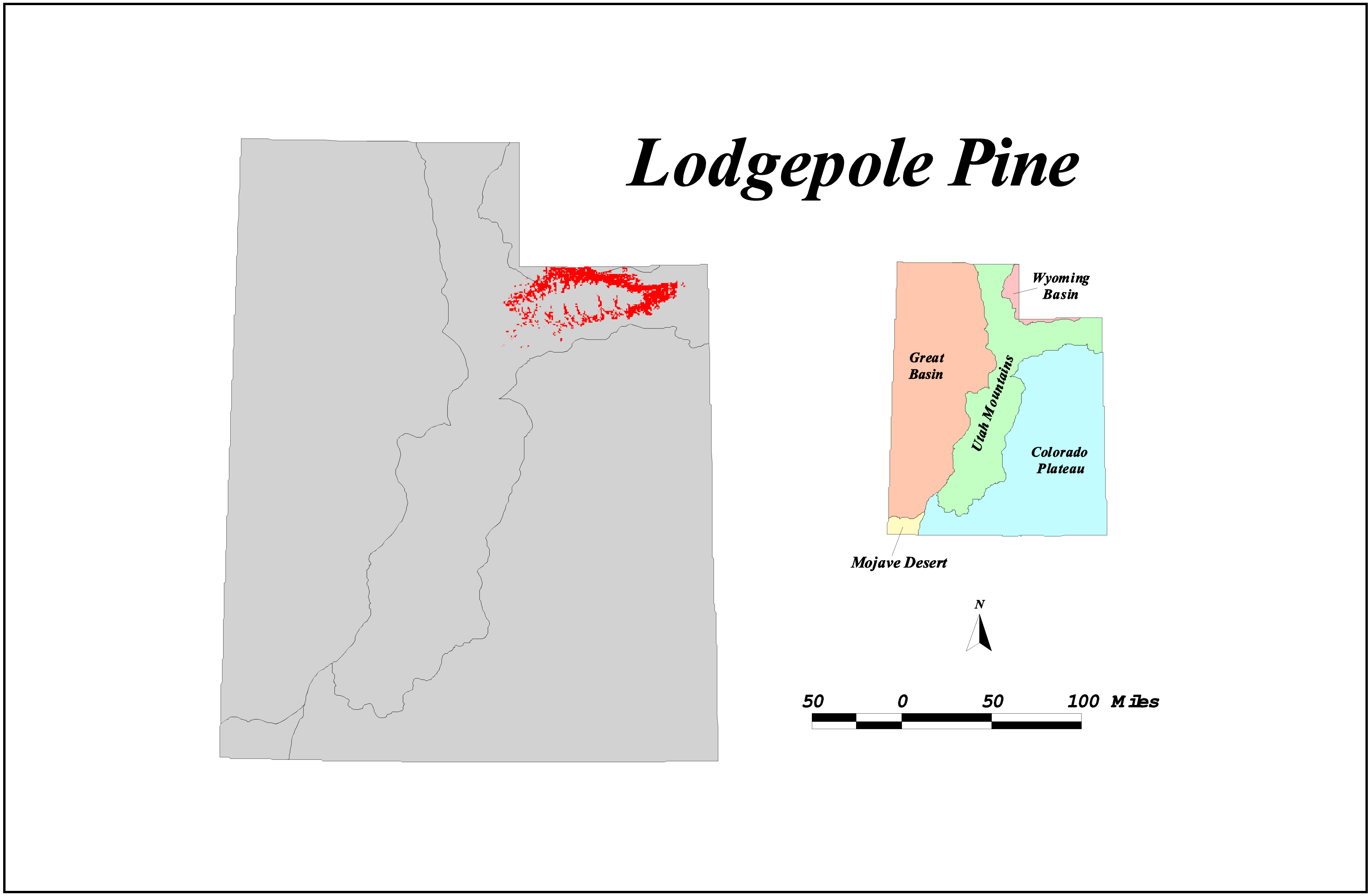


Figure 18. GAP Coverage Map for Lodgepole Pine Habitat in Utah.

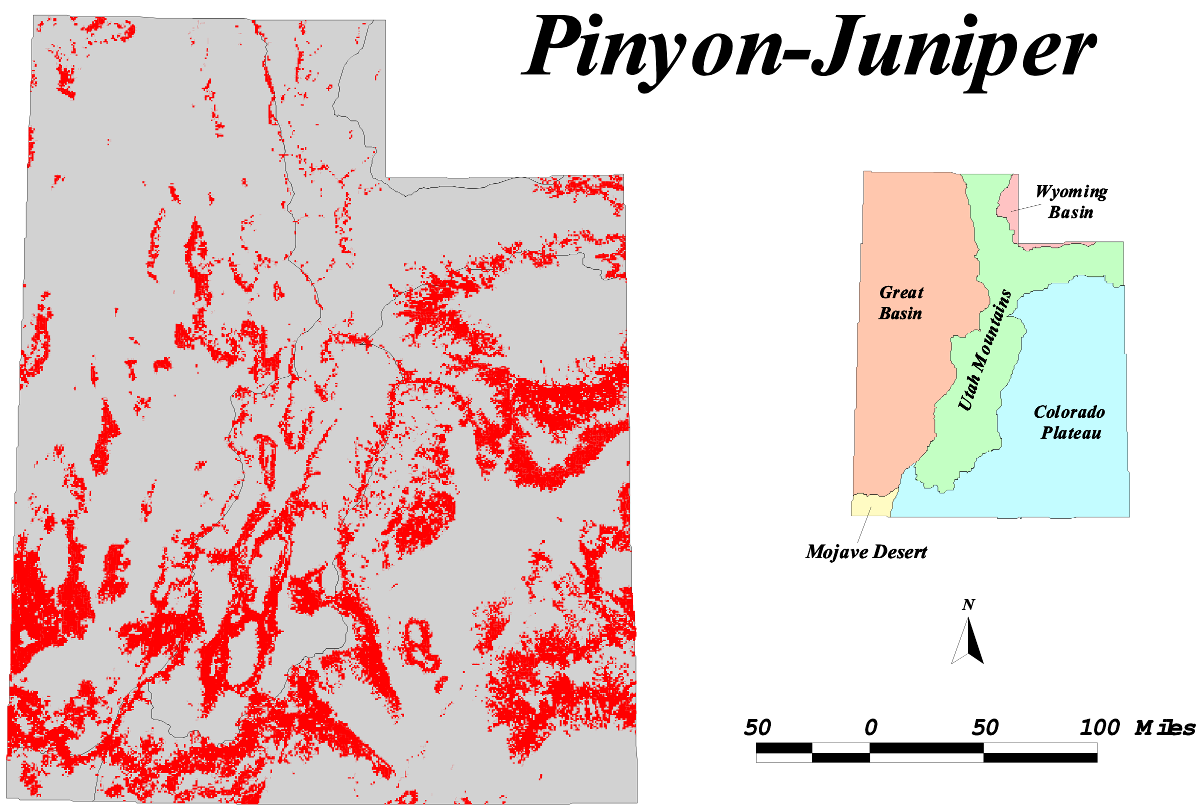


Figure 19. Revised GAP Coverage Map for Pinyon-Juniper Habitat in Utah.

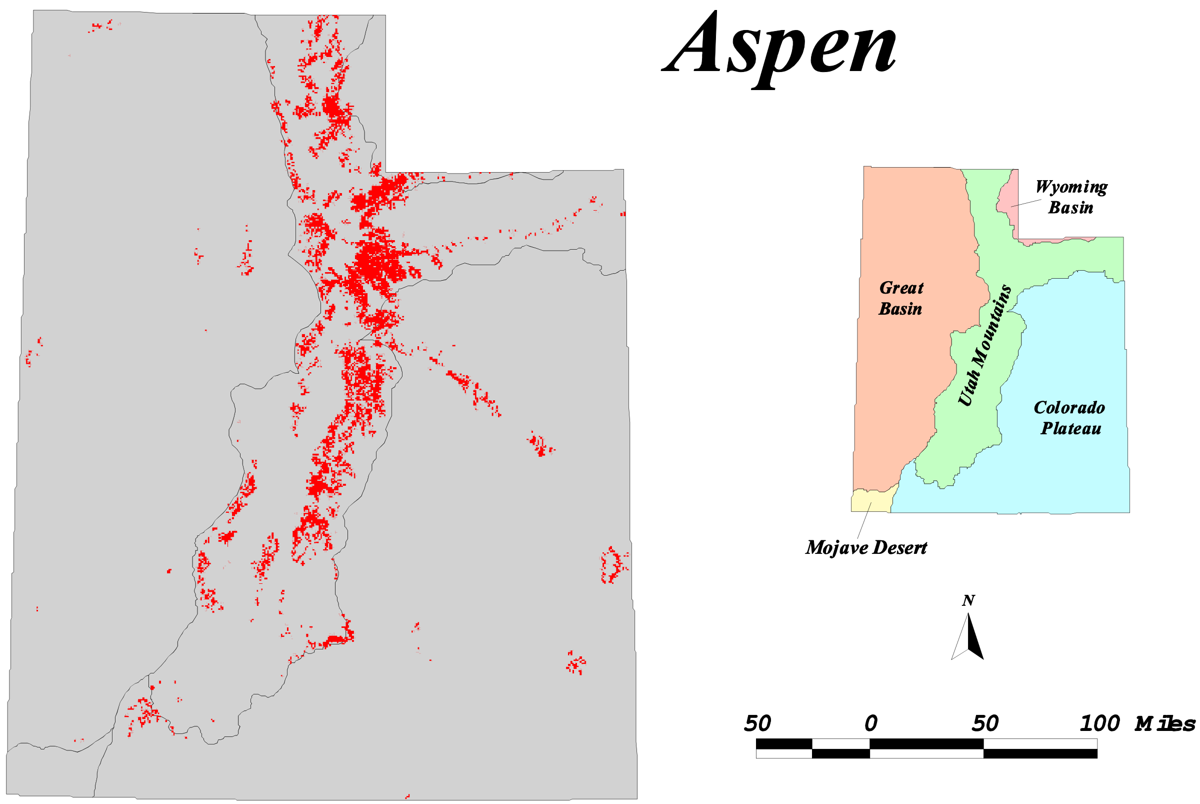


Figure 20. Revised GAP Coverage Map for Aspen Habitat in Utah.

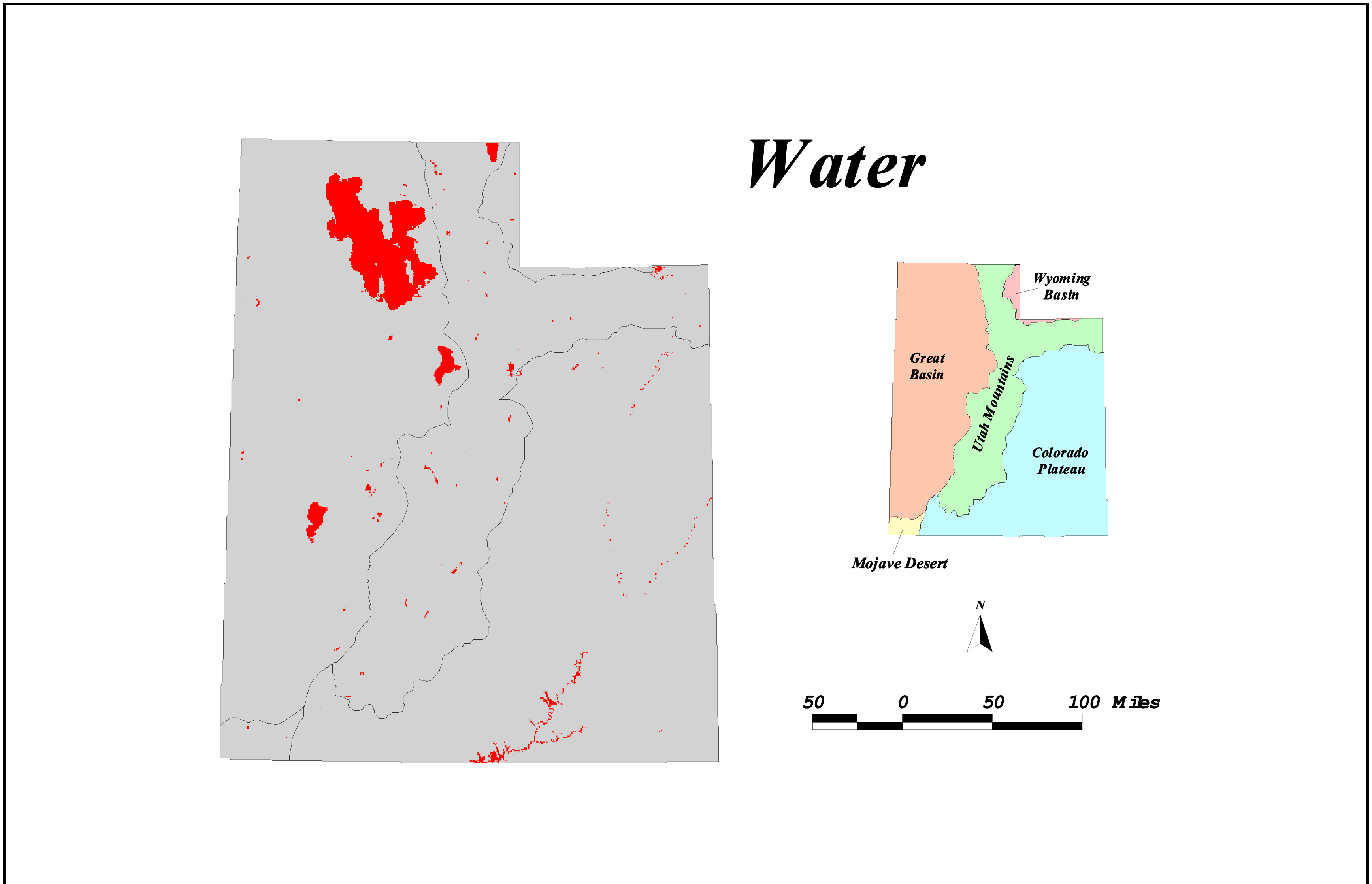


Figure 21. Revised GAP Coverage Map for Water Habitat in Utah.

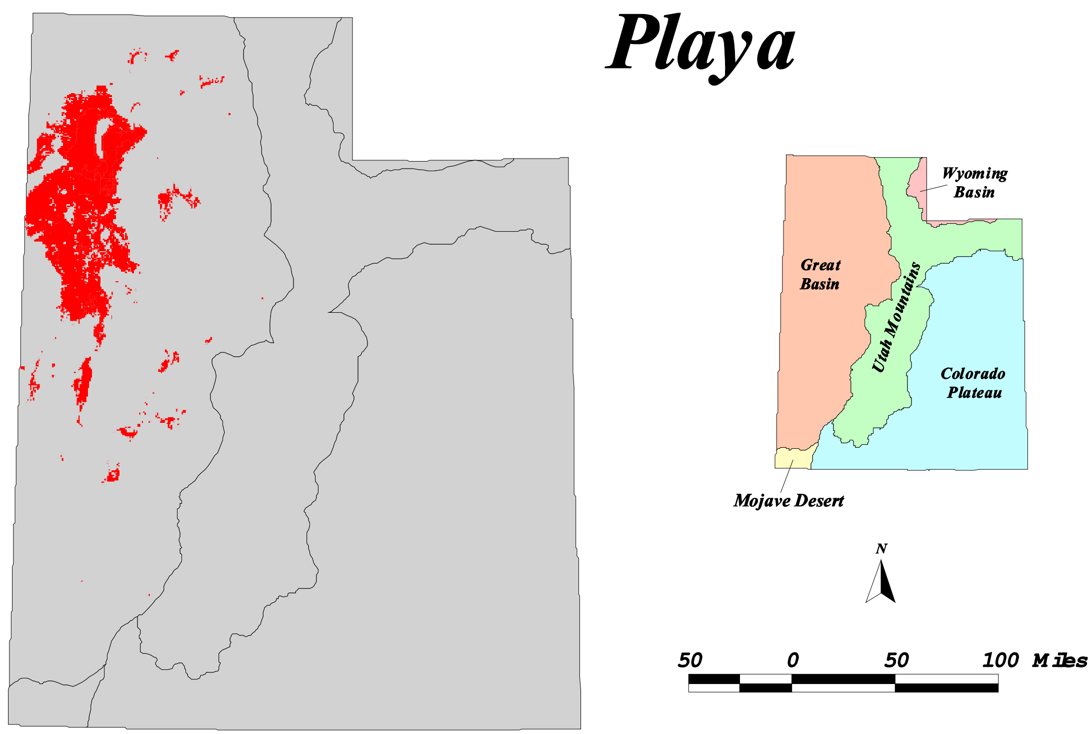


Figure 22. Revised GAP Coverage Map for Playa Habitat in Utah.

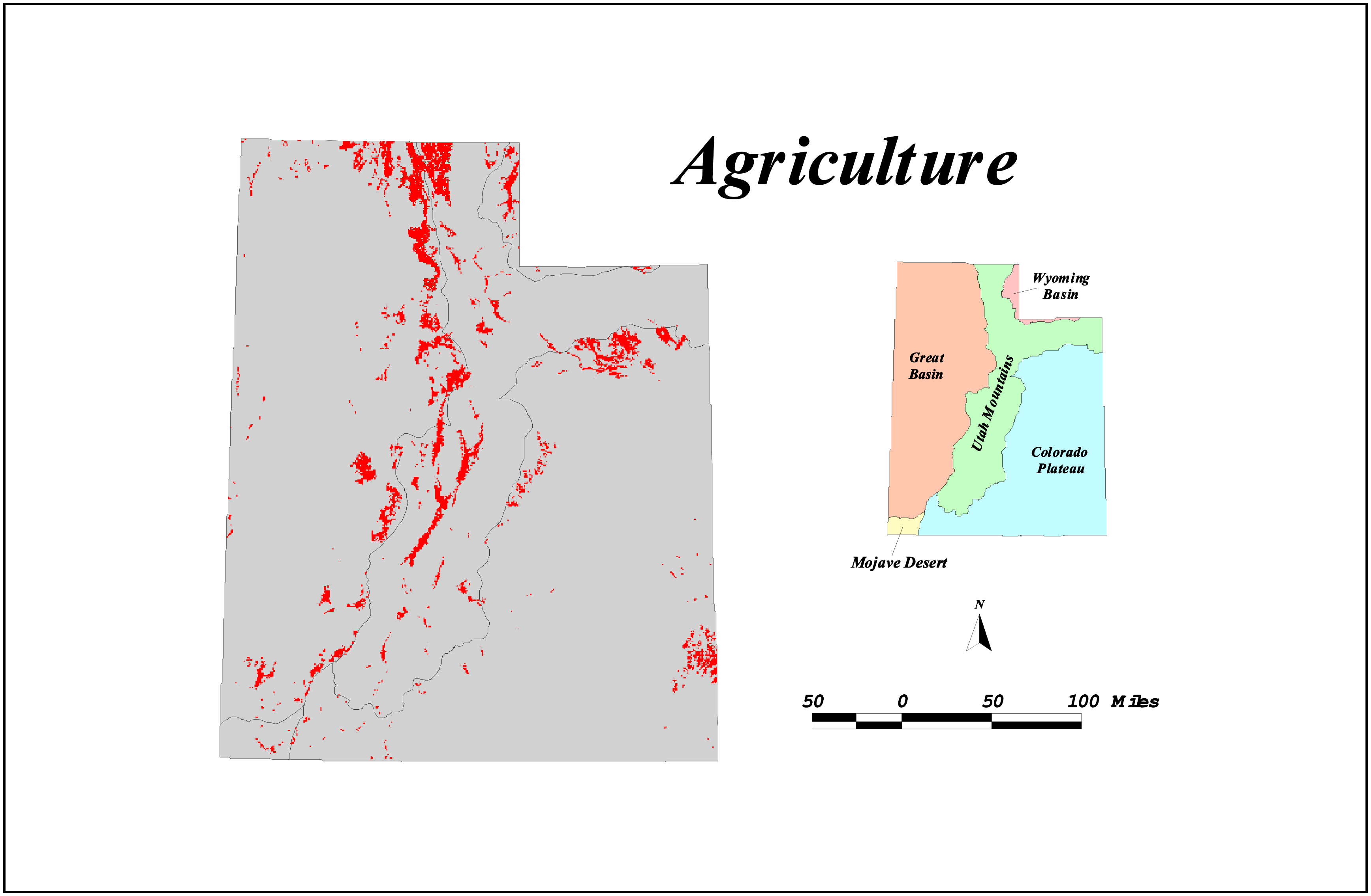


Figure 23. GAP Coverage Map for Agriculture Habitat in Utah.

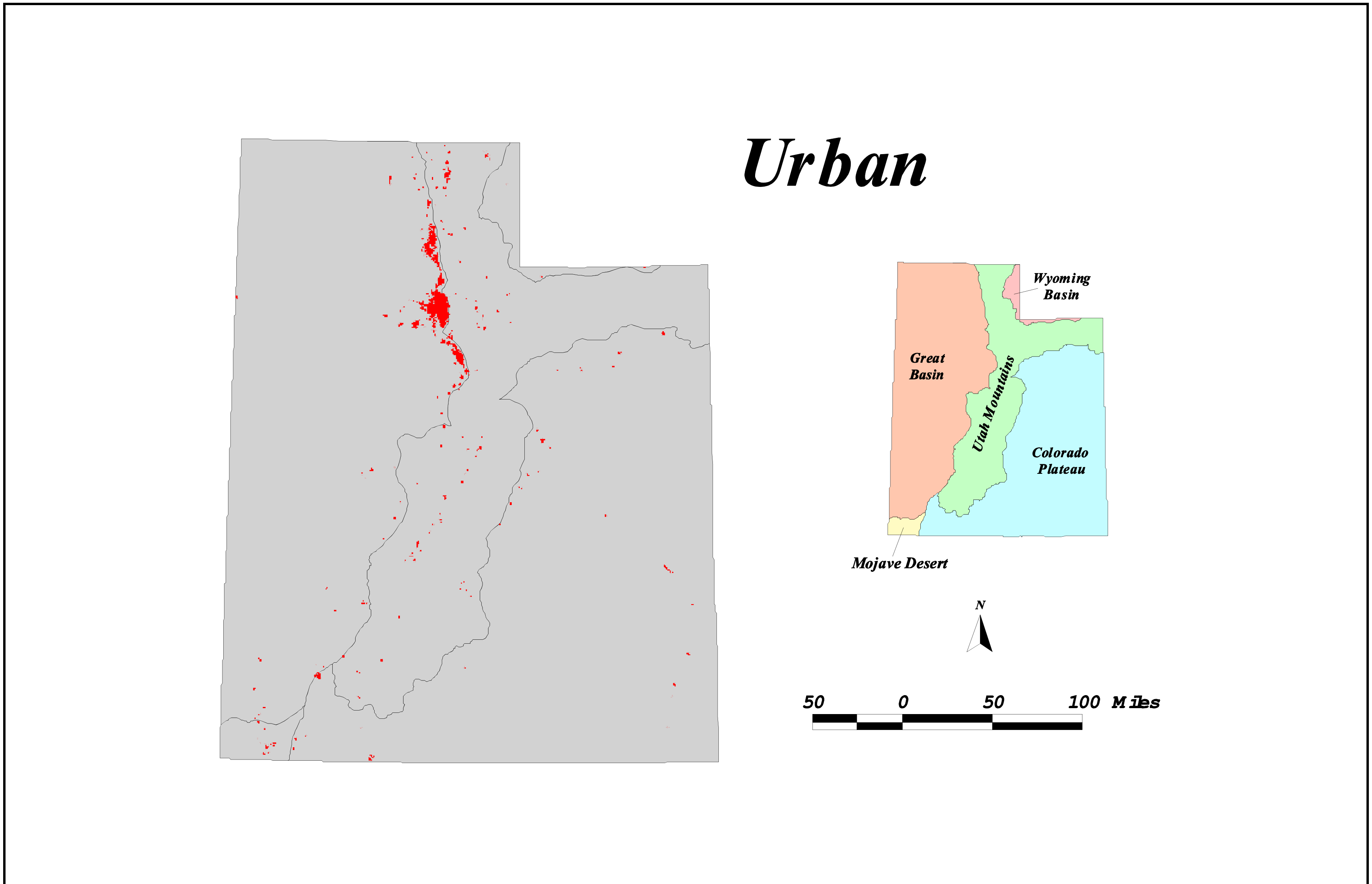


Figure 24. GAP Coverage Map for Urban Habitat in Utah.

UTAH PARTNERS IN FLIGHT PRIORITY HABITATS

All of the habitats described in this strategy are important to Utah's birds. This is evident in the individual habitat descriptions, species accounts and numerous tables and figures. Some of these habitats provide for a wide variety of birds; others provide for few species but are the only habitats capable of supporting those species. We identify 6 habitats that are considered to be Priority Habitats based on their importance to overall bird diversity (Figure 25) and/or Priority bird species (Figure 26). This does not imply that the other 18 habitats identified in this strategy are not important. On the contrary, each of these habitats is critical to a portion of Utah's avifauna. In order to maintain a diversity of bird species and insure healthy and sustainable populations, each of these habitats must be properly managed.

Riparian (Lowland and Mountain Riparian) and Wetland habitats are the most important to avian diversity in the state. These categories combined are used by Utah's birds as either breeding or wintering habitat almost twice as much as any other habitat category. Lowland Riparian habitat provides breeding or winter habitat for 107 birds, 8 of which are Priority species. Lowland Riparian is followed by Mountain Riparian (46 total and 1 Priority species) and Wetland (35 total and 4 Priority species) in importance as breeding or wintering habitat. Because of their importance to avian diversity, Lowland Riparian, Mountain Riparian and Wetland habitats are considered UPIF Priority Habitats.

In contrast, Shrubsteppe habitat (Sagebrush/grassland) does not support a wide variety of species (only 8 species use Shrubsteppe as primary or secondary breeding or winter habitat, 3 of these are Priority species). However, several species are considered "sagebrush obligates" and can survive only in Shrubsteppe and the closely related High Desert Scrub habitat (28 total and 4 Priority species). And, Utah provides a significant proportion of the world's Sagebrush-grasslands. This makes Utah vital to the survival of birds such as Sage-grouse, Sage Thrashers, Brewer's Sparrows and Sage Sparrows. Because Shrubsteppe grades into High Desert Scrub and because both habitats are important to "sagebrush obligates" and associated species, these two habitats are considered UPIF Priority Habitats.

Pinyon-Juniper habitat is also considered a UPIF Priority Habitat for much the same reasons as Shrubsteppe and High Desert Scrub. It supports relatively few (22 total species), highly habitat-specialized birds (4 Priority species) and Utah is a significant portion of Pinyon-Juniper range.

Priority bird species occurred in 12 habitats in addition to those mentioned above. Low Desert Scrub, Grassland and Agriculture each support 3 Priority bird species while Playa and Cliff habitats each support 2 Priority species. Northern Oak, Ponderosa Pine, Wet Meadow, Water, Alpine, Subalpine Conifer, and Lodgepole Pine each support a single Priority bird species.

Because so many habitats are important to Utah's birds, we've highlighted Priority Habitats to indicate which habitats might provide the "best bang for the buck" in terms of protection, restoration and management. However, we strongly encourage implementation of this strategy in all bird habitats of Utah.

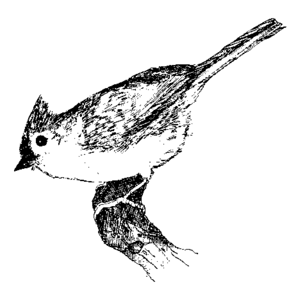


Figure 25. Species/Habitat Associations for Utah's Breeding Birds by revised GAP Category

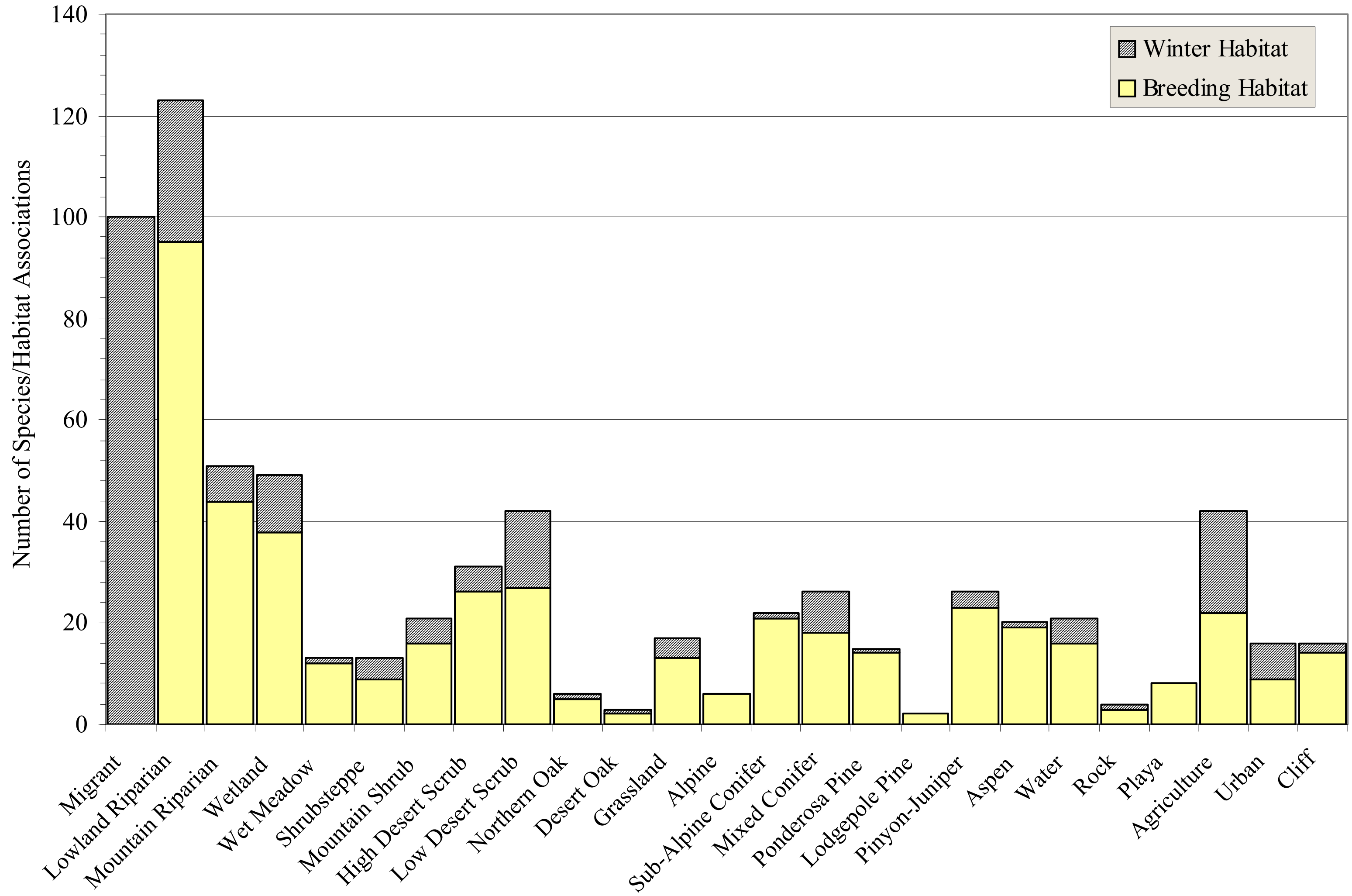
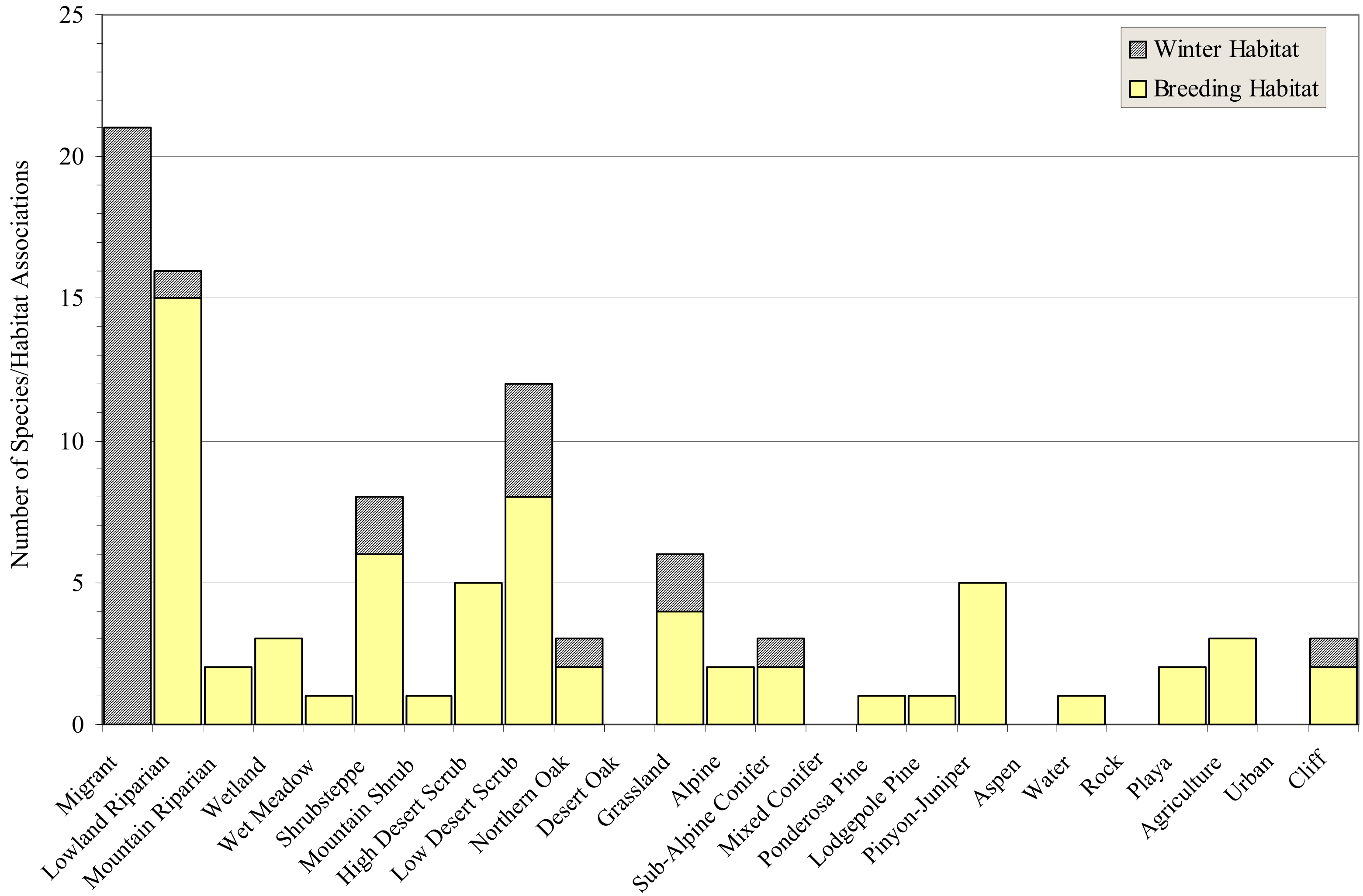


Figure 26. Species/Habitat Associations for UPIF Priority Species by revised GAP Category



ADDITIONAL CONSERVATION CONSIDERATIONS

In addition to issues related directly to the natural history or life history of Utah's breeding birds, there are additional conservation considerations that Utah Partners in Flight have determined are important to the overall strategy of conserving Utah's birds. Some of these additional considerations may or may not have been discussed in the species-specific or habitat-specific narratives.

Brood parasitism is known to occur with at least 98 species (42%) of Utah's breeding birds (Table 5), and often times the young of the host species are out-competed during brood rearing and fail to fledge. In addition, an estimated 10 million passerines are killed nationwide each year by collisions with communication towers, mostly occurring during periods of migration. Several of the communications towers located in Utah are either high enough or located in such a place as to make birds vulnerable to collisions while enroute during migration periods. Further, pesticides (mostly insecticides) are well documented to cause mortality in passerine birds. Specifically, certain Restricted Use Pesticides (RUPs) are used annually within Utah. While much of Utah's agricultural practices require only a limited use of these RUPs, the effects on Utah's breeding birds from that annual use has not been considered up until now.

Other considerations discussed include revision of the GAP models, compiling a Breeding Bird Atlas for Utah, conducting a statewide riparian inventory, and digitizing BBS routes in the state. Each of these additional conservation considerations are addressed in the following pages of this section. Utah Partners in Flight has determined that a better understanding of each of these issues and concerns and their relationship to the state's breeding birds will assist managers in implementing the recommendations proposed in the Utah Avian Conservation Strategy.

BROOD PARASITISM

Brood parasitism or nest parasitism are the terms used to describe the behavior of certain species of birds that deposit their eggs in the nests of other birds (hosts) which then provide incubation and all parental care needed until the young are fledged (Pasquier 1977). These so-called "brood parasites" build no nests of their own, and in the process of laying their eggs in the nest of a host species often times removal of the host species' eggs occurs.

Brood parasitism is practiced by representatives of five avian families, the Anatidae (waterfowl), Cuculidae (cuckoos), Indicatoridae (Honeyguides; do not occur in North America), Emberizidae (Subfamily Icterinae; Blackbirds), and Ploceidae (weavers) (Welty and Baptista 1988). In North America, the only obligate brood parasites are three species in the Family Emberizidae, the Brown-headed, Bronzed and Shiny Cowbirds (*Molothrus ater*, *M. aeneus* and *M. bonariensis*, respectively; Kaufman 1996). Of these, only the Brown-headed Cowbird is a resident of Utah.

PARASITIC SPECIES IN UTAH

Brown-headed Cowbird

The Brown-headed Cowbird occurs throughout North America, occupying most of the continent south of the Arctic (Ehrlich et al. 1988, DeGraaf and Rappole 1995, Kaufman 1996). The species is widespread in the United States, with breeding occurring in all states except Hawaii. In Utah, the Brown-headed Cowbird is the state's primary nest parasite, breeding throughout the entire state (Peterson 1990). The species is classified as a generalist parasite, laying its eggs in the nests of a wide range of other species at greatly varying intensities both within Utah and throughout its range (Ehrlich 1988). The Brown-headed Cowbird is known to parasitize at least 98 species of Utah's breeding birds, including the endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*), state sensitive species such as Bell's Vireo (*Vireo bellii*) (Utah DWR 1998) and PIF Priority Species such as Abert's Towhee (Table 5).

Brown-headed Cowbirds are known to have parasitized over 230 host species (Robinson et al. 1995), and over 140 (61%) of those have successfully reared cowbird chicks (Kaufman 1996).

Cowbirds prefer open or semi-open landscapes and agricultural areas year round. During the winter they often concentrate in farmland, pastures, or feedlots, and in the Eastern Sierra of California where most of the habitat is forests, sagebrush, or sparsely vegetated arid meadows, cowbird foraging generally always is associated with cattle grazing (USDA 1998). Cowbirds are more widespread in the breeding season, occurring in grassland areas, brushy country, forest edges, even desert but tend to avoid dense unbroken forest (Robinson et al. 1995, Kaufman 1996). Typically, cowbirds search for hosts near woodland edges and feed in agricultural sites like grazing yards and grain silos. Location of livestock facilities within 1 km of riparian areas results in a higher rate of parasitism among neighboring host species than when facilities are located farther away (Goguen and Mathews 2000).

Brood parasitism by Brown-headed Cowbirds is known to affect the fitness of many hosts by causing a reduction in the number of chicks that fledge from parasitized nests (Chace et al. 1997, Davis 1997, Clotfelter and Yasuka 1999, Ortega and Ortega 2000, Ortega and Ortega 2001). Cowbirds typically hatch earlier and acquire more food from host species as a result of their larger body size, larger mouths, and persistent, loud begging (Lichtenstein and Sealy 1998, Dearborn 1998, Robinson et al. 1995). As a result, host nestlings in parasitized nests receive less food and exhibit reduced rates of weight gain, which affects their survival (Dearborn et al. 1998). In addition, productivity (fitness) of the host species declines due to removal of host species' eggs from their nests or adult cowbirds killing host chicks. Some host species will even incubate clutches consisting solely of cowbird eggs (M. Sogge pers. comm, USFWS 2001a).

One day prior to, or on the day she lays her egg, the female cowbird usually removes one host egg from the nest (Robinson et al. 1995). Egg removal reduces the host species' clutch size affecting decreased reproductive output (Clotfelter and Yasuka 1999, Kozlovic 1998). Abandonment of a nest by a parasitized host may preclude renesting and result in zero production for that pair that breeding season (Ehrlich 1988). Also hosts with short breeding periods and long incubation times and those that begin the season raising cowbirds may not have enough time to renest (Braden et al.1997, Robinson et al. 1995). In addition, renesting could theoretically incur costs such as increased reproductive effort and late fledging of young, which could result in reduced survivorship of adults and young (USFWS 2001a). Another potential cost of desertion and renesting is these same hosts may still be parasitized even after renesting. Typically second clutches are smaller in most species, and while productivity may result from a renesting effort, the smaller clutches will further facilitate an overall reduction in productivity for the host species.

When multiple parasitism occurs (two or more cowbird eggs laid in a host nest), many hosts often will fail to raise any of their own young and will only produce cowbirds (Robinson et al. 1995). In British Columbia, Warbling Vireo nests that are parasitized by cowbirds typically produce no vireo young (Ward and Smith 2000). Blue-gray Gnatcatchers also typically raise none of their own young when parasitized (Goguen and Mathews 1996). For southwestern willow flycatchers, only 14% of 133 and 13% of 31 parasitized nests in California and Arizona, respectively, produced any host young, compared to 54% of 190 and 60% of 133 unparasitized nests, respectively, in these two states (Whitfield and Sogge 1999). Willow flycatchers

Bronzed Cowbird

The Bronzed Cowbird currently is not known to occur regularly in Utah but has expanded its range during the last century. In Arizona, where the species is now common, it was unrecorded before 1909 (Kaufman 1996). The Bronzed Cowbird occurs sporadically from southeastern California to southern Louisiana and may be a factor, along with habitat loss, in declines of several oriole species (*Icterus* spp.) in the Lower Rio Grande Valley (USFWS 2001a).

Bronzed Cowbirds generally parasitize moderate to large passerines (Baicich and Harrison 1997) and have been successful with 28 of 77 species (Ehrlich et al. 1988) In Utah, where it occurs occasionally, the Bronzed Cowbird has been recorded to parasitize grackles and orioles (Table 5).

FACTORS INFLUENCING BROOD PARASITISM

Range Expansion, Livestock Grazing, and Habitat Fragmentation

The Brown-headed Cowbird originally occupied open Grasslands and avoided unbroken forestlands. Prior to the arrival of Europeans in North America, cowbirds were nomadic, following the large herds of bison, foraging on the insects and prairie grass seed stirred up by the bison. When the bison were nearly extirpated from the North American landscape and replaced by cattle, sheep and goats, cowbirds adapted and began to associate with livestock. As a result, the range of the Brown-headed Cowbird has greatly expanded with increased agriculture, cattle grazing, and deforestation. Further, the species is now found in open coniferous and deciduous woodlands, forest edges, brushy thickets, agricultural lands, and suburban areas (DeGraaf and Rappole 1981, Ehrlich 1988, Robinson et al. 1995)

Edge Effects

Forest fragmentation has created access to an abundance of potential host species not previously available to cowbirds. Forested edges adjacent to open fields and nearby agricultural areas allow cowbirds to forage in preferred habitat and parasitize hosts in another (Robinson et al. 1995, Strausberger and Ashley 1997). In most regions, cowbirds spend the morning in areas such as forest edges or riparian strips that have large numbers of potential hosts. Their major activities in these habitats are related to breeding (e.g., egg laying, searching for nests, courtship and intrasexual aggression) but not feeding. Optimal feeding and breeding habitat are usually spatially separated and cowbirds typically leave their morning-breeding ranges by late morning to early afternoon and commute to feeding sites (Rothstein et al. 1984, Thompson 1994, Ahlers. and Tisdale 1999a), where large groups of several dozen birds may feed on concentrated food sources (USFWS 2001a).

Nest Search Strategies

Several studies have attempted to identify particular searching cues used by cowbirds for discovering nests. Most include one of two hypotheses: the necessity of adult hosts as cues for nest-finding (Host Activity Hypothesis) versus the discovery of nests by search of habitat without need for the presence of an adult host (Habitat Search Hypothesis). Robinson and Robinson (2001) argue that the presence of the adult host at or near a nest is essential at some stage of the parasitism event. It is essential either for initial discovery of the nest or for timing the laying of the parasitic egg in a manner that maximizes its likelihood of successfully producing offspring.

Results from a study on host activity also found that parasitism frequencies increased among species that made longer nest-building visits, had a greater propensity to perch during nest approach, spent more time near their nests, and had males that vocalized more often near nests (Banks and Martin 2001). Clotfelter's (1998) findings suggest that female cowbirds in search of potential host nests use trees to search from and that female vocalizations may also serve as a proximate cue for cowbirds to locate nests at appropriate stages for parasitism.

OTHER FACTORS THAT ATTRACT COWBIRDS

Proximity to potential perches was a significant predictor of cowbird parasitism of ground nesting song sparrows (Hauber and Russo 2000). Larison et al. (1998) also found that song sparrow nests with abundant foliage cover at a height of 2-3 m were more likely to be parasitized, suggesting that foliage cover above the nest may increase parasitism by providing perches from which female cowbirds can watch host activities and find nests. Other factors that influence cowbird nest search strategies include passerine hosts whose peak nesting coincides with cowbird peak nesting (Brown 1994), a diverse host community which increases the possibility that a decline of any one host species is unlikely to substantially affect cowbird reproduction in a given area (Strausberger 1998), preference for a particular host species, host species' defense, and easy access to open nests versus cavity-type nests (Pribil and Picman 1997, Strausberger and Ashley 1997).

In addition associations with livestock and agricultural practices, cowbird feeding is often associated with developments such as campgrounds, golf courses, suburban areas with lawns and bird feeders (Robinson et al. 1995, USDA 1998). Evidence indicates that Brown-headed Cowbirds are attracted to bird feeders primarily for millet (RHJV 2000). Therefore, informing the public to eliminate millet from their bird feeders may help in reducing cowbird numbers in local areas.

HOST SPECIES RESPONSES

Most North American passerines can be placed into one of two groups on the basis of their responses to cowbird eggs. "Acceptors" include many warblers, vireos, phoebes, and song sparrows, while robins, catbirds, and brown thrashers generally are "rejectors" (Ehrlich 1988, Robinson et al. 1995). In North America, there are about 25 species that are rejectors (Ortega 1998). Ejection behavior is associated with a reduced observed frequency of parasitism (Strausberger and Ashley 1997) and is maintained because the cost of accepting a cowbird chick is much greater than the cost of ejecting a cowbird egg (Lorenzana and Sealy 2001). Examples of rejector studies include gray catbirds which had ejected over 95% of cowbird eggs placed in their nests (Lorenzana and Sealy 2001) and western meadowlarks rejecting 78% of artificial and real cowbirds eggs (Peer et al. 2000).

It has long been known that although acceptor species do not remove cowbird eggs from their nests, they often desert parasitized nests and attempt to renest elsewhere (Robinson et al.1995). However, nest desertion appears to be more a response to adult cowbird activity at or near host nests than to the presence of cowbird eggs (Hosoi and Rothstein 2000, Goguen and Mathews 1996). Desertion is most likely in species that have broad habitat overlap with cowbirds, namely woodland edges and fields rather than forest interior, and that experience high losses when they accept parasitism. However, even species with relatively high desertion rates often accept cowbird parasitism (Hosoi and Rothstein *in press*) and parasitized individuals that fail to desert commonly suffer extreme reductions in reproductive output. Thus nest desertion, unlike egg ejection, is only partially effective as a host defense (USFWS 2001a).

Cowbirds may also depredate unparasitized nests to cause renesting by hosts with nests too advanced to be parasitized, thereby enhancing cowbird reproductive success by providing an additional opportunity for nest parasitism (Elliot 1999) There are direct observations of cowbirds removing nestlings and eggs and therefore acting as predators (Tate 1967 and Scott and McKinney 1994 *in* USFWSa). Elliot (1999) documented the first unequivocal evidence of cowbird attacks on host nestlings where a female cowbird was filmed killing all six nestlings of a blue-winged warbler.

Some species simply do not respond to cowbirds and will not eject eggs or attempt to renest. These species will accept cowbird eggs, even if their nests contains only cowbird eggs (Ehrlich 1988, Robinson et al. 1995). The warbling vireo is a common cowbird host, and the species is not known to show any response to the presence of cowbird eggs in their nests.

CONTROL

The North American Cowbird Advisory Council (NACAC) has been formed to address justifying initiation and termination of cowbird control, review trapping programs on a case-by-case basis, and advise land managers and regulatory agencies. As stated by the NACAC, cowbird parasitism is highly variable in space and time, and high rates of parasitism of a particular host species at one site over one sampling period do not necessarily reflect impacts at other sites and times. Despite cowbird impacts, cowbird control may not always be the best management action for a wide range of reasons. For example, it has resulted in increased host populations for only about half of the species it has been designed to protect and uses scarce resources that might be better spent on other actions.

The consensus of expert opinion (from the Research and Management of the Brown-headed Cowbird in Western and Eastern Landscapes; October 1997 Partners in Flight Cowbird Conference; and the NACAC) indicates cowbird control appears to be a short-term solution and often habitat degradation as a result of agricultural, grazing, and development is the primary reason for population declines. For example, habitat improvements have been a significant factor in helping restore both willow flycatcher and Kirtland's warbler populations more so than cowbird trapping alone (see below).

Cowbird control programs are recommended to help restore local populations of Threatened or Endangered species as a temporary solution until root problems can be corrected. Management measures such as landscape level alterations in human land use patterns or increases in vegetation density are appealing because they are likely to have long lasting effects on cowbird parasitism and do not involve massive killing of a native songbird. However, it is suggested that cowbird trapping seems to be the only viable management measure for most situations involving hosts that are endangered by parasitism. Trapping reduces parasitism levels and does so immediately. Moreover, trapping may need to be carried out for only a limited number of years if it boosts a host's population size and if increased host numbers alone reduce parasitism rates (USFWS 2001a).

Cowbird trapping has lowered parasitism of the southwestern willow flycatcher (*Empidonax traillii extimus*) in California at the South Fork Kern River Preserve from 50%-80% (1989-1991) to an average of 20.8% from 1993 to 1997 (RHJV 2000) However, large scale loss of southwestern Wetlands, particularly cottonwood-willow riparian habitat, is the principal reason for the flycatcher's current status (USGS 2000). In some cases, cowbird control may be the only short-term option for increasing willow flycatcher productivity in populations on the edge of extirpation while riparian habitat restoration proceeds.

Although cowbird trapping has lowered parasitism rates, since 1993 it has not resulted in population increases in the Kern River Valley. Instead the population has declined from 34 pairs in 1993 to 23 in 1999 and may now be crashing as it was down to 12 pairs in 2000. A demographic analysis indicates that control needs to be even more intense and that parasitism needs to be reduced from the present 11-19% to < 10% for this population to increase (Uyehara et al. 2000, USFWS 2001a).

Kirtland's Warbler

The Michigan Department of Natural Resources, USFWS, and U.S. Forest Service announced Michigan's 2001 Kirtland's warbler count recorded 1,085 singing males, the highest count since the first census was taken in 1951 (Michigan 2001), an increase of nearly 200 singing males over last year's count of 891. The lowest numbers were in 1974 and 1987, when only 167 singing males were counted (USFWS 2001b). Cowbird trapping may have forestalled further declines in this species (DeCapita 2000), however, Rothstein and Cook (2000) argue that the evidence for such effects is far from conclusive. The Kirtland's warbler began to increase dramatically about 18 years after trapping began but only after large amounts of new breeding (DeCapita 2000) and wintering habitat (Haney et al. 1998) became available, although the importance of wintering habitat is in some dispute (Sykes and Clench 1998, USFWS 2001a).

Southwestern Willow Flycatcher

The rate of degree of brood parasitism occurring within the Utah portion of the range of the Southwestern Willow Flycatcher is currently unknown. Therefore it is difficult to identify causal factor(s) that attract cowbirds to willow flycatcher nests.

Altering local landscapes or habitats to reduce cowbird impacts should be long-term management goals. However, local cowbird populations can often be quickly and easily reduced by intensive trapping efforts. Cowbirds are highly social (Rothstein et al. 1986) and can be attracted to decoy traps and removed from large areas where potential hosts breed (Eckrich et al. 1999, DeCapita 2000, Griffith and Griffith 2000). Vocalizations and the sight of live decoy cowbirds in the traps, along with food such as millet, attracts wild cowbirds and improves trap success (see Dufty 1982, Rothstein et al. 1988, 2000, USFWS 2001a). The NACAC is currently developing the best procedures to use for cowbird trapping.

Expense

Cowbird control is expensive. For example, control for Bell's Vireo parasitism averages approximately $665,000 annually; for Kirtland's Warbler approximately $90,000/yr; for Black-capped Vireo approximately $45,000/yr. (Partners in Flight Cowbird Conference 1997).

Cowbird trapping efforts in the West are often contracted out to private consulting firms. Because of profit incentives, some private parties may lobby unduly for continued or expanded trapping efforts and there may be no motivation for contractees to suggest cost saving changes in trapping methods. Even cowbird control done by governmental agencies may have some momentum towards expansion or continuance because stopping control for a year or more might make it difficult to acquire funds if it appears that control needs to be reinstated (USFWS 2001a).

Other Methods

A nonlethal method of limiting or eliminating cowbird impacts on hosts might be to inhibit their breeding. Yoder et al. (1998) reviewed the literature on avian contraceptives. They report that several compounds can be delivered via baited food and therefore might be administered to large numbers of birds. But these all have various problems. Some compounds are environmental hazards. Others keep eggs from hatching but allow breeding and would therefore not avoid host losses due to adult female cowbirds. The most promising compound, DiazaCon prevents egg laying and also inhibits fertility in males but must be administered over a 7-14 day period with available modes of delivery. Currently, there is no feasible method of inhibiting breeding of a large proportion of a local cowbird population but this approach is worthy of additional research.

Shooting adult male cowbirds attracted to playback of female calls (Rothstein et al. 2000) can be a valuable supplemental way to reduce cowbird numbers (Eckrich et al. 1999, USFWS 2001a). Removal or addling of cowbird eggs from parasitized nests can further reduce host losses (Hall and Rothstein 1999). However, removing or addling cowbird eggs does not recover host egg losses inflicted by adult cowbirds and cannot be accomplish at nests that are unaccessible. Addling cowbird eggs by shaking them may be preferable to removing cowbird eggs because birds like the willow flycatcher that do not remove cowbird eggs from their nests and consider the cowbird eggs as part of their clutch.

Shooting cowbirds and removal/addling of cowbird eggs may be more cost effective and practical than trapping if cowbird and/or local host numbers are low and if experienced personnel are available. These latter measures may also be better options than trapping if an impacted host population is in a remote or rugged area where the set-up and servicing of traps is difficult (Winter and McKelvey 1999).

GENERAL MANAGEMENT RECOMMENDATIONS

An essential factor in attempts to limit cowbird numbers on a landscape scale is the cowbird's commuting behavior (Rothstein et al. 1984). Several studies have shown that the maximum commuting distance between morning/breeding and afternoon/feeding sites was 7 km (Rothstein et al. 1984, Thompson 1994, Gates and Evans 1998, Ahlers and Tisdale 1999a), thereby implying that anthropogenic opportunities for cowbird feeding need to be at least 7 k m from habitat critical to endangered hosts. However, a recent study in northeast New Mexico (Curson et al. 2000) has shown that a small proportion of female cowbirds have daily commutes of 14 km or more each way. Given the pervasiveness of human influence and these large distances over which cowbirds are known to fly between feeding and breeding areas, there may be few areas of North America where landscape-level management measures can completely eliminate local cowbird populations. Rather than complete elimination, cowbird abundance may at least be reduced by landscape-level actions because abundance has been shown to decline with increasing distance from anthropogenic food sources over distances as short as 2-4 km (Verner and Rothstein 1988, Tewksbury et al. 1999, Curson et al. 2000).

The following are USFWS management recommendations for cowbirds (USFWS 2001a):

1. When a cowbird control program is initiated, define goals that will lead to a successful completion of the program and plan for periodic, 3-5 year, peer reviews to judge the program's efficacy.
2. Consult previous accounts of cowbird control programs and develop guidelines, as regards trap design, placement and seasonality, that maximize the effectiveness of cowbird control under local conditions (including actions alternative to, or in addition to, trapping).
3. Minimize impacts on non-target species
4. Determine whether cowbird management actions other than control, such as removal of cowbird food sources, can result in drastic reductions in cowbird numbers.
5. If cowbird control is undertaken, identify and pursue long-term landscape objectives that can reduce cowbird numbers over large areas.
6. If cowbird control is undertaken, identify and pursue habitat enhancement actions that reduce levels of cowbird parasitism
7. Initiate programs of public education to inform people about measures that can reduce cowbird numbers and about the justification for controlling cowbirds
8. Brown-headed Cowbird trapping should only be used as an interim/emergency measure.
9. Initiate cowbird control to protect a particular host population only after sufficient baseline data show cowbird parasitism to be a significant threat for that population.
10. Determine the need for continued cowbird control once a host population has grown to be large.
11. Manage or influence management at the landscape level for riparian areas (i.e., land surrounding riparian corridors or, preferably, entire watersheds
12. When grazing or agriculture constitutes a significant percentage of the landscape near the riparian corridor (particularly within a 1-12 kilometer distance), the following management guidelines are recommended:
    (a) use integrated pest management as an alternative to pesticide use; this prevents damage to nesting birds, increases available foraging habitat, especially in orchards immediately adjacent to healthy riparian areas. Riparian songbirds rely on local insect populations to feed young during the breeding season;
    (b) use groundcover crops in orchards and vineyards to minimize cowbird foraging habitat. Managers should limit or avoid mowing groundcover during the breeding season.
    (c) Eliminate, reduce, or closely manage grazing in spring and during the breeding season (April-July) to maximize the understory habitat value to wildlife and minimize foraging habitat for cowbirds.
    (d) If grazing must occur in riparian zones, establish wide pastures and move cattle often to avoid the devastating impacts of year-round grazing.

Cowbirds show a distinct preference for riparian habitats in the West (Farmer 1999a, Tewksbury et al. 1999). Recent studies have indicated that the structure of riparian vegetation influences rates of cowbird parasitism or cowbird numbers. Parasitism rates and cowbird densities usually decline with increases in the density of vegetation (Larison et al. 1998, Averill-Murray et al. 1999, Farmer 1999a,b, Spautz 1999, Staab and Morrison 1999, Uyehara and Whitfield 2000), probably because nests are more difficult to find in dense vegetation. This relationship with vegetation density, which is not necessarily a universal result in cowbird studies (see Barber and Martin 1997), raises the possibility that cowbird parasitism might be reduced by measures that result in denser riparian vegetation, such as increased water flows.

By contrast, landscape level measures may take years to institute and may be impossible in many to most areas given the extent to which humans have altered the landscape in ways that benefit cowbirds. Similarly, increased vegetation density takes time to develop and may be difficult to achieve in arid areas of the Southwest where water is scarce and likely to become more scarce given the high rate of human population growth. It is likely that any increases in vegetation will benefit endangered hosts much more by increasing the amount of breeding habitat than by direct effects on levels of parasitism.

In addition, effective landscape-level measures may be costly and time consuming given the likely economic impacts to agricultural and other interests that will occur if activities and facilities such as grazing and golf courses are curtailed. Furthermore, landscape-level measures may have only limited success in reducing parasitism rates. Therefore, although land managers should have long range goals that address landscape-level actions in regions where parasitism is a threat to host populations, effective results may require many years due to resistance from people whose economic and recreational interests are likely to be impacted. These long periods needed to produce benefits may not be acceptable for severely endangered hosts whose populations are strongly impacted by cowbirds and that need quick amelioration of cowbird impacts.

Regardless of whether cowbird management actions are undertaken, and what form those actions might take, managers should strive for increased amounts and quality of riparian habitat. Consideration of endangered host species across North America shows that a shortage of breeding habitat (or poor habitat quality) is always a major problem or the major problem if cowbird management is contemplated. Although endangered hosts may have large amounts of habitat in some localities, the amount, and often the quality, of habitat summed over a species' range is considerably less than under original conditions in all cases. Increased amounts of high quality habitat and increased patch sizes of such habitat will allow for larger breeding populations of concerned species. These larger populations are likely to experience reduced levels of cowbird parasitism by dispersing cowbird eggs over a larger number of nests. In addition, larger populations are more resistant to extinction for a range of well-known reasons. Due to their relatively larger amounts of interior habitat, large patches of riparian woodland are likely to further reduce cowbird parasitism and nest predation, both of which tend to be concentrated along habitat edges in some regions (Robinson et al. 1995b, Tewksbury et al. 1998, Farmer 1999b).

Determining whether cowbird parasitism has an impact at the level of a host population or species is the most significant challenge facing conservation biologists concerned with cowbirds and their hosts. Even if parasitism is shown to limit a host species, one must decide whether that limitation is a cause for concern because every population must ultimately be limited by some factor. Unless population limitation due to parasitism is a recent situation brought about by anthropogenic factors, there is no reason to believe that this limitation is any less natural than limitation by competition, habitat, nest predation or disease. On the other hand, any factor that limits a species or subspecies that is rare is of course a source of concern, even if the factor is wholly natural. Thus even a moderate loss in recruitment due to parasitism may require management action for a rare or endangered species. If parasitism is the only reason for a taxon's rarity, then long-term reduction of cowbird impacts is likely to be needed. However, all endangered passerines that appear to be affected adversely at the population level by parasitism also suffer from a severe scarcity or degradation of habitat due to anthropogenic factors (Rothstein and Cook 2000). It is likely in all cases that these endangered birds would be able to coexist with cowbirds if their habitat problems were remedied.

Increases and improvements in host breeding habitat should always accompany cowbird management efforts because habitat is a limiting factor for all endangered species impacted severely by cowbird parasitism (Rothstein and Cook 2000). Even if trapping results in the growth of a host's breeding population, cowbird control is a stopgap measure (U. S. Fish and Wildlife Service 1995) that must be done for a number of years if a host population is to continue growing, as all studies show that it has either no effect on cowbird numbers in subsequent years (Eckrich et al. 1999, DeCapita 2000, Ahlers and

Tisdale 1999, Griffith and Griffith 2000) or too small an effect to negate the need for yearly trapping (Whitfield et al. 1999). Nevertheless, if cowbird parasitism is indeed a limiting factor for an endangered species given the amount of currently available habitat, agencies may have to commit to a decade or more of cowbird trapping.

Although trapping is likely to be the most effective management tool in most situations for unacceptable cowbird impacts, managers need to be flexible regarding alternative approaches. Some host populations may be in areas that are so remote and far from roads that it may be difficult to use the large decoy traps that are effective for cowbird trapping. In such cases, it may be more cost effective to shoot cowbirds after they are attracted to female chatter calls (Eckrich et al. 1999, Rothstein et al. 2000) and/or to monitor host nests and remove or addle cowbird eggs in nests that are accessible to field workers (Kus 1999, Winter and McKelvey 1999). Similarly, if a host population is very small, it may be most cost effective to monitor all nests even if trapping is feasible. Although nest monitoring and removal or addling of cowbird eggs avoids the major losses incurred by cowbird nestlings, it cannot recover egg losses due to the actions of adult cowbirds. On the other hand, trapping alone may not remove all adult cowbirds and therefore some nests may still be parasitized.

SPECIES-SPECIFIC MANAGEMENT RECOMMENDATIONS

Management recommendations for cowbird parasitism of the Southwestern willow flycatcher include the following, which may also be useful in establishing management recommendations for other species as well:

1. Reduce cowbird parasitism to less than 20% at each site.
2. Continue to monitor nests to record incidence of parasitism.
3. Evaluate effectiveness of cowbird trapping at present locations by monitoring nests for parasitism and reproductive success.
4. Implement cowbird trapping programs where parasitism rates are greater than 20%.
5. If selective trapping on breeding territories is inadequate, initiate additional cowbird control around centers of concentration (i.e., dairies, feedlots, winter pastures)
6. Management strategies designed to benefit the southwestern willow flycatcher will also benefit the Bell’s vireo (*Vireo bellii*) and blue grosbeak *(Guiraca caerulea*), both species of special concern in Utah (Utah DWR 1998).

TOWER KILLS

It is estimated that 4 to 6 million migratory birds are killed annually in collisions with communication towers and their associated structures (Manville 1999). According to Shire et al. (2000), these estimates may be conservative. Published accounts of birds striking tall, lighted structures such as lighthouses — although often anecdotal — have appeared in the scientific literature since at least 1880 (Crawford and Engstrom 1999). The earliest known published report of a bird-tower kill in the United States took place in September 1948 at a 450-foot (137-m) radio tower in Baltimore, Maryland, although no details about the incident were made available (Aronoff 1949). The first long-term study of the impact of a television tower on birds was begun in 1955 by the Tall Timbers Research Station in northern Florida. With the ground conditions and the number of scavengers controlled as much as possible, daily searches for dead birds were made under this tower. After the first 25 years, 42,384 birds representing 189 species were tallied (Crawford and Engstrom 1999). The longest study yet conducted was by physician Charles Kemper over a 38-year period, beginning in 1957 (Kemper 1964, 1996). He collected 121,560 birds representing 123 species. On one night in 1963, over 12,000 birds were collected, the largest single-night kill yet documented. Other studies also have been conducted on the effects of tall towers on nocturnal bird migrations, most notably by Avery *et al.* (1976) at a U.S. Coast Guard Omega Navigation Station in North Dakota using a portable ceilometer. Since the 1970s there has been much information published about bird strikes with communication towers (Manville 2000).

Research into collisions of migratory birds with towers is lacking. Birds vulnerable to communication towers comprise some 350 Species of neotropical migratory birds. Of these, Thrushes (Muscicapidae), Vireos (Vireonidae), and Warblers (Parulidae) are the species that seem the most vulnerable. These species generally migrate at night and appear to be most susceptible to collisions with lighted towers on foggy, misty, low-cloud-ceiling nights during their migrations. The presence/absence of lights on towers seems to be key (Manville 2000).

The number of communication towers in the United States increases dramatically each year. According to the Federal Communication Commission's (FCC's) *2000 Antenna Structure Registry*, the total number of towers in the United States is over 74,000 with over 45,000 of these exceeding 199 feet above ground level (AGL) The FCC estimates non-compliance with its registry to be 24-36%, which could bring the total number of towers to approximately 92,000-102,000. Towers exceeding 199 feet are required to be lighted in order to comply with Federal Aviation Administration (FAA) regulations governing aviation safety. While birds may collide with any tower, lighted towers pose greater threat to migrating birds which are drawn to the lights, become disoriented, and collide with the tower or its guy wires. According to a report by the American Bird Conservancy (ABC) (Shire et al. 2000) nearly 350 species of Neotropical songbirds are vulnerable to collisions with communication towers, and 230 (66%) of these species have been documented as tower fatalities. Many of these are species in decline and are maintained on conservation lists as species of concern. The ABC report was compiled using study sites in the Eastern United States, although 90 (39%) of the 230 species mentioned above are found in Utah.

TOWER COLLISIONS AMONG MIGRATORY BIRDS

Many aspects of tower collision among migratory songbirds, including the degree of occurrence in Utah, are still unknown. It is apparent, however, that species which migrate at night such as mentioned above, especially during cloudy or foggy weather, are at increased risk of collision. In addition, the color of the beacon on the tower and variations in flashing frequency appear to affect the number of fatalities.

It has long been known that birds migrating at night utilize the stars and moon for navigation. Weather is also known to be a factor (Laskey 1954), and during periods of inclement weather, such as low clouds or fog, birds become drawn to the beacons of communication towers as if they were distant, stationary, light sources. Presence of moisture in the air causes light to refract off water droplets producing a bright halo around the tower, and may thereby make the tower more attractive to migrating birds. In the absence of any natural navigational light sources and the presence of tower lights, birds may become disoriented. Disoriented birds will fly in circular or tightly arcing paths around the communication tower in an attempt to keep the light source at a constant bearing. The birds are reluctant to leave the halo of light surrounding the tower which increases the likelihood of collision with the tower itself, the guy wires, or other birds. By shining bright flood lights at the tops of communication towers, observers have witnessed huge clouds of birds tightly circling the tops of the towers emitting distress calls (Seeman 2000).

As bird attractants, lights on tall structures have been cited in the literature since before 1900 (Crawford and Engstrom 1999). Cochran and Graber (1958) were among the first to document lighting impacts on birds that when tower lights were turned off, the number of migrant flight calls decreased significantly; but within minutes after the tower was relighted, flight calls "increased dramatically." Large scale bird kills seem to be related to either white or red lighting as reported by Avery *et al.* (1976). However, large bird kills do not always occur during inclement weather, as evidenced by a kill of some 450 songbirds representing 30 Species at a television tower with red blinking lights near Topeka, Kansas, Skies were clear until approximately 3:00 am the night of the tower kill. How many birds died during the clear weather conditions before 3:00 am is unknown (Manville 2000).

POSSIBLE SOLUTIONS

Numerous solutions have been suggested to decrease the number of tower-related bird fatalities. Most of these involve the modification of tower lighting and construction. Two aspects that could theoretically contribute to a tower's attractiveness to birds are illumination and the radio frequency (RF) signal that is transmitted by the antenna itself. Very little research has been conducted regarding the affect of RF signals on bird behavior, but preliminary findings suggest that this factor plays a far less important role in tower collision than illumination.

Illumination encompasses several variables. Beason (1999) and Gauthreaux (1999) both summarized that red lights are more attractive to birds than white, and that constant illumination may be more attractive than flashing lights or strobes. One possible explanation is that in all avian Species studied to date, have a very sensitive photo-receptive channel in the red spectrum. In addition, the relationship between long wavelength illumination and navigation has been tested on five different Species of birds. In every case, long wavelength illumination, such as that corresponding to red or red-orange in our visual spectrum, has been shown to have a disorienting effect on the birds. A bird's "magnetic compass" is apparently tied to its optical nerve and this type of lighting interferes with the "magnetic compass". Thus tower lights inhibit a bird's ability to navigate properly in the absence of other visual cues (Beason 1999). By placing white, flashing lights on communication towers the deleterious effects of red lights may be avoided and tower collisions greatly reduced.

Another aspect of tower modification suggested to decrease the number of avian fatalities is the elimination of guy wires in future tower construction. Birds most frequently collide with the guy wires rather than the tower itself. Free standing towers would greatly reduce the number of collisions.
The U.S. Fish and Wildlife Service in a September 2000 memorandum (Clark 2000), detailed a list of twelve voluntary compliance guidelines for the siting, construction, and decommissioning of communication towers. They have recommended whenever possible that new communications equipment be collocated on an existing structure. If such a collocation is not feasible, communications service providers are encouraged to consider the threat of avian collisions in all aspects of new tower construction. Some of these recommendations include using the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA, the use of free standing structures without guy wires, and construction of new towers which could accommodate at least two additional users thereby reducing the need for new tower construction in the future.

CONSIDERATIONS FOR UTAH

The FAA requires that all towers exceeding 199 feet (61 m) AGL must contain a pilot warning light(s). Based on the July 2000 FCC *Antenna Structure Registry* database, there were some 46,000 lit towers more than 199 feet AGL (not including towers classified as “poles") in the United States. Approximately 75,000 towers (including some 23,000 which are not lighted) are now listed in the FCC’s database (Manville 2000).

There are currently eighty-three registered towers or tower cluster sites which exceed 199 feet AGL in Utah. (Figure 27) These existing towers vary in height and thus vary in the degree of potential for collisions with migratory birds. Of these 83 registered towers, 44 (53%) are 200-299 feet high, 22 (26% are 300-399 feet high, 7 (8%) are 400-499 feet high, and 5 (6%) are greater than 500 feet high. Height information on the remaining 5 towers was not available. In addition, with the expansion of cellular and digital technology, towers are being constructed at a greatly increased rate. Depending on location, some of these new towers may potentially becomes hazards to migratory birds. The Utah Natural Heritage Program receives approximately 120 requests annually for the approval of new or collocated communication towers.

To date, no comprehensive study detailing the effect of tower kill has been conducted in Utah. Such a study would undoubtably prove beneficial to our understanding of the effect that tower kill has on Utah’s migratory bird populations. Ideally, a study designed to monitor avian mortality at communication towers should be conducted during Spring and Fall migrations at tower sites of varying specifications. The use of radar may also serve to help focus the sampling period by determining when large flocks of migrating birds are present. Towers of different heights should be incorporated in this sampling, as towers of greater AGL height have been shown to incur greater mortalities. In addition, towers at different elevations need to be considered as even short towers at greater elevations may have an effect on mortality.

By sampling towers of different lighting and structural configurations it could be determined which types of tower construction and illumination used in Utah are most deleterious to migratory bird populations. In addition to observational studies, active experiments in which the lights on the tower are altered, either in color or pulsing frequency, could be conducted. Sampling would not be difficult and could be accomplished with a relatively small amount of effort. In studies conducted in other states, the use of volunteers has been invaluable to the research effort, and has greatly reduced the cost of tower sampling and monitoring. As public awareness of this issue increases, the number of individuals willing to donate their time to this cause will likely increase. Ultimately, with increased awareness, comprehensive sampling efforts, and compliance with the voluntary guidelines set forth by the U.S. Fish and Wildlife Service, the impact of communication towers on avian mortality can be substantially reduced. The Telecommunications Act of 1996 (Public Law 104-104) mandates that all television stations be digitized by no later than 2003. By some estimates, this mandate could result in the addition of 1,000 new, 1,000-plus-foot "mega-towers" across the landscape in the United States (Manville 2000).

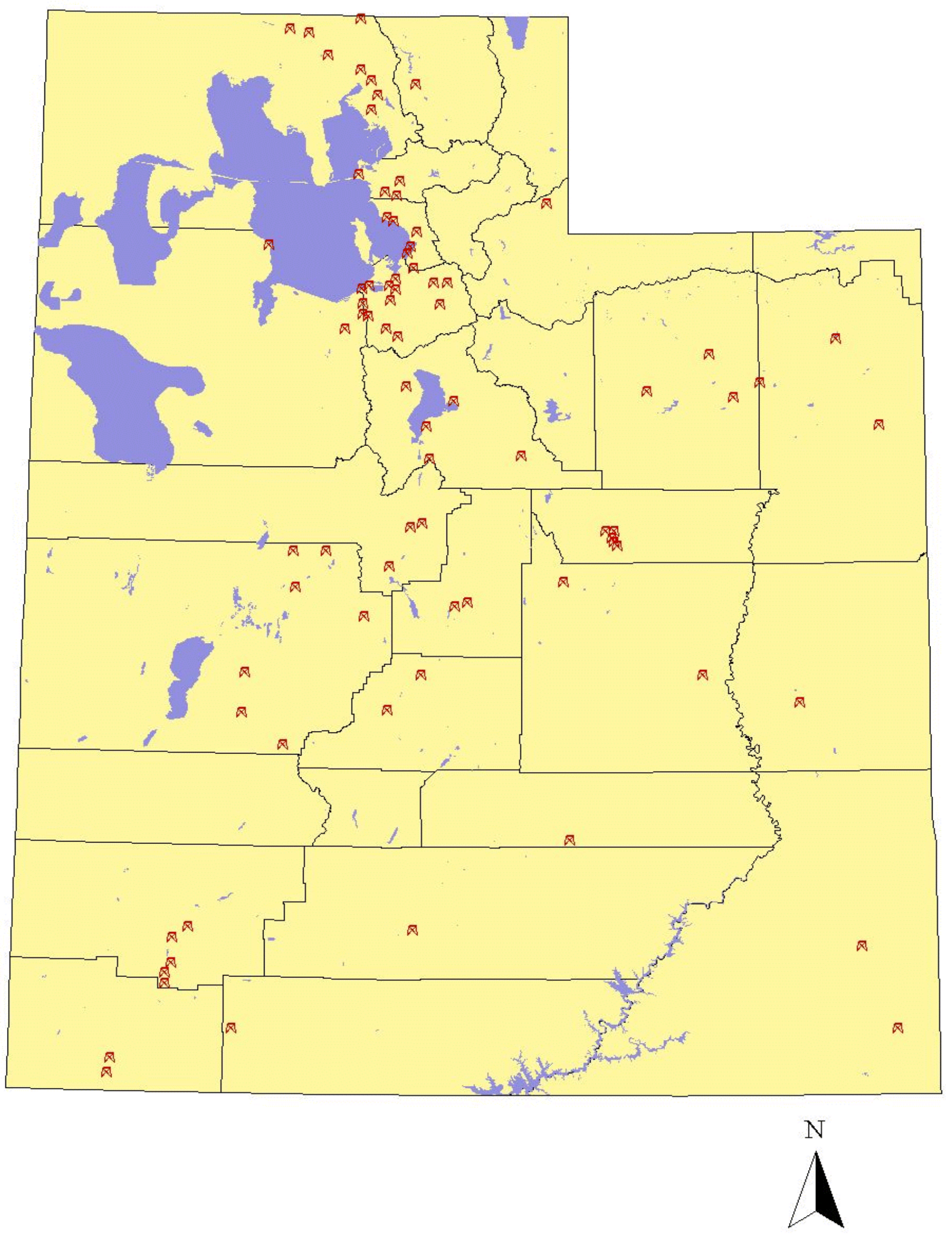


Figure 27. Location of communications towers and complexes within Utah.
(Source: Federal Aviation Administration 2001)

INTERIM GUIDELINES

The U. S. Fish and Wildlife Service has produced guidelines for tower placement and construction that are designed to reduce the potential for collisions with migratory birds and to provide guidance to industry on the siting and placement of towers. The recommendations are discretionary and non-binding to both Service personnel and to the public and are as follows:

1. Any license applicant proposing to site a new communication tower is strongly encouraged to collocate the proposed communication equipment on an existing communication tower or related existing structure (*e.g.*, a church steeple, billboard mount, water tower, electric transmission tower, monopole, or building). With Crown Castle International, for example, 9 tenants on average collocate on towers they own around Pittsburgh, Pennsylvania; and as many as 120 tenants can collocate on a tower (Powers 2000).

t 2. If collocation is not practical, license applicants are strongly encouraged to construct towers less than 200 feet (61 m) AGL, using construction techniques that do not require guy wires (*e.g.*, lattice or monopole structures). Such towers do not require lighting under FAA regulations unless located within 3.8 miles (6.1 km) of airports and near major travel corridors, and so should not be lighted unless required. If at all possible, new towers should be located within existing "antenna farms," preferably in areas not used by migratory birds or species Federally or state-listed as endangered or threatened, or listed as Nongame Species of Management Concern (Trapp 1995). Avoid siting towers in or near Wetlands, near other known bird concentration areas (*e.g.*, National Wildlife Refuges), or in habitat of threatened or endangered species known to be impacted by towers. Local meteorological conditions should be reviewed, and areas with an especially high incidence of fog, mist, and low cloud ceilings should be avoided, especially during spring and fall migrations.

3. For taller towers (more than 199 feet [61 m] AGL), the minimum amount of warning and obstruction lighting required by the FAA should be used. Where permissible by FAA and local zoning regulations, only white strobe lights should be used at night. These should be up-shielded to minimize disruption to local residents, and should be the minimum number, with minimum intensity and number of flashes per minute (*i.e.*, the longest duration between flashes, currently three seconds) allowed by the FAA. The use of solid red or pulsating red warning lights should be avoided at night. Construction techniques which do not require the use of guy wires should be employed whenever possible.

4. Guyed towers constructed in known raptor or waterbird concentration areas should use daytime visual markers (*e.g.*, bird diverter devices) on the guy wires to prevent collisions by these diurnally active species. Suggested bird avoidance guidelines are available from the electric utility industry (APLIC 1994, 1996), and research and experimental design recommendations are available from the wind generation industry (NREL 1995, Anderson *et al.* 1999).

5. Towers should be constructed in a way that limits or minimizes habitat loss within the tower "footprint." Road access and fencing should be minimized to reduce or prevent habitat fragmentation and disturbance, and to reduce above-ground obstacles that might impact birds in flight. A larger tower footprint, however, is preferable to construction of a guy-supported tower.

6. If significant populations of breeding birds are known to occur within the proposed tower footprint, construction should be limited to those months when birds are not nesting (*i.e.*, times other than spring and summer).

7. New towers should be designed structurally and electrically to accommodate the applicant's antenna(s), and comparable antennas for at least two additional users, to reduce the number of future towers — unless this design would require the addition of lights or guy wires to an otherwise unlighted and/or unguyed tower.

8. Security lighting for on-ground facilities and equipment should be down-shielded to keep light

within the boundaries of the site and minimize its potential attraction for birds.
9. If a tower is constructed or proposed for construction, FWS personnel and/or researchers from the Communication Tower Working Group or their designees should be allowed access to the site after construction is complete to conduct both large (*e.g.*, crane [Gruidae], swan, and goose [Anatidae]) and small dead-bird searches; to place net catchments below the tower but above the ground; to position radar, Global Positioning System, infrared, thermal imagery, and acoustical monitoring equipment as necessary to assess and verify bird migrations and habitat use; and to gain information on the impacts of various tower sizes, configurations, and lighting regimes.
10. If constructing multiple towers, providers should consider the cumulative impacts of all of those towers on migratory birds, including impacts on birds listed as threatened and endangered and nongame Species of management concern. The impacts of each individual tower should also be considered.
11. If significant numbers of breeding, feeding, or roosting birds are known to habitually use a proposed tower construction site, relocation to an alternate site is 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.
12. Towers no longer in use or determined to be obsolete should be removed within 12 months of the cessation of use.

A review and assessment of the current literature, research, and methodologies for studying communication towers has been conducted by USFWS which dates back to 1995. The review analyzed work in the United States, Canada, Europe, Australia, and New Zealand, and is available on the Service's web site (http://migratorybirds.fws.gov/issues/towers/review.pdf). Additional information can be obtained by visiting the following web sites as well: http://www.abcbirds.org/TowerKills.html, http://migratorybirds.fws.gov/issues/towers/agenda.html or http://www.fws.gov/ r9mbmo/homepg.html.

PESTICIDES

Pesticides are used in nearly every home, business, farm, school, hospital and park in the United States and are found almost everywhere in our environment. In fact, recent studies of major rivers and streams documented that 96% of all fish, 100% of all surface water samples and 33% of major aquifers contain one or more pesticides at detectable levels. In terms of global market share and thus use of pesticides, the United States accounts for less than 25% (Cremlyn 1991).

Pesticides consist of three main groups, insecticides, fungicides, and herbicides (or weed killers). In addition to these three main groups, there are additional pesticide groups such as rodenticides (for control of vertebrate pests), nematicides (for control of microscopic pests), molluscicides (for control of slugs and snails primarily), and acaricides (for control of mites). Many of the herbicides and fungicides act to disrupt biochemical processes specific to plants and fungi, whereas most of the insecticides act on the insect's nervous system. Consequently, the greater impact to the environment comes from insecticides rather than other types of pesticides. Most of the chemical compounds within these major groups are designed to be target specific while others are more broad-based. Miscellaneous other compounds are used in insect control programs, including a group of compounds known as insect growth regulators (IGRs) which inhibit chitin synthesis. The term "agrochemicals" is an even broader term referring to chemicals which enhance the growth and yield of crops, excluding inorganic fertilizers (Cremlyn 1991). While fungicides and particularly herbicides can have major impacts on bird habitats, the primary scope of this section is impacts to birds from insectides.

The pesticide group with the highest potential for impacting avian populations is the insecticides. The four main groups of insecticides are organophosphates, carbamates, pyrethroids, and organochlorines. Organophosphates and carbamates have a distinct advantage over organochlorines in that they act faster on target Species and typically breakdown quickly in the environment. The primary disadvantage of most of these compounds is their lack of specificity to a target insect and their lethal effect on non-target Species such as birds and other vertebrates. Generally, birds are the class of non-target animals most sensitive to the effects of these compounds. (Research Information Bulletin U.S. Dept of Interior Fish and Wildlife Service No.64 1992).

The organochlorines are well known to cause environmental pollution, and many of the compounds in this group have been banned or severely restricted in use in developed countries. However, their use in developing countries remains substantial, especially for control of insect disease vectors such as mosquitoes and lice.

Each pesticide currently on the U.S. market contains Environmental Protection Agency (EPA) approved application procedures printed on the product label. The labels constitute a legal document in terms of EPA policy, and altering the approved procedures is in effect a violation of Federal law.

ORGANOCHLORINE INSECTICIDES

The 1930s represent the beginning of the modern era of synthetic organic pesticides. In 1939, the powerful insecticidal properties of the organochlorine compound dichlorodiphenyltricholoroethane (DDT) in field tests in Switzerland against Colorado potato beetles. The compound began commercial manufacture in 1943 and soon became the most widely used single insecticide in the world. During the 1940s, DDT was used to destroy mosquitoes to reduce malaria and yellow fever, and beginning in the 1950s DDT is credited for increasing agricultural yields. DDT (and other organochlorines) is very persistent in soil and water with half-life estimates at 2-15 years in soil (US Dept of Health and Human Services Information). DDT in soil breaks down to various metabolic forms [most notably dichlorodiphenylethane (DDE)]. These metabolites evaporate into the air, and the sun or microorganisms break down these compounds in water.

DDT and its metabolites can be absorbed by small aquatic organisms and then become concentrated in the fish that feed on these organisms. In fact, the levels of DDT in animals or fish can be higher than in the environment since the compound is fat soluble and is easily stored in individual fat cells. Similar "bioaccumulations" were documented for other Species, and birds that feed on fish or fish-eating animals or other organisms with these bioaccumulations have shown even higher concentrations of DDT and its metabolites. Eggshell thinning, behavioral abnormalities, and a host of other abnormalities associated with DDT usage led to the ban of the compound in the United States in 1973 (except for health emergencies).

ORGANOPHOSPHATE INSECTICIDES

The organophosphorous compounds (commonly referred to as "organophosphates") were developed as a result of the wartime research on nerve gas for use in chemical warfare. These insecticides act by disrupting nervous transmissions in the insect(s) targeted.

Organophosphates are very toxic to man and other vertebrates, including birds, although some varieties have now been developed which have reduced toxicities. The acute toxic effects of the organophosphates is considerably greater than the organochlorines, and vertebrates directly exposed to sprays or ingesting granules during application typically succumb very quickly. An important advantage of this group of insecticides is that these compounds typically degrade very rapidly post-application into non-toxic materials. The rate of breakdown depends on the nature of the organophosphate being applied, the formulation (both liquid and granular formulations are available for some of these compounds), the method of application, climate, and growth of the treated plant crop. In addition, organophospates and are much less persistent in the environment than the organochlorine insecticides. Organophosphates do not accumulate in the body or along food chains, and after more than 40 years of application there is no evidence of chronic effects to ecosystems. Even so, some members of this group of insecticides can produce mutagenic or carcinogenic effects.

CARBAMATE INSECTICIDES

The carbamate ester compounds (commonly referred to as "carbamates") act on the insect's nervous system in a manner similar to the organophosphates but are even less persistent. Carbamates readily degrade and do not accumulate along food chains. Some of the compounds in this group have very high vertebrate toxicities, and some are only available in granular formulations which are incorporated into soil as a means of limiting toxic effects to non-target organisms. At least two of the more well-known carbamate compounds, aldicarb and carbaryl, are now considerably restricted in their use in the United States.

PYRETHROID INSECTICIDES

Pyrethrum is a contact insecticide obtained from the flower heads of *Chrysanthemum cinerariaefolium* which also attacks an insect's central nervous system. The key factor which renders pyrethrum compounds (commonly referred to as "pyrethroids") as an important insecticide is a very rapid knockdown action on flying insects coupled with a very low toxicity to vertebrates. Synthetic pyrethroids have low to medium toxicity to most vertebrates because they quickly detoxify and are excreted. However, fish and aquatic invertebrates cannot quickly detoxify or secrete pyrethroids and are thus highly susceptible to the toxic effects of these products.

The pyrethroids are not persistent and typically leave no toxic residues. Pyrethroids are the most common form of insecticide in household sprays. A major disadvantage with pyrethroids acting alone as insecticides is their instability in the presence of air and light. Consequently, the pyrethroids are commonly mixed with other insecticides to ensure that target insects do not recover after application. After organophosphates and carbamates, pyrethroids are now recognized as the third major class of insecticides amounting to over 15% of the global insecticide market.

OTHER CONSIDERATIONS

The extensive use of insecticides has led to the appearance of resistant strains of insects. Consequently, users of insecticides have responded with application of increasingly higher doses.

Resistance to these compounds refers to the ability of a certain portion of an insect population to tolerate doses of an insecticide that would kill the majority of the population of the same Species. There are numerous examples, for instance, of insects that have developed a resistance to DDT, to certain forms of cyanide, and to arsenic. Remnants of treated populations contain naturally resistant individuals which subsequently reproduce explosively and became very successful due to reduced competition from non-target Species or natural predators that were also reduced or eliminated from the treatment area.

Pesticides do not themselves produce resistance. Instead, resistant individuals already present in a natural population are ultimately selected, and these tolerant individuals produce progeny in succeeding generations that are also tolerant to the pesticide. Resistance can also occur in a behavioral or morphological form as well as a biochemical one. Behavioral resistance involves the insect adapting a pattern of behavior that brings it into less and less contact with the compound. Morphological resistance is associated with such things as the insect developing or having an exceptionally thick cuticle which would hinder transport of the insecticide into the nervous system. In response to this resistance, insecticides are often mixed or compounds are rotated in their applications as an attempt to reduce the problems associated with these more tolerant insect strains (Cremlyn 1991).

Potential Hazards to Birds and Wildlife

In order to better protect birds and wildlife from the risks of pesticide exposure it is necessary to understand the effects of these compounds. Several hundred compounds are on the market today, each with its own different characteristics that may pose a risk to wildlife. While a particular pesticide may pose little or no harm to mammals, it may cause severe harm to aquatic organisms or bird life. Knowing these differences is necessary for decision making about pesticide use. There is much documentation showing that wildlife are harmed by particular pesticides. The documentation includes laboratory toxicity studies on various types of wildlife, field trials that must be performed in order to register the pesticide and reports of incidents of wildlife poisoning. Pesticide effects on birds and wildlife may be lethal, sublethal, acute, chronic, habitat related, or there may be no effect. In general, the risk a pesticide poses to wildlife is related to the pesticide type, toxicity, proximity of the application to wildlife habitat, the dose, application rate, number of applications, persistence of the pesticide in the environment, and its ability to concentrate in the wildlife food chain. These factors interact with food habits and behavior of individual Species to produce a response. In general, insecticides are more toxic to fish and wildlife than herbicides or fungicides, although some herbicides may indirectly pose a harm to wildlife by impacting habitat.

The type and magnitude of the effect of a given compound depends on two factors, toxicity of the compound and amount of application (dose). If exposure causes death, the result is referred to as a lethal effect. Lethal effects are the most common type of direct pesticide effect on wildlife.

Direct effects result from actual pesticide exposure. Young birds that eat or are fed pesticide treated insects are at great risk of suffering lethal pesticide exposure effects. Sublethal insecticide effects occur when damage to the central nervous system results in behavioral effect which may hinder the animal's ability to survive or reproduce. Some typical sublethal responses in birds exposed to pesticides include the inability to sing properly, establish and defend breeding territories, or an inability to attract mates. Adults may be unable to care for themselves or their young properly, resulting in death to the nestlings or increased chance of predation.

Wildlife in general, and birds in particular, may experience lethal and sublethal effects without being directly exposed to pesticides. This typically occurs when a pesticide application destroys or disrupts food sources such as insects. Insects supply protein necessary for growing birds, and normal growth and development of young birds can be impacted in areas where insecticides have been heavily used. Lethal and/or sublethal effects of pesticides on wildlife and fish may occur from one exposure over a short time period (acute) or they may result from exposures to small amounts over a longer time period (chronic).

The tradeoff is that the acute toxicity of some of these modern pesticides is higher than the older, more persistent compounds.

PESTICIDE/INSECTICIDE USE IN UTAH

Agriculture

Approximately 12 million acres (23% of the total land area of Utah) is classified as farmland. Of this, approximately 42% is irrigated land and 27% is pastureland. The top 5 counties in Utah in terms of agricultural sales are Cache, Box Elder, Utah, Sanpete, and Millard County. The top 5 agricultural commodities in Utah are cattle production, dairy products, hay, greenhouse and nursery production, and hogs (Utah Department of Agriculture). In terms of crop production, the top 12 crops in terms of total acres in production annually are alfalfa (541,939 ac), wheat (182,372 ac), barley (94,072 ac), corn (55,695 ac), oats (9,028 ac), dry beans (5, 201), cherries (4,010 ac), apples (3,699 ac), potatoes (3.247 ac), onions (2,221 ac), peaches (1,775 ac), and tomatoes (198 ac). Cache, Weber, Sanpete and Utah counties annually use more than 5 times the amount of insecticides as the remaining counties, and Davis, Salt Lake, and Box Elder counties use more than twice the amount of other counties (Figure 28).

Products that have higher toxicities overall are generally classified as restricted use pesticides (RUPs) by EPA. EPA requires that applicators wishing to use RUPs be certified by their state regulatory agency to purchase and apply these products. Approximately 95 RUP compounds are currently registered in Utah, and of these 11 compounds are used annually. Use varies by county and type of agricultural practices that are targeted.

The total annual use of insecticides in Utah for crop production is over 300,000 pounds. Alfalfa also ranks number one in Utah in terms of total pounds of insecticide use at over 130,000 lbs annually, approximately 43% of the state’s total use. Most of the other crops produced in Utah require much lower amounts of pesticides, with the exception of fruit production. Production of apples, cherries, and peaches combined annually involves the use of over 120,000 pounds of pesticides. Peach production alone requires ten times the amount of pesticide use of all of the other crops, with the exception of apples and cherries. In short, orchards overall require large quantities of pesticide use with peach production being the highest. Birds and other vertebrates attempting to nest or forage in orchards would have a high likelihood of being exposed to several pesticides, some of which could be fatal.

Mosquito Abatement

Malathion (an organophosphate) and pyrethrin (a pyrethroid) are the two common chemicals used in Utah for mosquito abatement. Use varies annually by county with approximately 600 gallons of malathion and 275 gallons of pyrethrin used annually for each county targeted for control.

Mormon Cricket and Grasshopper Control

Mormon Cricket and grasshopper control in Utah is carried out by the Pest Protection and Quarantine branch of the Animal and Plant Health Inspection Service (APHIS) of the U. S. Department of the Interior. Carbaryl (a carbamate) is combined with rolled oats and flaky bran as bait for crickets and applied at the rate of approximately 10 lbs/acre in areas targeted for treatment. Acres targeted for treatment vary annually and consist of federal and state agency lands, private lands, and transportation right-of-ways.

Grasshopper and Mormon Cricket control also varies annually, depending on when outbreaks occur. Aerial applications of malathion or dimilin (an insect growth regulator compound) are used for control of outbreaks, and the total acres treated annually in Utah for both Mormon Crickets and grasshoppers can be a few hundred up to several thousand.

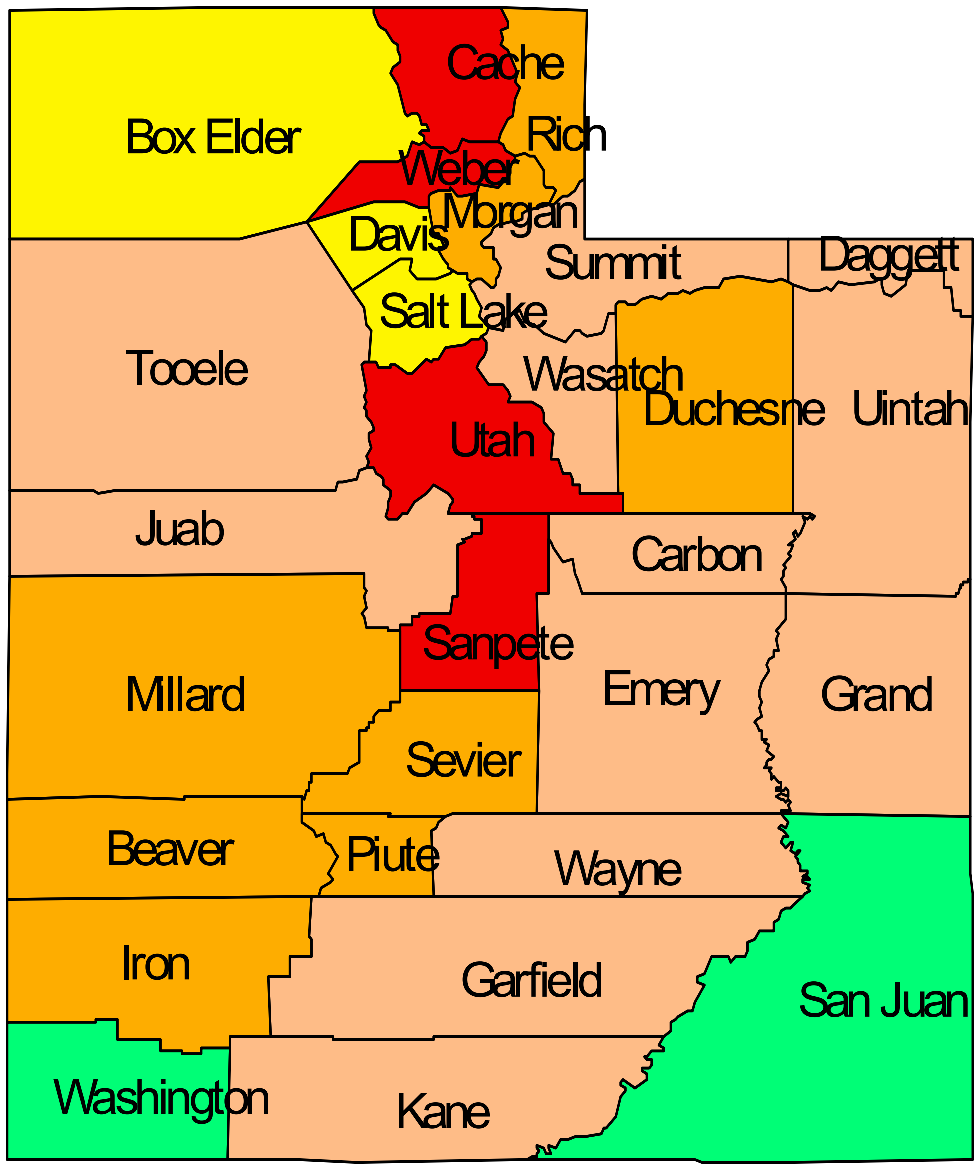


Figure 28. Average annual use of pesticides in Utah. Counties colored in red use 5 times the expected use each year, those colored in yellow use twice the expected amounts each year, those colored in orange, green, and brown use at or below the expected amounts annually, with those counties colored brown being the lowest users of pesticides overall.

Avian Pest Control

Avian pest control in Utah is also carried out by APHIS. Approximately 13,000 - 15,000 mixed flocks of blackbirds are targeted annually, which consist primarily of European Starlings and Brown-headed Cowbirds. Feedlots generally attract large numbers of these birds particularly during winter. An APHIS approved compound known as DRC 1339 is typically used which causes renal failure in birds after being metabolized. The compound degrades in light after about 3 days and is non-toxic to mammals. Non-target avian Species such as Mourning Doves are vulnerable to application of the compound, but surveys are done in target areas prior to application to prevent non-target Species impacts. Control has been carried out in Box Elder, Cache, Duchesne, Millard, Washington, Salt Lake, Sevier and Utah Counties. Some applications targeting Common Ravens have been carried out using the same compound in areas where ravens congregate on lambing grounds or for protection of Gunnison Sage-grouse nests (APHIS pers. comm.).

INTEGRATED PEST MANAGEMENT

Integrated Pest Management (IPM) has been shown to be an affective and environmentally sensitive approach to pest management in agricultural settings, since growers inspect their crops and monitor for damage before there is a need for the use of pesticides. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information is used to manage pest damage by the most economical means and with the least risk to people, property, and the environment.

In agriculture, IPM takes advantage of all appropriate pest management options including, but not limited to, the judicious use of pesticides. Effective, less risky pest controls are considered first such as the use of biopesticides such as pheromones to disrupt pest mating or mechanical controls such as trapping or weeding. If less risky controls do not work, then additional pest control methods are employed such as the selective and targeted spraying of pesticides. In most cases, the cost of different control options must be taken into consideration.

IPM is not a single pest control method but, rather, a series of pest management evaluations, decisions and controls. In practicing IPM, growers typically follow a four-tiered approach, as follows:

Set Action Threshold(s)

Before taking any pest control action, an IPM program first develops an action threshold consisting of a determination point at which pest populations or environmental conditions indicate that pest control action must be taken.

Monitor and Identify Pests

Not all insects, weeds, and other living organisms require control. Many organisms are innocuous, and some are beneficial and help control pests. Successful monitoring and identification ensures that pesticides are used only when really needed and that pesticides are not misapplied.

Prevention

Prevention may mean rotating between different crops, selecting pest-resistant plant varieties, or planting pest-free rootstock, measures that pose little to no risk to human health and the environment.

Control

Once pest control is determined to be necessary and preventive methods are no longer effective or available, a method of control is considered. Broadcast spraying of a non-specific pesticide is typically considered as a last resort (U.S. EPA and D. Alston, pers. comm.).

NATURAL/BIOLOGICAL CONTROLS

Virtually all pest populations are affected by natural enemies to some extent. In many cases, natural enemies are the primary regulating force of the pest populations. Natural controls include effects of natural enemies (e.g., predators, parasites, pathogens), other biotic (living) factors such as food availability and competition, and abiotic (non-living) factors such as weather and soil. Biological control is generally defined as any activity of one Species that reduces the adverse effect of another. In pest management, biological control usually refers to the action of parasites, predators or pathogens on a pest population which reduces its numbers below a level causing economic impact. Herbivorous insects and pathogens that attack pest weeds are also considered biocontrol agents. Biological control can apply to any type of organism, pest or not, regardless of whether the biocontrol agent occurs naturally, is introduced by humans, or manipulated in any way. Birds are biological control agents but generally are not considered with pest control programs.

Biological control differs from chemical, cultural, and mechanical controls in that it requires maintenance of some level of food supply (e.g., the pest Species) in order for the biocontrol agent to survive and flourish. Therefore, biological control alone is not a means by which to obtain pest eradication.

Biological control is often relatively inexpensive and can be "permanent" for those biocontrol agents that can survive multiple years and become self-perpetuating. However, overall effectiveness can be from low to high. Biological control can be disrupted by other pest management tactics, especially application of broad-spectrum pesticides. Suppressive effects are density-dependent with greatest impact when pest densities are high. Biological control can be pest-specific, and often a lag time occurs between build up of the pest population and build up of the biocontrol agent. So the procedure is generally not fast-acting. Biological control can be a valuable component of an IPM program and even fits in well with cultural, mechanical, and some chemical controls. Most of the successes with biological control have been in perennial crops (orchards, vineyards), rangeland, and field or forage crops which can withstand a moderate level of pest injury.

Biological control agents can be purchased from commercial suppliers and released for supplementary control of pests. However, most biological control occurs without human assistance. Many predators, parasites and pathogens occur naturally and are continually working to help keep pest populations in control. The importance of natural enemies is often not appreciated until a broad spectrum pesticide, which kills many beneficials as well as the targeted pest, is applied and a new pest— suddenly released from biological control— becomes a serious problem. Conservation and enhancement of natural enemies already present in the system can be a very effective method of biological control (D. Alston, pers. comm.).

ADDITIONAL INFORMATION

In addition to references mentioned above, the following website addresses are valuable sources for further information concerning pesticide use in Utah and within the continental United States. The Utah Department of Agriculture also has further information on pesticide use within an individual county.

U. S. Fish and Wildlife Service - http://www.contaminants.fws.gov/Issues/#Gillion,Robert
Agency for Toxic Substances and Disease Registry (US Dept of Health and Human Services) http://www.atsdr.cdc.gov/ToxProfiles/phs8908.html)
Integrated Pest Management - http://extension.usu.edu/publica/gardpubs/ipm01.pdf
Biological Controls - http://extension.usu.edu/publica/gardpubs/ipm04.pdf
Utah Data -http://ca.water.usgs.gov/pnsp/use92/; http://www.ers.usda.gov/StateFacts

GAP ANALYSIS AND POTENTIAL RANGE MODELS

BACKGROUND

The term “GAP” is an acronym for the multi-agency program entitled Geographic Approach to Planning. Gap Analysis (referred to hereafter as GAP) uses satellite remote sensing and geographic information systems (GIS) to identify and delineate vegetation types. These vegetation types are then used in combination with other GIS data (e.g., elevation) to develop potential range models for birds and other wildlife. While GAP has many applications, it was initially intended to identify information "gaps" in biodiversity protection that may be filled by the establishment of new preserves or changes in land-use practices.

Gap Analysis consists of three primary data layers:1) the distribution of actual vegetation types delineated from satellite imagery, 2) land ownership, and 3) distributions of terrestrial vertebrates as predicted from their habitat preferences and the distribution of vegetation within a given landscape.

The first generation of GAP was completed for Utah in 1995. A prototype CD-ROM with vegetation, land ownership, and potential range models was published in 1995 and modified in 1997.

GAP Vegetation Mapping

Utah GAP discriminates vegetation classes from satellite imagery or aerial photographs; the mapped classes are then linked with existing wildlife/habitat-relation databases. Each vegetation class includes all seral stages within that class (i.e., vegetation classes do not distinguish different seral stages; and classes developed in Utah are complementary, though not exactly the same, as those of neighboring states.

Vegetation mapping in Utah was based primarily on digital analysis of satellite data. Ancillary data used to model vegetation in Utah included digital elevation data, hydrology, an existing vegetation map, and training points collected from a variety of outside collaborators. Based on preliminary data, map accuracy for Utah was estimated at 76 percent.

Technical aspects of GAP data collection, analysis, and validation are beyond the scope of this document. This information and additional information on GAP can be found at Dr. Tom Edwards Utah State University web site (http://ella.nr.usu.edu/~utcoop/tce/) and the University of Idaho web site (http://www.gap.uidaho.edu). Also, see the Habitat section regarding how GAP vegetation classifications were used to define bird habitats in this document.

Bird/Habitat Relationship Modeling

GAP used two sets of information to model animal distributions; these were digital vegetation maps and the wildlife habitat association data linking particular Species to mapped vegetation classes. The resulting models provide a description of the predicted distribution or spatial location for each animal Species (i.e., potential range map). Utah GAP used a variety of sources on ecological relationships to model “potential bird ranges”. The models used primarily published data on general bird/habitat relationships though some actual bird location data was also used.

The bird models and resulting range maps use habitat as the primary surrogate for distribution. Using vegetation as a surrogate to map presence or absence of animals has limitations but allows the prediction of occurrence in areas that have not been sampled.

CHALLENGES

Several factors complicate the use of GAP vegetation classes and model to predict Species presence and absence (Edwards et al. 1996). These include poor or generalized bird/habitat relationship information, lack of distinction among seral stages, absence of important habitat components in GAP (e.g., cliffs), and absence of bird relationships to non-habitat factors (e.g., climate).

Perhaps the most daunting problem with the current models and range maps stems from the lack of Utah-specific bird/habitat relationship information. In cases where specific information was not available, general published information was used to develop the models. Thus, many of the models are too general and do not effectively predict the ranges of Utah birds. For example, Spotted Owl habitat was modeled as coniferous forests. Spotted Owls do nest in contiguous coniferous forests in Arizona and New Mexico; but in Utah, Spotted Owls nest primarily in canyon habitats which may or may not contain conifers. Thus, the model predicts owl occurrence in contiguous conifer forests where owls do not occur (error of commission) and does not predict owls in canyons where they do occur (error of omission).

In many cases, natural history data linking animals to specific habitats are sparse. This necessitates mapping groups of habitats that correspond to the available information about a Species. For example, the best information on a bird Species may be that it is associated with coniferous forests. Given that at least seven mapped classes in Utah contain conifers, the potential distribution for that Species is exceedingly general.

Some birds respond more to vegetation structure than to the type of vegetation (floristics). Because GAP vegetation mapping relies principally on floristics rather than structure, bird distribution maps may contain error. Since GAP does not effectively distinguish among different structural (seral) stages of vegetation, a Species that only uses early seral stage Ponderosa Pine would have a GAP model that predicts its presence in all stages of Ponderosa Pine.

GAP alone cannot distinguish some important habitat variables. For example, Peregrine Falcons rely on cliffs (usually near water) as nesting habitat. Since cliff is not a habitat type that can be mapped with GAP alone, GAP cannot effectively predict the range of Peregrine Falcons in the state. Supplemental information (e.g., curvature derived from Digital Elevation Model) would be needed to make an effective predictive range model for the peregrine.

Some Species may respond to climate (or other non-habitat factors) as well as vegetation; some Species change their habitat relationship as climate (latitude and/or elevation) changes. Elevation is included in current GAP models, but latitude is not. For example, the northern extent of the Spotted Owl's range is found in Utah. As previously mentioned, this results in owls nesting in canyons (not coniferous forests), but they do not nest in canyons in the northern part of the state. Thus, GAP models for some Species will need to predict the complex relationship among climate, elevation, latitude, and vegetation.

Rare Species having localized distributions are also overestimated. Again, information supplemental to GAP would be required to map the ranges of these Species.

Errors in vegetation classification are carried forward into errors in model predictability. Narrow, linear habitats, such as riparian, are notoriously difficult to classify. Thus, the distribution of riparian-dependent Species is difficult to predict.

The images used to classify Utah vegetation are nearly 20 years old. While many habitats have not changed, substantial changes have occurred to many habitats types. For example, original satellite imagery was taken during an extremely wet period; thus current amounts of open water are overestimated and amounts of barren playa habitats are underestimated. Widespread fire events have also converted large amounts of vegetation.

SOLUTIONS

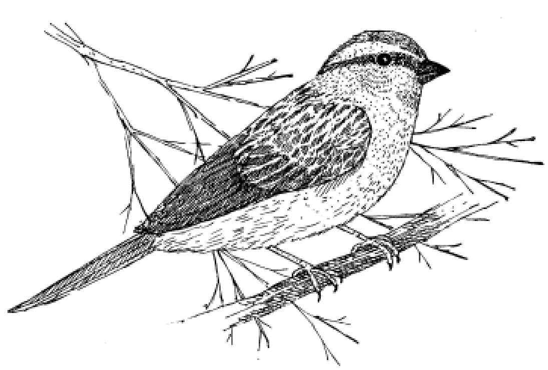
Potential range models for birds should be revised to be specific to Utah. This should be done using a combination of methods to update bird/habitat relationship information for the state and supplement deficiencies in such information. We recommend a combination using a graduate student and a panel of bird experts (Delphi method).

A jointly funded project, lead by UDWR, USGS, and USFWS, should involve a graduate student who would gather the best available Utah-specific information and revise the GAP bird models. The project would include thorough revision of background information used to develop models. This would include, to the extent possible, Utah-specific published and unpublished information (e.g., agency file data, BBS data, Natural Heritage records, museum records, etc.).

The models would be developed in two stages–"full" model and GAP model. The full model would transcend current technical and informational barriers in GAP and identify the factors most important to bird Species whether or not these can be derived in GAP (e.g., cliffs for peregrines and canyons for spotted owls). These models would be extremely important in identifying what types of information would be needed to supplement GAP in order to produce effective predictive models. The GAP model would focus on those factors which can currently be illustrated with GAP. This would provide timely and useful models for most Utah birds.

The Delphi method can be used to supplement bird/habitat information in order to make the models more Utah-specific. The Delphi method simply involves gathering a group of Utah bird experts and having them evaluate the bird/habitat model factors (developed by the graduate student). This is a quick and fairly accurate method of gathering data, though it can be subject to some bias based on the personal experience of the participants.

GAP vegetation classifications are in the process of being redone. The Southwest ReGAP project is the second generation of GAP for Utah as well as Nevada, Colorado, Arizona, and New Mexico. The project is being coordinated through the Remote Sensing and GIS Laboratories at Utah State University. Currently the project is establishing protocols for database construction, vegetation classification, data transfer, field data collection, and land cover model generation. While ReGAP products are still several years away, improved accuracy of vegetation classifications and updated imagery will improve the predictability of the revised bird range models. For additional information on ReGAP, see Dr. R. Douglas Ramsey's (USU) web site (http://www.gis.usu.edu/~doug/doug.html).



UTAH BREEDING BIRD ATLAS

BACKGROUND

A Breeding Bird Atlas is a valuable conservation tool that provides comprehensive distribution of breeding birds in a selected study area. An atlas provides valuable information on presence or absence and current breeding status of bird populations. There are gaps in our knowledge of breeding status for many Utah bird Species. A Utah Breeding Bird Atlas project would serve to fill those gaps and provide a comprehensive and up-to-date summary of the more than 400 bird Species found in Utah. In addition, the information accumulated in a Utah atlas may be combined with information compiled from across the region to create a large-scale view of bird migration and breeding patterns. Many states have already compiled breeding bird atlases and others have atlas projects in progress.

TECHNIQUES

An atlas project requires that the selected study area (such as the state of Utah) be divided into blocks of standardized size in which surveys of breeding birds are conducted. Typically, these blocks are approximately 10 square miles (25 km^2) (Sutcliffe et al. 1986). The number and size of blocks varies with the area to be surveyed. For example, the Colorado Atlas project surveyed 1,760 blocks that were between 9.7 and 10.2 square miles each. The selection of block location is often randomized to reduce the risk of bias and to provide a statistically valid sample of representative habitats. Block surveys are typically carried out in half-day intervals (Kingery 1998).

Once the locations of all the blocks to be surveyed have been identified and mapped, the task of surveying each block may begin. Depending on the habitat diversity associated with a given block, the number of visits required for an accurate survey may vary. The average number of visits is generally 4, but additional visits may be required depending on the length of the breeding season for specific bird Species. Evidence of breeding, such as nest construction or courtship displays, is then recorded and compiled in a database. This information is used to construct a map for each Species showing their distribution and evidence of breeding as individual points. The result is an overall distribution and breeding status pattern for each Species in the study area.

CHALLENGES

Major challenges with compiling a statewide Breeding Bird Atlas include the need for extensive long-range planning, considerable time, considerable funding, and considerable support. Due to the population density and topography of Utah, several additional considerations unique to the state need to be taken into account. Colorado, for instance, in compiling data for its atlas project utilized more than a thousand volunteers to gather field data. In addition, Colorado also employed a full–time coordinator and several assistants. By the time of completion, 1,295 people contributed to the Colorado Breeding Bird Atlas (Kingery 1998). Given that the population of Colorado exceeds that of Utah, the number of bird-enthusiasts required to complete a large-scale atlas project may not currently be available. Consequently, fewer numbers of individuals will be tasked with greater workloads. In addition, many of Utah's wilderness areas are rather remote making them potentially difficult to survey. Comparatively fewer volunteers and greater travel distances may result in a greater time investment overall for each person involved.

Several questions need to be addressed in assessing whether a statewide Breeding Bird Atlas Project can be successfully completed in Utah. First, is there adequate interest in an atlas project in Utah? Given the number of volunteers and staff required to make an atlas project possible, is there enough interest among bird-enthusiasts and Utah ornithological groups to provide the necessary manpower? Second, can sufficient funding be made available to allow for a project of this magnitude?

Finally, although several states have relied on volunteers for the bulk of the field work, the planning, implementation, and publication of a statewide atlas project would require a substantial amount of funding in order to complete. For example, the recently completed Nevada Breeding Bird Atlas cost approximately $125,000 annually to complete.

SOLUTIONS

To insure the success of a Utah Breeding Bird Atlas, the involvement and support of various organizations and individuals would be essential. The incorporation of experts in ornithology and data analysis would be necessary for the production of a sound and reliable Breeding Bird Atlas which incorporates standardized methods allowing for comparison between atlas projects of other regions. In addition, the formation of a steering committee would be useful to the development and monitoring of an atlas project in Utah.

The involvement of different Utah-based ornithological groups and Audubon Chapters would be vital to the success of a Utah Breeding Bird Atlas. These groups would undoubtedly contribute much of the volunteer-based structure as well as the necessary enthusiasm to see a Breeding Bird Atlas project to completion. In order to ascertain the available volunteer support for such an endeavor, it may be useful to distribute to Utah-based bird groups a questionnaire regarding interest in participation. Review of the results would provide organizers with an estimate of volunteer number as well as the level of interest present in Utah.

Although a Breeding Bird Atlas project would require a considerable investment of time and energy, the rewards of such an endeavor far outweigh the costs. States which have already completed atlas projects regard the resulting publication as an invaluable resource and have received purchase requests from many diverse organizations.

CORRELATING BREEDING BIRD SURVEY (BBS) DATA WITH HABITAT

BACKGROUND

The North American Breeding Bird Survey (BBS) is a roadside survey program, with more than 4000 active routes in the U.S. and Canada. Each route is 24.5 miles (39.4 km) long, with 3-minute point counts conducted at 0.5 mile (0.8 km) intervals for a total of 50 point count stops. All birds heard or seen within a 0.25 mile (0.4 km) radius of each stop are recorded. The surveys are run in early summer (late May through June in Utah); they begin 30 minutes before sunrise and normally require 4 - 5 hours for completion. The starting point and direction of each route has been randomly located within a degree block of latitude and longitude (latilong). Surveys are conducted by skilled volunteer birders and professional biologists. The data gathered through BBS has yielded the largest bird database in North America and provides information on relative abundance, population trends, Species richness, and distribution (Sauer et al. 2001). Additional information on BBS can be found at the BBS web site (http://www.mp2-pwrc.usgs.gov/bbs/).

There are currently 99 active breeding bird surveys routes in Utah; four in each latilong block and six "experimental" routes. In addition, there are 4 routes which are no longer active but for which data has been collected in the past. Unfortunately, there is no habitat component to the BBS. Thus, it is not currently possible to correlate BBS data with habitat.

LIMITATIONS

The BBS is the best tool of its kind available; however, BBS does not include a habitat component. Only bird data is collected when BBS routes are run. There is no habitat information collected either at the point or the route level. Thus it is currently not possible to correlate the bird data collected on BBS routes with habitat. The only way to make such correlations is with supplemental habitat data. Other limitations with BBS that relate to bird/habitat correlations include inherent biases of the BBS (e.g., roadside bias) and blocking of data (data entered in 10-point blocks).

Roadside Bias

The birds along roadsides may not represent birds in general. Some Species of birds may be drawn to roadsides and some Species may avoid roadsides. Birds of a given Species bird may be more abundant or more easily detected along a roadside than in the interior of a heavily forested habitat. Thus, a major criticism of the BBS is that it only yields data on "roadside birds". Also, habitat changes along roadsides may not be representative of regional habitat changes. Trends from the BBS may therefore reflect only populations along roads rather than regional bird population changes.

Habitat Bias

Many habitats types are not well covered by BBS, and Species that specialize in those habitats are poorly sampled. Wetland, Riparian, and Alpine tundra Species are examples of groups thought to be poorly represented in the survey.

Observer Bias

Observers change from year to year and not all observers abilities are the same. Some observers may estimate too few or too many birds of one Species, some may not detect certain Species, observers that have run a route for several years may "know what to expect" at each point and thus be listening for a certain Species. This bias is not specific to BBS but is inherent in many bird survey and inventory methods.

Blocked Data

All BBS data prior to 1997 was entered in 10-point blocks. While data provided on data sheets records bird detections at each point, only the 10-point summaries were entered and are available for analysis. Since 1997, data for each point has been entered.

SOLUTIONS

Since the BBS protocol is well established, the way in which BBS data is collected cannot be easily changed. In some cases (e.g., Observer Bias) biases can be corrected in analysis. Biases, such as Roadside Bias and Habitat Bias, can only be recognized without extensive comparisons to non-roadside or habitat specific surveys. Some comparisons have been made (Hutto et al. 1995) and habitat specific data for Utah riparian birds has been collected by UDWR (e.g., Howe 1993) and could be compared to BBS data.

The lack of any habitat component can be corrected by digitizing routes and overlaying existing habitat coverages (e.g., GAP) or by collecting habitat data at each stop. The former approach can be accomplished with relatively little effort and expense and could be accomplished in a few months. This would provide broad scale habitat information such as dominant and co-dominant vegetation (see GAP Models section) which can then be correlated with relative abundance, richness, distribution, and other bird data.

Collecting habitat data along at each BBS point would entail a concerted statewide effort. The same volunteers that collect bird data could collect habitat data but would have to be trained to insure statewide compatibility of data. Also, in order to adhere to the BBS time restrictions, it is not likely that habitat and bird data could be collected simultaneously. Another approach would be to have a few well trained observers collect habitat data from all BBS routes. This would require extensive time and travel and would not likely be a volunteer effort. Dominant/co-dominant vegetation and more detailed habitat information, such as seral stage and percent cover, could be gathered with this technique; but the greater the detail, the greater the expense.

An alternative to digitizing routes would be to gather GPS locations at each point. This would again require a concerted effort with either volunteers or hired technicians collecting the GPS coordinates. The most efficient but more costly approach would involve hiring technicians to travel to each point; this could be done in less than a month. An alternative would be to have the BBS volunteers collect coordinates; this again would require some training and depending on the availability of GPS units may take several years to complete.

For any bird/habitat correlations prior to 1997, analyses would be limited to the 10-point blocks used in entering BBS data. This would confound results in areas where habitat varies greatly within the block. Finer detail could only be obtained by reentering BBS data from original data sheets to the specific point level which would be costly. Correlations for data collected after 1997 could be done on a point specific basis.

RECOMMENDATIONS

We recommend a two-stage approach to incorporating habitat data into the BBS bird data. First, given the small cost and effort involved, we recommend that all Utah BBS routes be digitized as soon as possible. UDWR has transferred route data from BBS maps to 1:100,000 scale maps which could be digitized by the GAP analysis laboratory at Utah State University. Second, we recommend that UDWR lead an interagency funded effort to collect point-specific habitat and GPS data along each BBS route. The second stage would serve to ground truth the digitized routes, and provide point-specific GPS coordinates and habitat data.

Finally, we recommend that a bird/habitat correlation analysis be conducted either by a university graduate student or UDWR. Results would be presented in an easily accessible, user-friendly database for use by land and wildlife managers among others. This would also be a jointly funded project.

Importance of Data

Our recommendations would provide a comprehensive statewide body of geographically specific bird and habitat data. This information would be extremely useful in managing for specific Species or groups of birds as well as bird diversity. The information would also be useful in developing or validating bird habitat models such as the GAP models (see GAP Models section). It would also be a useful tool in implementing the UTACS.

UTAH RIPARIAN INVENTORY

BACKGROUND

Riparian habitat is the single most important bird habitat in Utah. Approximately 75% of all Utah birds use riparian habitats at some time during their life cycles though riparian habitat covers less than 1% of Utah's land cover. Approximately half of the Species listed in this document use riparian habitat as their primary or secondary breeding habitat (Table 1). Nearly 1/3 of the Species that winter in Utah use riparian as winter habitat (Table 1) and riparian habitat is used over 10 times more than upland habitats during Spring migration (Knopf et al. 1988).

Despite the importance of riparian to birds and other wildlife, no statewide inventory of riparian habitats has ever been conducted. Several agencies, e.g., BLM, USFS, Bureau of Reclamation (BOR), U.S. Army Corps of Engineers (COE), USFWS, have been involved with riparian inventories, though these efforts have been sporadic and uncoordinated. Information from these inventories has not been compiled on a statewide basis and most of the data is not currently available in a uniform format.

The UDWR monitors riparian bird populations and riparian habitat at nearly 50 locations across Utah (Howe et al. 1999). UDWR has also published a riparian restoration and revegetation “Handbook” (Gardner et al. 1999). This information could be most effectively used for the conservation of Utah's riparian birds if a comprehensive statewide riparian inventory were completed.

CHALLENGES

While no exact estimates can be made, it is likely that between 80 and 95% of Utah's riparian habitat has been destroyed or altered in the last 150 years. This impact has been greatest on Lowland Riparian habitats but also affects Mountain Riparian. Numerous activities continue to impact riparian habitats, and without a comprehensive riparian inventory, it is unclear how much or at what rate riparian habitats are currently being lost in Utah.

While all riparian habitats are important, some provide critical links or “stepping stones” for migration. Others provide connections between riparian and upland habitats. A riparian inventory would provide information on where these critical links occur or where restoration efforts should be focused to reestablish those links.

There is currently no adequate statewide inventory of riparian habitats. Several inventories have been completed, but these have been done by different agencies using different techniques and different terminology. The process of assessing “Proper Functioning Condition” (U.S. Bureau of Land Management 1993, 1994) has alleviated some of these problems. However, this process tends to focus on habitat within the stream banks and does not adequately address vegetation in the flood plain where riparian habitats occur. And, there is no unifying effort to compile the various inventories that have been completed.

SOLUTIONS

Several tools are available to assist with management of Utah riparian areas for birds (see Gardner et al. 1999 and Species accounts in this document), but proper management of our riparian areas depends on knowing where these areas are, what condition they are in, and how they relate geographically to each other and to other important habitats.

Completing a useful statewide riparian inventory will require the cooperation of many federal and state agencies as well as private nongovernmental organizations (e.g., The Nature Conservancy - TNC). We recommend the formation of a Riparian Inventory Task Force to be jointly headed by the USFS and BLM (the two agencies that have been most active in riparian inventory and assessment). The Task Force should also include representatives from UDWR, USFWS, BOR, COE, TNC, NPS, and other interested parties.

The Task Force should first assess what has been and what is being done to inventory riparian habitats in Utah. They should also determine how best to standardize methods and combine efforts. They should compile all existing inventory information and determine what inventory needs remain (needs assessment).

Riparian inventories will need to be completed at two different scales, the landscape scale and the site scale. Inventory at the landscape scale will most likely require remote sensing capable of identifying riparian habitats. Unfortunately, existing coverages such as GAP, do not effectively identify narrow, linear habitats such as riparian. The best approach would be similar to the National Wetlands Inventory (NWI) which uses aerial photography to identify, classify, and delineate different types of Wetlands. The landscape-scale inventory will illustrate how much riparian habitat exists in the state and how it is distributed. It will also provide some information on Species composition and condition of habitats and help direct site-level inventory efforts. However, more accurate information on riparian composition, structure, and condition will need to come from site-level inventories.

Site-scale inventories are needed to assess where riparian restoration is needed and what level of effort will be required for habitat restoration. This level of information will be required for effective bird management. We recommend a PFC-like approach that will assess riparian habitats within the flood plain. This will require the coordination of the Task Force to insure that all data are comparable and that inventory efforts focus on the areas with the greatest need first.

The USFWS has proposed a National Riparian Inventory (NRI) similar to NWI, but this program has not progressed. If the NRI progresses, Utah should make every effort to encourage the NRI to complete the Utah inventory first. This might include offering financial and technical assistance, office space, or in-kind support. This could be facilitated by the interagency Task Force.

In addition to functioning as bird habitat, riparian areas also serve many other vital functions and are a critical and valuable natural resource. While a two-scale statewide riparian inventory will require a concerted multi-agency effort, such an effort is essential to the proper management of Utah's rarest habitats.

UTAH AVIAN CONSERVATION STRATEGY IMPLEMENTATION

Among wildlife, birds have a unique relationship with humans. Partly due to their unique status in our society, and their unique life history traits, there is a sense of importance, and urgency to some degree, in striving to conserve birds for present and future generations. In fact, avian conservation is now implemented in such a way as to provide an "umbrella" for conservation of other forms of wildlife and their habitats within a much broader perspective than has been considered in the past.

Utah is quickly becoming a birder's destination, and the level of participation in bird-related recreation is a strong indicator of the value that society places on its avian resources. Nature-based recreation is the fastest growing segment of the tourism industry, increasing approximately 30% annually since 1987. Over 70% (160 million) of Americans spent $29.2 billion in 1996 to observe, photograph, or feed wildlife (an increase of 39% over the previous 5 years). If wildlife-watching were a corporation, it would rank 23 on the *Fortune 500* list of indicators.

A high proportion of nature-based tourism includes birds and birding-related activities. Birding is growing faster than biking, pleasure walking, skiing, and golf among outdoor recreation activities. In 1997 it was estimated that 63 million people participated in birding activities, an increase of 200% from 21 million in 1982-83. Approximately $20 billion/year is spent by birders. Results of a 1991 survey revealed that at least 24.7 million people traveled away from their homes to participate in birding activities and spent $5.2 billion in goods and services in doing so.

These are just a few examples to illustrate the actual and potential economic benefits of birds and their conservation. On the other hand, there is potential for even greater costs of failing to conserve birds. Whenever avian populations decline to the point of being considered as threatened or endangered, conservation costs escalate tremendously. For example, in 1995, $18.5 million was spent on the conservation and recovery of the northern spotted owl, $15.7 million on the marbled murrelet, $8.3 million on the red-cockaded woodpecker, and $6.4 million on the bald eagle.

Further, birds are integral parts of the landscape and provide important, sometimes irreplaceable roles, which end up costing society tremendously when lost or diminished. Birds are important pollinators for numerous Species of plants, they are efficient seed dispersers, and birds play a substantial role in insect pest control. Insects and pathogens cause greater forest losses than any other cause, including fire. Studies have show repeatedly that insect-eating birds can reduce up to half the number of insects impacting various tree Species which serve to enhance tree growth and produces greater biomass. The projected loss of forest land is 28 million acres by 2040, and during that same time period it is estimated that consumption will increase by 40%. Addressing both scarcity and overabundance post substantial challenges for conservation today.

No landbird Species are eminently threatened with extirpation in Utah at present. Utah populations of the Yellow-billed Cuckoo and Ferruginous Hawk, for example, are presently unknown in terms of relative abundance, current use areas, more specific habitat and overall natural resource requirements, and other aspects of the life histories for UPIF Priority Species should be considered in developing initial conservation goals and implementation. Without question, habitat degradation, particularly for Riparian and Shrubland habitats, poses a real threat to numerous Species of Utah birds, and conservation action to reverse Riparian and Shrubland degradation should be given top priority.

Conservation considerations for landbirds should generally be framed within a landscape context. However, conservation, and conservation action, are ultimately local in perspective. Federal and state agencies within Utah are most knowledgeable about local conditions, needs, and opportunities, and are also most empowered by successful conservation activities within the state. Implementation should therefore be considered in terms of continuing existing inter-agency partnerships and also creating new partnerships that can continue to provide cost-effective management actions and conservation strategies for Utah's birds.

An initial task should be to develop habitat-specific objectives, and to implement those objectives through a coordinated effort involving broad-scale monitoring schemes, formal power analyses to guide efforts across taxa and Physiographic Regions, management plans, critical lands assessments, and objectives for designating Important Bird Areas (IBAs) and Bird Conservation Areas (BCAs) in Utah. Implementation and evaluation of conservation actions and monitoring strategies should strongly consider incorporating a rigorous statistical framework and analysis in conservation planning efforts. There is also a need to incorporate new information into a form that is understandable and "user friendly" for land managers and planners. Information on distribution and habitat requirements of landbirds should be incorporated into land-use planning decisions. Lastly, creating a greater awareness in the general public concerning the complex natural history of Utah's landbirds and the net cost-benefit to the quality of life from conservation actions is critical.

GOALS AND OBJECTIVES

The Utah Avian Conservation Strategy has resulted from an effective "partnership" involving State and Federal natural resources management agencies, academic faculty, and private organizations. It is strongly recommended, and indeed deemed critical, that this partnership continue and new partnerships be formed to facilitate implementation of the recommendations provided in this document.

The Utah Partners in Flight Principles are listed on Page 4 of this document. Principle 1 reflects the mandate that State and Federal natural resource organizations are required to comply with. Protection and conservation of bird populations in Utah is thus not an option but a requirement. Effective management that ensures avian conservation in Utah not only reflects proper adherence to directives but also a stewardship ethic that ultimately reflects on quality of life. Principle 6 reflects on quality of life issues, including economic, recreational, scientific, education, and aesthetic values for society.

Principles 2 - 5 are taken as a set of initial goals for implementation of UTACS. In setting objectives for each of these goals, we feel that the mandates and quality of life issues reflected in Principles 1 and 6 will also be met. Addressed individually or as a whole, affecting implementation of UTACS in this manner will ensure meaningful and long-term conservation of Utah's avian resources.

UTACS GOAL 1 — INCORPORATE UTACS RECOMMENDATIONS INTO RESOURCE MANAGEMENT PLANS

Objective 1.1 — Amend/Revise Appropriate Land Management Guidance and Policy Documents for Federal lands

Objective 1.1.1 — U. S. Bureau of Land Management Resource District Conservation Plans

Objective 1.1.2 — U. S. Forest Service Forest Plans

Objective 1.1.3 — Tribal Management Plans

Objective 1.1.3.1—Tribal Council Directives

Objective 1.1.3.2—Tribal Wildlife Agency Directives

Objective 1.1.4 — National Park Service

Objective 1.1.5 — U. S. Fish and Wildlife Service

Objective 1.1.6 — U.S. Department of Defense Integrated Natural Resources Management Plans

Objective 1.1.7—Other Federal Land Owners and Wildlife Managers

Objective 1.2 — Amend/Revise Appropriate Land Management Guidance and Policy Documents for State Lands

Objective 1.2.1 — Utah Division of Wildlife Resources
Objective 1.2.2 — Utah Division of Parks and Recreation
Objective 1.2.3 — Utah Division of Forestry, Fire, and State Lands
Objective 1.2.4 — Utah Division of Oil, Gas, and Mining
Objective 1.2.4 — Other State Landowners and Managers

Objective 1.3 — Amend/Revise Appropriate Land Management Guidance and Policy Documents for Private Lands

Objective 1.3.1 — Natural Resources Conservation Service
Objective 1.3.2 — Soil Conservation Service
Objective 1.3.3 — Utah Farm Bureau
Objective 1.3.3 — Extension Services

UTACS GOAL 2 —— EVALUATE AND ASSESS AFFECTS OF HABITAT ALTERATION ACTIVITIES AND PROJECTS

Objective 2.1 —— Evaluate (Predict) Impacts to Priority Species and Habitats
Objective 2.2 —Assess (Monitor) Impacts (Pre- and Post-Conditions)
Objective 2.2.1 — Assess (Monitor) Impacts (Pre- and Post-Conditions) to Birds
Objective 2.2.2 — Assess (Monitor) Impacts (Pre- and Post-Conditions) to Habitat
Objective 2.2.3 — Incorporate Findings into Future Decisions
Objective 2.2.4 —Incorporate Conservation Recommendations into Evaluation Process

UTACS GOAL 3 —— ESTABLISH AND ADDRESS CONSERVATION NEEDS FOR UPIF PRIORITY SPECIES

Objective 3.1 — Identify priority birds and habitats in Utah for conservation action
Objective 3.2 —Carry Out Implementation Recommendations for Each Priority Species
Objective 3.3 —Conduct Recommended Research for Each Priority Species
Objective 3.4 — Revise the Utah Avian Conservation Strategy Every 5 Years
Objective 3.4.1 — Reevaluate Management Recommendations Every 5 Years
Objective 3.4.2 — Reevaluate Whenever Major Change Occurs

UTACS GOAL 4 —— ESTABLISH LONG-TERM PARTNERSHIPS

Objective 4.1 — Continue Existing partnerships within Utah Partners in Flight to Facilitate Avian Species Management In Utah
Objective 4.2 —Strengthen Existing Partnerships Through Implementation of the Utah Avian Conservation Strategy Recommendations for Management, Research, Monitoring, and Outreach
Objective 4.3 — Expand Partnerships by Incorporating Other Interested Agencies, Organizations, and Interested Parties
Objective 4.3.1 — Actively Seek Funding and Support From Agencies, Private Organizations, and the General Public

North American Bird Conservation Initiative (NABCI)

Since the initial publication of a draft form of this document in 1999, the North American Bird Conservation Initiative (NABCI) has been formed. The initiative is stated to exist to facilitate the conservation of North American birds by increasing the effectiveness of existing and new initiatives, enhancing coordination, and fostering greater cooperation among nations and peoples of the continent.

Toward this end, NABCI to date has informally attempted to combine the conservation actions either proposed or underway involving the major bird conservation programs, Partners in Flight (PIF), the North American Waterfowl Management Plan (NAWMP), the United States Shorebird Conservation Plan (USSCP), the North American Colonial Waterbird Conservation Plan (NACWCP), and the Important Bird Areas (IBA) program. The primary purposes of NABCI are to 1) help broaden bird conservation partnerships, 2) increase financial resources available for bird conservation in the U.S., and 3) enhance the effectiveness of those resources and partnerships by facilitating integrated bird conservation.

Toward this end, Bird Conservation Regions (BCRs) were created for the purposes of 1) facilitating communication among bird conservation initiatives, 2) systematically and scientifically apportioning the U. S. into conservation units, 3) facilitate a regional approach to bird conservation, 4) promote new, expanded, or restructured partnerships, and 5) identify overlapping or conflicting conservation priorities. Utah contains a portion of just two BCRs, the Great Basin (BCR 9), and the Southern Rockies/Colorado Plateau (BCR 16) covering approximately the eastern two-thirds of the state (Figure 29). For Utah, BCR 16 essentially combined three of the five Physiographic Regions described earlier in this document into a single land area, and BCR 9 combined two of the five into a single land area (see Figure 1 and Figure 30). Utah also contains a very small portion of the Rocky Mountains (BCR 10) and the Sonoran and Mojave Desert (BCR 33) areas as well (NABCI 2000).

Each BCR has been subdivided into more discrete habitat units for purposes of establishing Bird Conservation Areas (BCAs) to facilitate setting and meeting initial habitat and bird Species goals and objectives. In a joint effort, the U. S. Forest Service (USFS), U. S. Environmental Protection Agency (USEPA), the Natural Resources Conservation Service (NRCS), and the Bureau of Land Management (BLM) have identified a total of 13 areas of importance for management considerations statewide (Figure 30). These areas of importance have been adopted for use with UTACS to serve as Bird Conservation Areas.

Recommendation Summary Matrix

Table 15 summarizes the management recommendations for each of Utah’s priority habitats and priority avian Species identified in this Strategy. This table is meant to compliment, not replace, the individual Species accounts found in the Utah Bird Species Most in Need of Conservation section. In this table, recommendations are grouped by priority habitat type; so, all priority Species which use the same primary or secondary breeding habitat are listed together. We highly recommend reading the individual Species accounts for detailed descriptions of management recommendations and habitat requirements.

The recommendations for each of the identified Species and habitats are the result of input from a variety of knowledgeable individuals with considerable expertise with both the priority Species and priority habitats. Of course, conservation or management actions recommended in this table would also benefit a variety of other avian Species and other forms of wildlife, many of which have been noted in the individual Species accounts above.

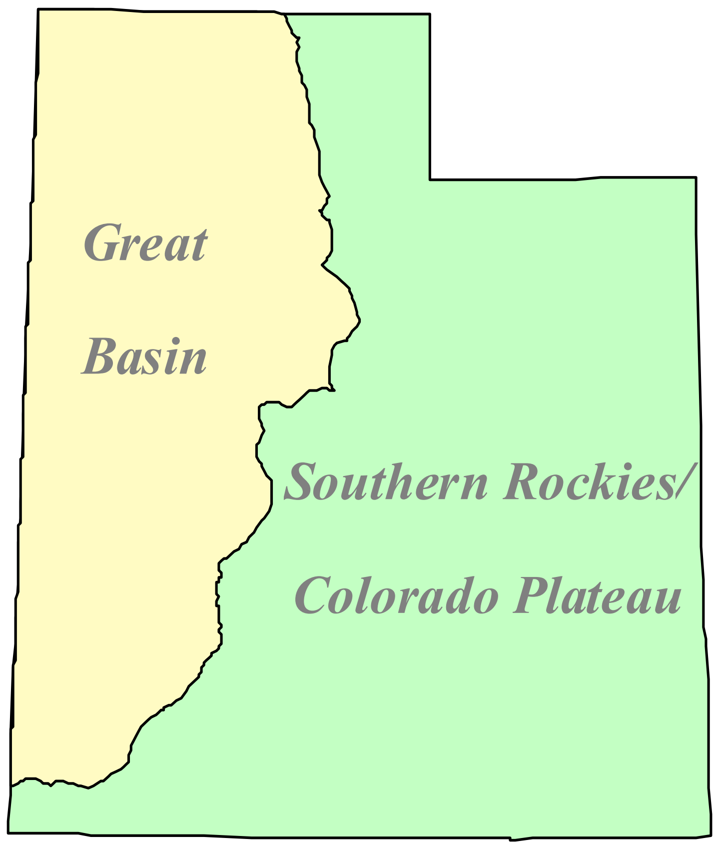


Figure 29. The Utah Bird Conservation Regions

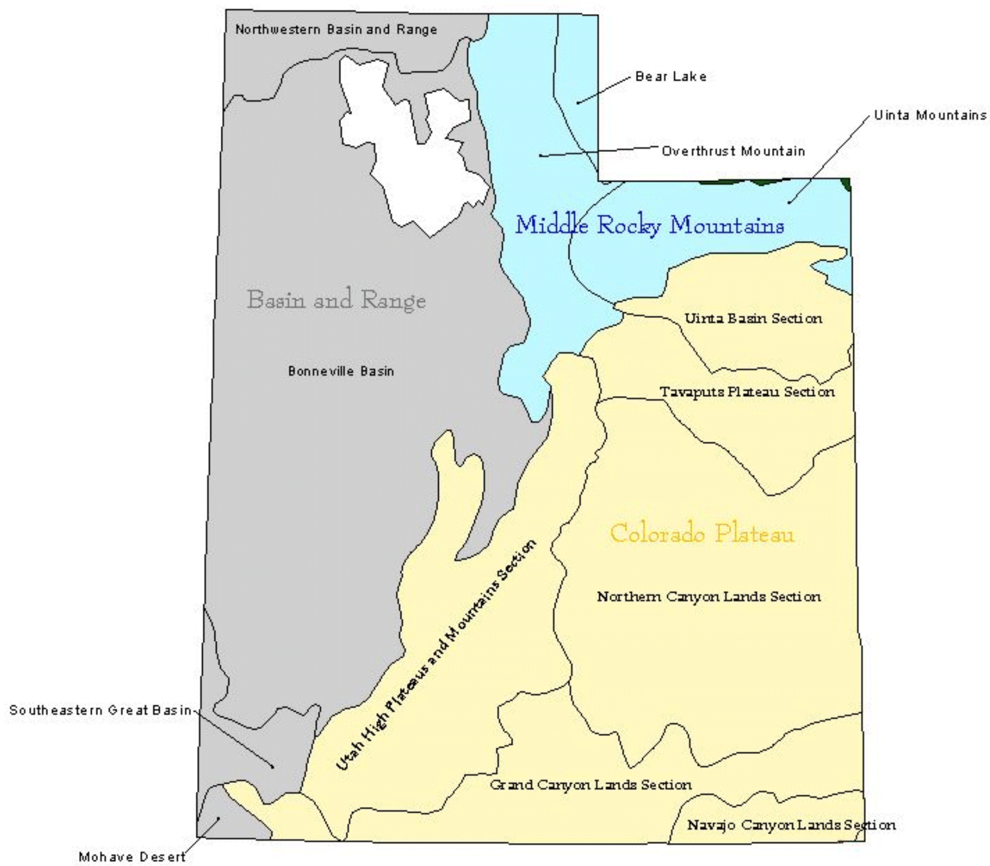


Figure 30. The Utah Bird Conservation Areas

Table 15. Management Recommendations Summary for Utah Partners in Flight Priority Species and Habitats[1].

<table>
<tr><th>SPECIES</th><th>CONSERVATION ISSUE</th><th>CONSERVATION RECOMMENDATION</th></tr>
<tr><td colspan="3">ALPINE HABITAT</td></tr>
<tr><td>Black Rosy-Finch</td><td>Roosting Sites</td><td>1. Determine if abandoned mine shafts are traditional roost site before mines are sealed or collapsed.
2. Determine extent of roosting use near human populations areas.
3. Determine extent and use regularity of winter roosts that may be in human reconstructions that risk being destroyed.</td></tr>
<tr><td colspan="3">GRASSLAND HABITAT</td></tr>
<tr><td rowspan="3">Bobolink</td><td>Habitat Loss and Fragmentation</td><td>1. Manage for contiguous patches (patch size of 10-30 ha) of suitable Wet Meadow, wet Grassland, or wet hay field habitats. Blocks of habitat consisting of 4 or more contiguous patches located within 5 km of each other should be established.
2. Cowbird parasitism should be controlled through maintenance and reestablishment of large, contiguous blocks of Wet Meadow habitat and reduction of habitat fragmentation.</td></tr>
<tr><td>Agricultural Impacts</td><td>1. Delay hay cutting of suitable patches until mid July. Cutting on a 1-2 year rotation will help to maintain habitat suitability.
2. Discourage heavy grazing of suitable habitats. Grazing should be timed to avoid the nesting season (early May though mid July) and may be used to maintain suitable habitats.</td></tr>
<tr><td>Pesticide Use</td><td>1. Avoid broad-scale use of pesticides during the nesting and brood-rearing season (mid-May through July).
2. If used, avoid persistent pesticides and those with high Bioaccumulation potential.
3. Avoid use of pesticides in years of low food abundance.</td></tr>
<tr><td rowspan="2">Long-billed Curlew</td><td>Habitat loss</td><td>1. Restrict development on Long-billed Curlew breeding habitat on the eastern shores of the Great Salt Lake. Managing upland habitats associated with Wetlands is important in breeding shorebird conservation.</td></tr>
<tr><td>Predation by red fox</td><td>1. Fragmentation and loss of adjacent uplands have provided predators with travel corridors where predation of ground-nesting birds can be high. The use of predator barriers, such as electric fences, is important in reducing nest loss (Helmers 1992).</td></tr>
<tr><td>Sharp-tailed Grouse</td><td>Habitat Loss, Fragmentation, and Degradation</td><td>1. Monitor and maintain records of locations of all leks and make maps of leks available to land management agencies for use in environmental evaluations of proposed management activities.
2. Vegetation manipulation within a breeding complex (lek and nesting areas within a 1.24 mile radius of the lek) should be avoided.
3. Prohibit physical, mechanical and audible disturbances within the breeding complex during the breeding season (Mar-Jun), if they might impact courtship activities and breeding during the daily display period (within 3 hours of sunrise and sunset).
4. Avoid manipulation or alteration of vegetation within the breeding complex during the nesting period (May-Jun). Management practices should not reduce height, canopy cover, or density of chokecherry, snowberry, sagebrush, serviceberry or other shrub Species important for nesting.
5. No vegetation manipulation or disturbance that results in loss of deciduous tree and shrub height, canopy cover and density should occur within 100 m (328 ft) of streams, including seasonally dry and intermittent secondary drainages. Cottonwoods (Populus spp.), willows and deciduous shrubs in riparian areas should be protected and maintained. Livestock use of riparian areas should be managed or eliminated to minimize destruction of associated shrubs and trees.</td></tr>
</table>

SPECIES	CONSERVATION ISSUE	CONSERVATION RECOMMENDATION
GRASSLAND HABITAT (cont'd)		
Sharp-tailed Grouse (cont'd)	*Habitat Loss, Fragmentation, and Degradation (cont'd)*	6. Manipulation or disturbance of vegetation, including pesticide application, burning or mechanical destruction that results in long-term (>5 year) or permanent reduction of height, canopy cover, or density of Mountain Shrub habitats within occupied ranges should be avoided if shrubs comprise <10% of the cover within occupied areas. Management practices to rejuvenate or increase Mountain Shrub communities within breeding complexes or winter ranges should be restricted to #25% of this cover type annually.
	Physical Disturbance	1. Minimize research and data collection that negatively impacts Sharp-tailed Grouse. 2. Remove unused overhead utility lines and fences. 3. Reduce speeds on roadways in high use Sharp-tailed Grouse areas. 4. Manage impacts from motorcycles, mountain bikes, OHVs and other mechanical or motorized vehicles. 5. Manage recreational hunting opportunity. 6. Deter poaching. 7. Conduct predator control where necessary. 8. Manage recreational bird watching activities. 9. Avoid disturbance which impairs the "acoustical component" of breeding displays in the spring.
Ferruginous Hawk	*Habitat Conversion*	13. Discourage clearing of juniper woodlots and sagebrush shrublands. 14. Encourage maintenance of native Grasslands for cattle grazing where prey populations may be maintained.
	Prey Base Conservation	1. Encourage change in attitude towards jackrabbits and their wanton killing.
	Artificial Habitat Enhancement and Reduction of Industrial Activities	1. Where nesting trees have been removed near good foraging lands, erect artificial nesting platforms. 2. Encourage adequate buffer zones around nests in areas of land development (oil, mining etc.). 3. Increase public awareness of conservation issues in areas of development.
Mountain Plover	*Habitat Loss*	1. Create a buffer zone around the breeding concentration areas on the Myton Bench and restrict any further development. This restriction would involve an area of approximately two sections (1280 acres). 2. As cited in Knopf 1996: Grasslands have been burned to attract Mountain Plovers both on wintering grounds (Knopf and Rupert 1995) and breeding grounds (FLK). 3. New construction for gas and oil exploration, wind-power development, and water well drilling should be restricted from 1 Apr to 30 Jun at key locales in Colorado, Utah, and Wyoming.
HIGH DESERT SCRUB HABITAT		
Ferruginous Hawk	*Habitat Conversion*	1. Discourage clearing of juniper woodlots and sagebrush shrublands. 2. Encourage maintenance of native Grasslands for cattle grazing where prey populations may be maintained.
	Prey Base Conservation	1. Encourage change in attitude towards jackrabbits and their wanton killing.
	Artificial Habitat Enhancement and Reduction of Industrial Activities	1. Where nesting trees have been removed near good foraging lands, erect artificial nesting platforms. 2. Encourage adequate buffer zones around nests in areas of land development (oil, mining etc.). 3. Increase public awareness of conservation issues in areas of development.

SPECIES	CONSERVATION ISSUE	CONSERVATION RECOMMENDATION
HIGH DESERT SCRUB HABITAT (Cont'd)		
Brewer's Sparrow and Sage Sparrow	*Habitat Loss and Fragmentation*	1. Establish a "no net loss" policy for Shrubsteppe and High Desert Scrub (sagebrush and sagebrush plus grass) habitats. 2. Maintain or modify existing grazing regimes to promote growth of native shrubs and grasses. Temporarily remove grazing from degraded habitats and habitats recovering from fire or other detrimental factors. 3. Promote use of grazing to reduce cheatgrass dominance and prepare areas for native grass and shrub reseedings. 4. Promote reestablishment of native Shrubsteppe and High Desert Scrub habitats through the use of prescribed fire and revegetation. Burns should be timed to promote growth of native grasses, minimize loss of sagebrush, and minimize establishment/regrowth of exotic annuals; revegetation should promote native grass and shrub reestablishment. 5. Avoid road and right-of-way construction in large, contiguous patches of Shrubsteppe and High Desert Scrub habitat. Construction footprints should be minimized and all rights-of-way should be revegetated with native grasses and shrubs. 6. Manage large blocks of land for contiguous Shrubsteppe and High Desert Scrub habitat and avoid activities that cause fragmentation. Revegetate old roads and other disturbance corridors to native grasses and shrubs. 7. Avoid conversion of existing Shrubsteppe and High Desert Scrub habitats to croplands, urban areas, etc.. Maintain or reestablish native Grassland/shrubland open spaces in urbanized areas.
	Habitat Loss and Fragmentation	1. Monitor all revegetation efforts for success and enhance areas with poor native plant reestablishment. 2. Establish economic and reliable sources of native seeds for revegetation efforts and stockpile native seeds whenever possible. 3. Eliminate large-scale chaining and chemical control of Shrubsteppe and High Desert Scrub habitats and eliminate large scale establishment of nonnative grasses in disturbed areas. 4. Use small-scale chemical and mechanical control methods to enhance Brewer's Sparrow habitats.
	Fire Management and Exotic Plant Invasion	1. Promote use of prescribed burning and revegetation to avoid catastrophic wildfires. 2. Post-wildfire revegetation should focus on reestablishment of native grasses and shrubs, avoid use of nonnative and aggressive Species and strive to exclude cheatgrass. 3. Use green-stripping, if necessary, to prevent stand-replacing fires in high quality Shrubsteppe and High Desert Scrub patches.
	Brown-headed Cowbird Parasitism	1. Cowbird parasitism should be controlled through maintenance and reestablishment of large, contiguous blocks of Shrubsteppe and High Desert Scrub habitat and reduction of habitat fragmentation.
	Pesticide Use	1. Avoid broad-scale use of pesticides during the nesting and brood-rearing season (mid-May through July). 2. If used, avoid persistent pesticides and those with High Bioaccumulation potential. 3. Avoid use of pesticides in years of low food abundance.
LOW DESERT SCRUB		
Gambel's Quail	*Habitat Loss*	1. Discourage the clearing of riparian habitat.
	Livestock Grazing	1. Manage grazing practices to promote the growth of native grasses and forbs.
Lucy's Warbler	*Habitat Loss*	1. Discourage the clearing of large tracts of habitat. 2. Encourage natural and xeric landscaping developments. 3. Encourage plots of natural habitat within and surrounding golf courses.
	Livestock Grazing	1. Manage grazing practices to maintain shrub habitat.

SPECIES	CONSERVATION ISSUE	CONSERVATION RECOMMENDATION
LOWLAND RIPARIAN HABITAT		
Abert's Towhee	*Habitat Loss*	1. Discourage the clearing of riparian (native and nonnative) habitat. 2. Encourage the replacement of salt cedar with native cottonwood-willow vegetation.
	Livestock Grazing	1. Manage grazing practices to promote the growth of native riparian vegetation and reduce grazing impacts during the nesting season.
	Brown-headed Cowbird Parasitism	1. Restrict livestock grazing in riparian habitats from April through July nesting season.
Bell's Vireo	*Habitat Loss*	1. Discourage the clearing of riparian (native and nonnative) habitat. 2. Encourage the replacement of salt cedar with native cottonwood-willow vegetation.
	Livestock Grazing	1. Manage grazing practices to promote the growth of native riparian vegetation and reduce grazing impacts during the nesting season.
	Brown-headed Cowbird Parasitism	1. Restrict livestock grazing in riparian habitats from April through July nesting season.
Black Swift	*Habitat Loss and Modification*	1. Protect flow to all permanent waterfalls in the state. 2. Restore flows to intermittent or dry waterfalls that were historically permanent. 3. Maintain or restore pristine water quality to all streams above waterfalls. 4. Protect, enhance, and restore habitats in and adjacent to streams which create waterfalls. 5. Protect Black Swift nesting areas from disturbance by humans and predators.
	Lack of Habitat	1. Create artificial waterfalls where conditions are feasible and suitable for Black Swift colonization. 2. Enhance existing waterfalls that lack the ecological requirements for Black Swift nesting (e.g., create nesting pockets).
	Pesticide Use	1. Avoid use of pesticides in Mountain Riparian habitats and areas adjacent to riparian areas. 2. Avoid use of persistent and bioaccumulating pesticides within 10 mi (16 km) of known Black Swift nesting sites.
	Human Disturbance	1. Eliminate intense and repeated human disturbance of nesting areas from 1 June through 15 September.
Black-throated Gray Warbler	*Habitat Loss/Alteration*	1. Survey target areas for Black-throated Gray Warblers prior to initiating habitat alteration activities 2. Discourage clearing of large mature tracts of habitat 3. Encourage small-scale opening of habitat and maintain overstory trees 4. Avoid use of herbicides and insecticides in areas used by Black-throated Gray Warbler for nesting.
	Livestock Grazing	1. Grazing in areas of High Black-throated Gray Warbler concentration should not be allowed until after 31 July.
Broad-tailed Hummingbird	*Habitat Loss/Alteration*	1. Survey target areas for Broad-tailed Hummingbirds prior to initiating habitat alteration activities 2. Produce landscape scale mosaics of altered and unaltered habitat 3. Prevent invasion of exotic plants 4. Select native seed mixes for revegetation actions 5. Provide some open patches adjacent to or within wooded areas 6. Avoid use of herbicides and insecticides in areas used by Broad-tailed Hummingbirds for nesting and foraging

SPECIES	CONSERVATION ISSUE	CONSERVATION RECOMMENDATION
LOWLAND RIPARIAN HABITAT (cont'd)		
Broad-tailed Hummingbird (cont'd)	*Fire*	1. Limit controlled burns to occur after August 1 2. Use controlled burns that do not promote establishment of cheatgrass monocultures in existing or potential habitats for nesting Broadtails. 3. Create openings and maintain wildflower density in the landscape
	Livestock Grazing	1. Grazing in areas of High Broad-tailed Hummingbird concentration should not be allowed until after 1 August 2. Manage grazing practices (allotments) so as to not reduce density of wildflowers in areas used for nesting and foraging by Broadtails
Gambel's Quail	*Habitat Loss*	1. Discourage the clearing of riparian habitat.
	Livestock Grazing	1. Manage grazing practices to promote the growth of native grasses and forbs.
Lewis's Woodpecker	*Habitat Loss*	1. Encourage leaving tall trees in burned over areas.
	Overgrazing by Livestock	1. Manage grazing practices to maintain understory vegetation. 2. Manage grazing practices to maintain riparian habitats with all stages of plant development, with predominantly mature plants (cottonwoods).
Lucy's Warbler	*Overgrazing by Livestock*	1. Manage grazing practices to maintain shrub habitat. 2. Manage grazing practices to maintain riparian habitats with all stages of plant development, with predominantly mature plants.
Sage-Grouse	*Habitat Quality*	1. Enhance and protect existing riparian areas to benefit Sage-grouse production and chick survival.
	Habitat Loss and Fragmentation	1. Enhance existing riparian areas to benefit Sage-grouse production and chick survival by creating incentives for private landowners and developers so that riparian areas remain undeveloped. 2. Enhance existing riparian areas to benefit Sage-grouse reproduction and chick survival by restoring and rehabilitating riparian areas impacted or lost from water developments, recreation, power lines, utility corridors and roads.
Sharp-tailed Grouse	*Habitat Loss, Fragmentation, and Degradation*	1. No vegetation manipulation or disturbance that results in loss of deciduous tree and shrub height, canopy cover and density should occur within 328.08 feet of streams, including seasonally dry and intermittent secondary drainages. Cottonwoods (*Populus* spp.), willows and deciduous shrubs in riparian areas should be protected and maintained. Livestock use of riparian areas should be managed or eliminated to minimize destruction of associated shrubs and trees.
Yellow-billed Cuckoo	*Habitat Loss and Modification*	1. Establish a "no net loss" policy for riparian habitats. 2. Eliminate destruction of existing native cottonwood-willow dominated riparian forests (Patten 1998) and restore riparian habitats where possible. 3. Eliminate loss of dense shrub layers in existing riparian areas and restore shrub layers where absent. 4. Encourage the use of buffer zones to insure connectivity between riparian habitats and adjacent uplands. 5. Establish corridors between patches of suitable habitat. 6. Manage for large, contiguous blocks of habitat (>10 ha) in conjunction with removal of competing exotic Species (i.e., saltcedar) (Laymon and Halterman 1987). 7. Design developments, i.e., roads, trails, pipelines, housing, etc., to avoid or minimize impacts to riparian habitats. 8. Mitigate all riparian losses at 2:1 ratio.

SPECIES	CONSERVATION ISSUE	CONSERVATION RECOMMENDATION
LOWLAND RIPARIAN HABITAT (cont'd)		
Yellow-billed Cuckoo (cont'd)	*Lack of Habitat Recruitment* (cottonwood-willow forests)	1. Closely monitor grazing, recreational, and other impacts on cottonwood and willow seedlings in riparian systems and reduce or remove sources when seedlings are being impacted. 2. Initiate or maintain flow regimes that mimic natural flow regimes to allow accumulation of sediments and establishment of seedlings. 3. Reestablish proper function in streams and rivers that are not currently functioning properly. 4. Reestablish native vegetation with plantings and by promoting natural regeneration (>10 ha) (Laymon and Halterman 1987).
	Pesticide Use	1. Avoid use of pesticides in riparian habitats and adjacent areas. 2. If used, avoid drift and apply nonpersistent pesticides with low bioaccumulation potential.
	Demographics (low colonization potential due to fragmented breeding localities)	1. Establish riparian corridors and "stepping stone" habitats to allow dispersal and colonization of suitable habitats. 2. Focus efforts on areas with High potential for successful riparian restoration. 3. Establish High priority target areas near existing suitable habitat, particularly occupied areas, for restoration.
	Human Disturbance	1. Eliminate intense and repeated human disturbance of nesting areas from 20 May through 15 August.
MIXED CONIFER HABITAT		
Lewis's Woodpecker	*Habitat Loss*	1. Encourage leaving tall trees in burned over areas. 2. Encourage prescribed burns to open the understory of Ponderosa Pine and Mixed Conifer habitats.
	Overgrazing by Livestock	1. Manage grazing practices to maintain understory vegetation.
Black Swift	*Habitat Loss and Modification*	1. Protect flow to all permanent waterfalls in the state. 2. Restore flows to intermittent or dry waterfalls that were historically permanent. 3. Maintain or restore pristine water quality to all streams above waterfalls. 4. Protect, enhance, and restore habitats in and adjacent to streams which create waterfalls. 5. Protect Black Swift nesting areas from disturbance by humans and predators.
	Lack of Habitat	1. Create artificial waterfalls where conditions are feasible and suitable for Black Swift colonization. 2. Enhance existing waterfalls that lack the ecological requirements for Black Swift nesting (e.g., create nesting pockets).
	Pesticide Use	1. Avoid use of pesticides in and adjacent to riparian habitats. 2. Avoid use of persistent and bioaccumulating pesticides within 10 mi (16 km) of known Black Swift nesting sites.
	Human Disturbance	1. Eliminate intense and repeated human disturbance of nesting areas from 1 June through 15 September.
MOUNTAIN SHRUB HABITAT		
Sharp-tailed Grouse	*Habitat Loss, Fragmentation, and Degradation*	1. Manipulation or disturbance of vegetation, including pesticide application, burning or mechanical destruction that results in long-term (>5 year) or permanent reduction of height, canopy cover, or density of Mountain Shrub habitats within occupied ranges should be avoided if shrubs comprise <10% of the cover within occupied areas. Management practices to rejuvenate or increase Mountain Shrub communities within breeding complexes or winter ranges should be restricted to #25% of this cover type annually.

SPECIES	CONSERVATION ISSUE	CONSERVATION RECOMMENDATION
MOUNTAIN RIPARIAN		
Broad-tailed Hummingbird	*Habitat Loss/Alteration*	1. Survey target areas for Broad-tailed Hummingbirds prior to initiating habitat alteration activities 2. Produce landscape scale mosaics of altered and unaltered habitat 3. Prevent invasion of exotic plants 4. Select native seed mixes for revegetation actions 5. Provide some open patches adjacent to or within wooded areas 6. Avoid use of herbicides and insecticides in areas used by Broad-tailed Hummingbirds for nesting and foraging
	Fire	1. Limit controlled burns to occur after August 1 2. Use controlled burns that do not promote establishment of cheatgrass monocultures in existing or potential habitats for nesting Broadtails. 3. Create openings and maintain wildflower density in the landscape
	Livestock Grazing	1. Grazing in areas of High Broad-tailed Hummingbird concentration should not be allowed until after 1 August 2. Manage grazing practices (allotments) so as to not reduce density of wildflowers in areas used for nesting and foraging by Broadtails
Virginia's Warbler	*Habitat Loss/Alteration*	1. Survey target areas for Virginia's Warblers prior to initiating habitat alteration activities 2. Produce landscape scale mosaics of altered and unaltered habitat 3. Prevent invasion of exotic plants 4. Select native seed mixes for revegetation actions 5. Reduce harvest of Gambel oak for firewood 6. Avoid use of herbicides and insecticides in Virginia's Warbler nesting areas
	Fire	1. Limit controlled burns to occur after July 20 2. Use controlled burns that promote regeneration of shrubs and native understory grasses. 3. Create forest openings and maintain Gambel oak in the landscape.
	Livestock Grazing	1. Grazing in areas of High Virginia's Warbler concentration should not be allowed until after 20 July 2. Manage grazing practices (allotments) to maintain shrub component
PINYON/JUNIPER HABITAT		
Black-throated Gray Warbler	*Habitat Loss/Alteration*	1. Survey target areas for Black-throated Gray Warblers prior to initiating habitat alteration activities 2. Discourage clearing of large mature tracts of habitat 3. Encourage small-scale opening of habitat and maintain overstory trees 4. Avoid use of herbicides and insecticides in areas used by Black-throated Gray Warbler for nesting 5. Limit seasonal pinyon collection (May through July), and limit larger size pinyon collection overall. 6. Manage for Pinyon-Juniper forests with a 50%-to-50% pinyon to juniper ration or higher (higher pinyon percentage) and maintain at least a 15% canopy cover (15-25% canopy).
	Livestock Grazing	1. Grazing in areas of High Black-throated Gray Warbler concentration should not be allowed until after 31 July.
Ferruginous Hawk	*Habitat Conversion*	1. Discourage clearing of juniper woodlots and sagebrush shrublands. 2. Encourage maintenance of native Grasslands for cattle grazing where prey populations may be maintained.
	Prey Base Conservation	1. Encourage change in attitude towards jackrabbits and their wanton killing.

SPECIES	CONSERVATION ISSUE	CONSERVATION RECOMMENDATION
PINYON/JUNIPER HABITAT (Cont'd)		
Ferruginous Hawk (cont'd)	***Artificial Habitat Enhancement and Reduction of Industrial Activities***	1. Where nesting trees have been removed near good foraging lands, erect artificial nesting platforms. 2. Encourage adequate buffer zones around nests in areas of land development (oil, mining etc.). 3. Increase public awareness of conservation issues in areas of development.
Gray Vireo	*Habitat Loss/Alteration*	1. Inventory existing Pinyon-Juniper, juniper, and mixed brush (i.e., Pinyon-Juniper or juniper and big sagebrush or other shrubby Species) habitats, and classify by: (a) age-stand, (b) fire history (or lack of it), and (c) extent of infestation by exotic annual weeds. 2. Based on the above and combined with distributions of obligate or semi-obligate Species, determine manageable habitat units at landscape level (based on percent or size) with focus on Neotropical bird conservation. Initiate coordination and consultation with appropriate land managing agencies. 3. Within the units identified above, identify land management practices conducive with conservation and preservation of birds. 4. Develop cooperative management agreements or memoranda of understandings with appropriate agencies.
Virginia's Warbler	*Habitat Loss/Alteration*	1. Survey target areas for Virginia's Warblers prior to initiating habitat alteration activities 2. Produce landscape scale mosaics of altered and unaltered habitat 3. Prevent invasion of exotic plants 4. Select native seed mixes for revegetation actions 5. Reduce harvest of Gambel oak for firewood 6. Avoid use of herbicides and insecticides in areas used by Virginia's Warbler for nesting
	Fire	1. Limit controlled burns to occur after July 20 2. Use controlled burns that promote regeneration of shrubs and native understory grasses. 3. Create forest openings and maintain Gambel oak in the landscape.
	Livestock Grazing	1. Grazing in areas of High Virginia's Warbler concentration should not be allowed until after 20 July 2. Manage grazing practices (allotments) to maintain shrub component
PONDEROSA PINE HABITAT		
Lewis's Woodpecker	*Habitat Loss*	1. Encourage leaving tall trees in burned over areas. 2. Encourage prescribed burns to open the understory of Ponderosa Pine and Mixed Conifer habitats.
	Overgrazing by Livestock	1. Manage grazing practices to maintain understory vegetation.
SHRUBSTEPPE HABITAT		
Brewer's Sparrow and Sage Sparrow	*Habitat Loss and Fragmentation* *Habitat Loss and Fragmentation*	1. Establish a "no net loss" policy for Shrubsteppe and High Desert Scrub (sagebrush and sagebrush plus grass) habitats. 2. Maintain or modify existing grazing regimes to promote growth of native shrubs and grasses. Temporarily remove grazing from degraded habitats and habitats recovering from fire or other detrimental factors. 3. Promote use of grazing to reduce cheatgrass dominance and prepare areas for native grass and shrub reseedings. 4. Promote reestablishment of native Shrubsteppe and High Desert Scrub habitats through the use of prescribed fire and revegetation. Burns should be timed to promote growth of native grasses, minimize loss of sagebrush, and minimize establishment/regrowth of exotic annuals; revegetation should promote native grass and shrub reestablishment.

SPECIES	CONSERVATION ISSUE	CONSERVATION RECOMMENDATION
SHRUBSTEPPE HABITAT (Cont'd)		
Brewer's Sparrow and Sage Sparrow (cont'd)	*Habitat Loss and Fragmentation* *Habitat Loss and Fragmentation (cont'd)*	5. Avoid road and right-of-way construction in large, contiguous patches of Shrubsteppe and High Desert Scrub habitat. Construction footprints should be minimized and all rights-of-way should be revegetated with native grasses and shrubs. 6. Manage large blocks of land for contiguous Shrubsteppe and High Desert Scrub habitat and avoid activities that cause fragmentation. Revegetate old roads and other disturbance corridors to native grasses and shrubs. 7. Avoid conversion of existing Shrubsteppe and High Desert Scrub habitats to croplands, urban areas, etc.. Maintain or reestablish native Grassland/shrubland open spaces in urbanized areas. 8. Monitor all revegetation efforts for success and enhance areas with poor native plant reestablishment. 9. Establish economic and reliable sources of native seeds for revegetation efforts and stockpile native seeds whenever possible. 10. Eliminate large-scale chaining and chemical control of Shrubsteppe and High Desert Scrub habitats and eliminate large scale establishment of nonnative grasses in disturbed areas. 11. Use small-scale chemical and mechanical control methods to enhance Brewer's Sparrow habitats.
	Fire Management and Exotic Plant Invasion	1. Promote use of prescribed burning and revegetation to avoid catastrophic wildfires. 2. Post-wildfire revegetation should focus on reestablishment of native grasses and shrubs, avoid use of nonnative and aggressive Species and strive to exclude cheatgrass. 3. Use green-stripping, if necessary, to prevent stand-replacing fires in High quality Shrubsteppe and High Desert Scrub patches.
	Brown-headed Cowbird Parasitism	1. Cowbird parasitism should be controlled through maintenance and reestablishment of large, contiguous blocks of Shrubsteppe and High Desert Scrub habitat and reduction of habitat fragmentation.
	Pesticide Use	1. Avoid broad-scale use of pesticides during the nesting and brood-rearing season (mid-May through July). 2. If used, avoid persistent pesticides and those with High Bioaccumulation potential. 3. Avoid use of pesticides in years of low food abundance.
Ferruginous Hawk	*Habitat Conversion*	1. Discourage clearing of juniper woodlots and sagebrush shrublands. 2. Encourage maintenance of native Grasslands for cattle grazing where prey populations may be maintained.
	Prey Base Conservation	1. Encourage change in attitude towards jackrabbits and their wanton killing.
	Artificial Habitat Enhancement and Reduction of Industrial Activities	1. Where nesting trees have been removed near good foraging lands, erect artificial nesting platforms. 2. Encourage adequate buffer zones around nests in areas of land development (oil, mining etc.). 3. Increase public awareness of conservation issues in areas of development.

SPECIES	CONSERVATION ISSUE	CONSERVATION RECOMMENDATION
SHRUBSTEPPE HABITAT (Cont'd)		
Sage-Grouse	*Habitat Quality*	1. Enhance and protect existing riparian areas to benefit Sage-grouse production and chick survival. 2. Create, enhance and protect small ephemeral "wet areas" within nesting and brood-rearing habitats. 3. Manage growth of agricultural and urban development so as not to impact Sage-grouse habitats. 4. Manage existing and new overhead utility lines and other utility development and maintenance activities to remove impacts to Sage-grouse. 5. Manage roads by removing, realigning and reseeding as opportunities arise in important Sage-grouse habitats. 6. Suppress wildfires occurring in Sage-grouse habitats. 7. Eliminate or modify habitat components that facilitate predation on Sage-grouse. 8. Manage motorized and mechanical travel to minimize impacts to Sage-grouse. 9. Improve Sage-grouse habitat quality by planting/reseeding with a High proportion of forbs. 10. Selectively brush beat stands of sagebrush to lower age classes to create an age mosaic to improve habitats. 11. Increase spring residual herbaceous cover and height. 12. Enforce USFS/BLM grazing allotment plans and regulations. 13. Adjust livestock management during drought to promote grass, forb and soil health in Sage-grouse habitats. 14. Prohibit land treatments known to be negative for Sage-grouse. 15. Manage big game populations so their grazing/browsing does not impact Sage-grouse habitats. 16. Manage the use of pesticides so as not to impact Sage-grouse or their habitats.
	Habitat Loss and Fragmentation	1. Preserve Sage-grouse winter habitats--"no net loss." 2. Enhance existing riparian areas to benefit Sage-grouse production and chick survival by creating incentives for private landowners and developers so that riparian areas remain undeveloped. 3. Enhance existing riparian areas to benefit Sage-grouse reproduction and chick survival by restoring and rehabilitating riparian areas impacted or lost from water developments, recreation, power lines, utility corridors and roads. 4. Prevent habitat loss and fragmentation. 5. Mitigate habitat loss and fragmentation. 6. Many of the same recommendations made in the Habitat Quality section above apply here as well.
	Physical Disturbance	1. Minimize research and data collection that negatively impacts Sage-grouse. 2. Remove unused overhead utility lines and fences. 3. Reduce speeds on roadways in High use Sage-grouse areas. 4. Manage impacts from motorcycles, mountain bikes, OHVs and other mechanical or motorized vehicles. 5. Manage recreational hunting opportunity. 6. Deter poaching. 7. Conduct predator control where necessary. 8. Manage recreational bird watching activities. 9. Avoid disturbance which impairs the "acoustical component" of breeding displays in the spring.

SPECIES	CONSERVATION ISSUE	CONSERVATION RECOMMENDATION
SHRUBSTEPPE HABITAT (Cont'd)		
Sharp-tailed Grouse	*Habitat Loss, Fragmentation, and Degradation*	1. Monitor and maintain records of locations of all leks and make maps of leks available to land management agencies for use in environmental evaluations of proposed management activities. 2. Vegetation manipulation within a breeding complex (lek and nesting areas within a 1.24 mile radius of the lek) should be avoided. 3. Prohibit physical, mechanical and audible disturbances within the breeding complex during the breeding season (Mar-Jun), if they might impact courtship activities and breeding during the daily display period (within 3 hours of sunrise and sunset). 4. Avoid manipulation or alteration of vegetation within the breeding complex during the nesting period (May-Jun). Management practices should not reduce height, canopy cover, or density of chokecherry, snowberry, sagebrush, serviceberry or other shrub Species important for nesting. 5. No vegetation manipulation or disturbance that results in loss of deciduous tree and shrub height, canopy cover and density should occur within 328.08 feet of streams, including seasonally dry and intermittent secondary drainages. Cottonwoods (*Populus* spp.), willows and deciduous shrubs in riparian areas should be protected and maintained. Livestock use of riparian areas should be managed or eliminated to minimize destruction of associated shrubs and trees. 6. Manipulation or disturbance of vegetation, including pesticide application, burning or mechanical destruction that results in long-term (>5 year) or permanent reduction of height, canopy cover, or density of Mountain Shrub habitats within occupied ranges should be avoided if shrubs comprise <10% of the cover within occupied areas. Management practices to rejuvenate or increase Mountain Shrub communities within breeding complexes or winter ranges should be restricted to #25% of this cover type annually.
	Physical Disturbance	1. Minimize research and data collection that negatively impacts Sharp-tailed Grouse. 2. Remove unused overhead utility lines and fences. 3. Reduce speeds on roadways in High use Sharp-tailed Grouse areas. 4. Manage impacts from motorcycles, mountain bikes, OHVs and other mechanical or motorized vehicles. 5. Manage recreational hunting opportunity. 6. Deter poaching. 7. Conduct predator control where necessary. 8. Manage recreational bird watching activities. 9. Avoid disturbance which impairs the "acoustical component" of breeding displays in the spring.

SPECIES	CONSERVATION ISSUE	CONSERVATION RECOMMENDATION
SUB-ALPINE CONIFER HABITAT		
Three-toed Woodpecker	*Habitat Loss*	1. Encourage leaving burned over areas intact for the first three to five years after a stand replacing fire. 2. In salvage areas leave clumps of snags rather than individual trees. 3. Snags with a majority of their bark present and trees with heartrot should be available. 4. Aspen should be maintained throughout the landscape to provide nesting sites. 5. Establish management areas (528 acres per pair in Lodgepole Pine habitats) where salvage logging or commercial harvest would not be permitted. 6. Select areas to become future management areas to insure habitat in the future. 7. Plan and implement a fire management plan that allows fires to burn in areas where acceptable to other resources. 8. Insect infestations should be interpreted in terms of a landscape scale rather than in terms of the loss of wood fiber on individual sites.
WATER HABITAT		
American White Pelican	*Habitat Loss*	1. Develop a sustainable water use plan for Bear River Bay. 2. Work with salt industries to eliminate, reduce or mitigate impacts to the Gunnison Island colony in the north arm and foraging sites in Bear River Bay. 3. Work with the Division of State Lands to protect American White Pelican habitats within state land holdings. 4. Work with Wetland managers within the greater Great Salt Lake ecosystem to manage for pelican habitat as part of their comprehensive management plans.
	Human Disturbance	1. Provide modification to the railroad causeway that allows for better Great Salt Lake brine distribution, but precludes boat travel into the north arm of the Great Salt Lake. 2. Maintain and enforce Division of Wildlife Resources rule restricting human disturbance of Gunnison and Bird Islands during the American White Pelican breeding season.
WET MEADOW HABITAT		
Bobolink	*Habitat Loss and Fragmentation*	1. Increase Wet Meadow habitats statewide by 50%. 2. Manage for contiguous patches (patch size of 10-30 ha) of suitable Wet Meadow, wet Grassland, or wet hay field habitats. Blocks of habitat consisting of 4 or more contiguous patches located within 5 km of each other should be established.
	Habitat Loss and Fragmentation (cont'd)	3. Design developments, i.e., roads, trails, pipelines, housing, etc., to avoid or minimize impacts to Wet Meadow habitats. 4. Cowbird parasitism should be controlled through maintenance and reestablishment of large, contiguous blocks of Wet Meadow habitat and reduction of habitat fragmentation.
	Agricultural Impacts	1. Delay hay cutting of suitable patches until mid July. Cutting on a 1-2 year rotation will help to maintain habitat suitability. 2. Discourage heavy grazing of suitable habitats. Grazing should be timed to avoid the nesting season (early May though mid July) and may be used to maintain suitable habitats.
	Pesticide Use	1. Avoid broad-scale use of pesticides during the nesting and brood-rearing season (mid-May through July). 2. If used, avoid persistent pesticides and those that bioaccumulate. 3. Avoid use of pesticides in years of low food abundance.

SPECIES	CONSERVATION ISSUE	CONSERVATION RECOMMENDATION
WETLAND HABITAT		
American Avocet	*Habitat Loss and Degradation*	1. Develop local and regional Wetland conservation plans with the cooperation of local government, resource managers, and landowners.
	Contaminants	1. Require contaminant discharges to provide mitigation habitat targeted for American Avocets and other shorebirds.
	Habitat Distribution	1. Consider large-scale habitat connectivity strategies for Great Basin Wetland ecosystems. 2. Conduct long-term monitoring of American Avocet breeding, migrating, and wintering populations.
	Setting Management Priorities	1. Develop an organization dedicated to establishing regional and local priorities based upon the potential contribution of different areas to global biodiversity .
Black-necked Stilt	*Habitat Loss and Degradation*	1. Develop local and regional Wetland conservation plans with the cooperation of local government, resource managers, and landowners.
	Contaminants	1. Require contaminant discharges to provide mitigation habitat targeted for Black-necked Stilts and other shorebirds.
	Habitat Distribution and Use by Black-necked Stilts	1. Consider large-scale habitat connectivity strategies for Great Basin Wetland ecosystems. 2. Conduct long-term monitoring of Black-necked Stilt breeding, migrating, and wintering populations.
	Setting Management Priorities	1. Develop an organization dedicated to establishing regional and local priorities based upon the potential contribution of different areas to global biodiversity.
Long-billed Curlew	*Habitat loss*	1. Restrict development on Long-billed Curlew breeding habitat on the eastern shores of the Great Salt Lake. Managing upland habitats associated with Wetlands is important in breeding shorebird conservation.
	Predation by red fox	1. Fragmentation and loss of adjacent uplands have provided predators with travel corridors where predation of ground-nesting birds can be High. The use of predator barriers, such as electric fences, is important in reducing nest loss.

[1.] This table is meant to compliment, not replace, the individual Species accounts; we highly recommend reading the individual Species accounts for detailed descriptions of management recommendations and habitat requirements.

INFORMATION AND EDUCATION

The Utah Avian Conservation Strategy has been compiled primarily for use by habitat and wildlife managers to assist them in identifying and responding to bird conservation issues in Utah. In addition, Utah Partners in Flight recognizes that the objectives and recommendations presented are potentially useful to a much broader audience, including the general public, government officials (e.g., federal, state, county, city), natural resources conservation businesses, and educators, to name a few. The objectives and recommendations identified in the Utah Strategy will be continuously updated and modified as goals and objectives are met, as we obtain additional information on priority habitats and priority bird Species, and as Partners in Flight grows both nationally and internationally in scope.

A Utah Partners in Flight web site is being developed that describes the program from a state, national, and international perspective. The site will be linked to the national Partners in Flight web sites, and appropriate sections will be linked to areas of interest within Utah and from outside. A copy of the Utah Avian Conservation Strategy will be available on the site, results and summaries from the ongoing statewide riparian surveys, and results and summaries from numerous other Partners in Flight habitat and bird study programs. The site will also be linked to the Utah Partners (e.g., federal and state agencies, universities, and private organizations) and other key bird related web sites containing information about Utah Partners in Flight and avian conservation.

The following items have been identified as important aspects of Information and Education outreach which Utah Partners in Flight feels is necessary in order to maximize the distribution of information and to enlist others in the statewide avian conservation efforts:

1) Coordinate with local bird conservation organizations to establish an Important Bird Areas (IBA) program for Utah;
2) Establish a Breeding Bird Atlas for Utah;
3) Produce an electronic brochure on CD format with lists habitats and bird Species in Utah that are in need of conservation action, to include identification tips and where to go to see them;
4) Establish a centralized information source for priority habitats and priority birds initially, and then expand to include all Utah birds;
5) Establish an annual recognition program for individuals that contribute to avian conservation issues; can include non-professional as well as professional natural resources individuals or organizations

The above information is a starting point for developing and expanding an Information and Education Outreach for the Utah PIF Program. Additional ideas and opportunities will likely be developed in time that will be helpful in meeting the Utah PIF Program Goals and Objectives. Your ideas are welcomed and can be received by contacting Jimmie R. Parrish, Ph.D., Utah Partners in Flight Program Coordinator, Utah Division of Wildlife Resources ,1594 West North Temple, Salt Lake City, Utah 84116 (801) 538-4788/Fax (801) 538-4709; email: jimparrish@utah.gov.

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APPENDICES

APPENDIX A. CRITERIA FOR PRIORITIZING UTAH'S NATIVE LANDBIRDS (see Hunter et al. 1993)

I. RA - Relative Abundance

1 - Abundant
Species which can be observed in quantity in their habitat any day in the proper season without any special search.
2 - Common (to include Locally Abundant)
Species for which several representatives should be noted daily in appropriate habitat.
3 - Uncommon to Fairly Common (to include Locally Common)
An uncommon species might require searching in a selected favorable locale with resulting discovery of scattered pairs of isolated small colonies.
4 - Rare to Uncommon (to include Locally Fairly Common)
A rare species is not often encountered when looked for but is not considered unusual when found.
5 - Very Rare to Rare (to include Locally Uncommon)
A very rare species is one that might not be encountered except by chance in several days of search.

II. BD - Breeding Distribution

1 - Very Widespread
Species occurs in ≥ 76 - 100% of temperate North America.
2 - Widespread
Species occurs in 51 - 75% of temperate North America.
3 - Intermediate
Species occurs in 26 - 50% of temperate North America.
4 - Local
Species occurs in 11 - 25% of temperate North America.
5 - Very Local
Species occurs in ≤ 10% of temperate North America.

III. WD - Winter Distribution

1 - Very Widespread
Species occurs in southern latitudes of the U.S. through middle American into northern South America; or all of South America.
2 - Widespread
Species occurs in southern latitudes of the U.S. through Central American; or southern Central America into most of South America.
3 - Intermediate
Species occurs throughout, but only in, Mexico; the entire Caribbean Basin and Caribbean Slope of Central America and southern Mexico; the Middle American highlands; or the entire Amazon Basin.
4 - Local
Species occurs in the Caribbean Basin alone; Caribbean Slope of Middle America alone; Pacific Slope of Middle America alone; the Mexican Highlands; or the Andean Ridge of northern South America.
5 - Very Local
e.g., Bahamas only; Guatemala, Honduras, and Nicaragua highlands only; States of Jalisco,

Michoacan, and Guerrero in Mexico; southern Sinoloa and southern Baja California in Mexico

IV. TB - THREATS IN BREEDING RANGE

1 - No Known Threat

Habitat increasing or stable, species with high reproductive potential, an ecological generalist.

2 - Minor Threat

Habitat loss between 1 - 10%, moderate generalist.

3 - Moderate Threat

Habitat loss between 11 - 25%, species with moderate reproductive potential, and ecological specialization

4 - Extensive Threat

Habitat loss between 26 - 50%, ecological specialist.

5 - Extirpation Likely

Habitat loss exceeding 50%, species with low reproductive potential, and ecological specialist.

V. TB - THREATS IN NON-BREEDING RANGE

1 - No Known Threat

Habitat increasing or stable, an ecological generalist during both migration and winter.

2 - Minor Threat

Habitat loss between 1 - 10%, moderate generalist during both migration and winter.

3 - Moderate Threat

Habitat loss between 11 - 25%, species with moderate ecological specialization during migration and/or winter

4 - Extensive Threat

Habitat loss between 26 - 50%, ecological specialist during migration and/or winter.

5 - Extirpation Likely

Habitat loss exceeding 50%, ecological specialist during migration and/or winter.

VI. IA - IMPORTANCE OF UTAH TO EACH SPECIES

1 - Very Low (Accidental to Peripheral)

< 1% of species' total distribution

2 - Low (Occurs Regularly but is Uncommon)

1 - 10% of species' total distribution

3 - Moderate (Present in Low Relative Abundance)

11 - 25% of species' total distribution

4 - High (Present in Moderate to High Relative Abundance)

26 - 50% of species' total distribution

5 - Very High (Present in Highest Relative Abundance)

51 - 100% of species' total distribution

VII. PT - POPULATION TREND

1 - Significant or Definite Increase

Significant overall increase or widespread signs of increase across a majority or sample units regardless of detection rate.

2 - Possible Increasing Trend

Non-significant increasing trend or signs of increase especially in sample units where species is most frequently detected

3 - Apparently Stable or Trend Unknown
Overall balance of increasing and decreasing trends among all sample units regardless of detection rates or data are unavailable or inadequate for interpretation.
4 - Possible Decreasing Trend
Non-significant decreasing trend or signs of decrease especially in sample areas where species is most frequently detected.
5 - Significant or Definite Decrease
Significant overall decrease or widespread signs of decrease across all sample units regardless of detection rate.

VIII. PU - POPULATION TREND UNCERTAINTY
1 - Large Increase
(a) stable or increasing with 14 or more BBS routes with statistical significance and significant proportion of increasing routes agree with overall trend or (b) $\geq$ 5% annual increase with 14 or more routes with statistical significance and proportion of increasing routes agreeing with overall trend..
2 - Increase
(a) stable or increasing with 14 or more BBS routes without statistical significance and/or the proportion of increasing routes corresponding with overall trend or (b) 14 or more routes without statistical significance and/or the proportion of increasing routes do not agree with overall trend, with trend being $\geq$ 1% annual increase.
3 - Trend Unknown
(a) non-significant trend is between -1.0 and 1.0% exclusive and/or sample size for species from BBS is insufficient or (b) no quantitative monitoring information exists for species in the area..
4 - Decrease
(a) decreasing with 14 or more BBS routes without statistical significance and/or the proportion of decreasing routes corresponding with overall trend or (b) 14 or more routes without statistical significance and/or the proportion of decreasing routes do not agree with overall trend, with trend being 1% annual decrease.
5 - Large Decrease
(a) decreasing with 14 or more BBS routes with statistical significance and significant proportion of decreasing routes agree with overall trend or (b) $\geq$ 5% annual decrease with 14 or more routes with statistical significance and proportion of decreasing routes agreeing with overall trend...

IX. UPIF SUM = WEIGHTED TOTAL OF CRITERIA SCORES

APPENDIX B. 231 BREEDING BIRDS PRIORITIZED BY UPIF RANKINGS SCORES

SPECIES	IA	RA	BD	WD	TB	TN	PT	UPIFSUM
Abert's Towhee	2	3	5	5	5	5	4	40
Lewis's Woodpecker	3	4	4	4	4	4	5	40
Le Conte's Thrasher	2	5	5	5	4	4	3	37
American Avocet	5	2	3	4	4	4	3	37
Mountain Plover	2	5	5	4	4	4	3	36
Gray Vireo	4	4	4	5	3	3	3	36
Lucy's Warbler	2	2	5	5	5	4	3	36
Virginia's Warbler	4	4	4	5	3	3	3	36
American White Pelican	5	3	3	3	4	3	3	36
Bobolink	2	4	3	4	5	3	4	36
Sage-grouse	3	4	3	3	4	4	4	36
Black Rosy-Finch	5	3	5	5	2	2	3	35
Bell's Vireo	2	4	3	4	5	4	3	35
Black Swift	2	5	5	4	3	4	3	34
Brewer's Sparrow	3	2	4	3	4	3	4	34
Sharp-tailed Grouse	2	4	3	3	4	4	4	34
Long-billed Curlew	2	3	4	4	4	3	4	34
Black-necked Stilt	3	3	4	3	4	4	3	34
Brown-crested Flycatcher	2	5	5	2	4	3	3	33
Bendire's Thrasher	2	4	5	5	3	3	3	33
Broad-tailed Hummingbird	3	2	4	4	3	3	4	33
Black-tailed Gnatcatcher	2	4	5	5	3	3	3	33
Ferruginous Hawk	3	4	3	3	4	3	3	33
Cordilleran Flycatcher	3	3	4	4	3	3	3	32
Spotted Owl	2	5	4	4	3	3	3	32
Gambel's Quail	3	3	4	4	3	3	3	32
Gray Flycatcher	4	3	4	4	3	3	2	32
Sage Sparrow	3	3	4	4	3	3	3	32
Common Black-Hawk	2	5	3	3	4	3	3	32
Three-toed Woodpecker	4	2	2	3	4	3	3	32
Grasshopper Sparrow	2	4	2	3	4	3	4	32
Black-throated Gray Warbler	3	3	4	4	3	3	3	32
Yellow-billed Cuckoo	3	3	2	3	4	4	3	32
Williamson's Sapsucker	3	3	4	3	3	3	3	31
Franklin's Gull	2	3	3	3	4	4	3	31
Olive-sided Flycatcher	2	3	3	3	3	4	4	31
Pinyon Jay	4	2	3	3	3	3	3	31
Clark's Grebe	3	3	4	4	3	2	3	31
Western Screech-Owl	3	3	3	4	3	3	3	31
Hammond's Flycatcher	3	3	3	4	3	3	3	31

SPECIES	IA	RA	BD	WD	TB	TN	PT	UPIFSUM
Costa's Hummingbird	2	3	5	4	3	3	3	31
Snowy Plover	4	3	3	3	3	2	3	31
Wilson's Phalarope	4	2	3	4	3	2	3	31
Summer Tanager	3	2	3	3	4	3	3	31
Black-chinned Sparrow	2	4	4	4	3	3	3	31
Calliope Hummingbird	2	4	4	4	3	2	3	30
Blue Grouse	3	3	3	3	3	3	3	30
Dusky Flycatcher	3	2	3	4	3	3	3	30
Northern Pygmy-Owl	3	3	3	3	3	3	3	30
Crissal Thrasher	2	3	4	4	3	3	3	30
Northern Goshawk	2	4	3	2	4	3	3	30
Townsend's Solitaire	2	3	3	3	3	3	4	30
Western Grebe	4	3	3	2	3	2	3	30
American Dipper	3	3	3	3	3	3	3	30
Juniper Titmouse	4	2	4	4	2	2	3	30
American Bittern	2	3	2	3	4	4	3	30
Pygmy Nuthatch	3	3	3	3	3	3	3	30
Plumbeous Vireo	3	2	4	3	3	3	3	30
Prairie Falcon	3	4	3	2	3	3	3	30
Black Tern	2	3	3	3	4	3	3	30
Blue Grosbeak	2	3	3	3	3	3	4	30
Sandhill Crane	2	3	3	4	3	3	3	29
Peregrine Falcon	2	4	3	2	3	4	3	29
Veery	2	2	3	4	3	4	3	29
Grace's Warbler	2	3	3	4	3	3	3	29
Scott's Oriole	2	3	3	4	3	3	3	29
Acorn Woodpecker	2	5	4	4	2	2	3	29
Caspian Tern	2	4	3	3	3	3	3	29
Red-naped Sapsucker	2	3	3	3	3	4	3	29
Cassin's Kingbird	2	3	3	4	3	3	3	29
Willet	4	3	3	2	2	3	3	29
Gray Catbird	2	3	2	3	4	3	3	29
Sage Sparrow	3	2	4	3	3	2	3	29
Green-tailed Towhee	3	2	3	3	3	3	3	29
Short-eared Owl	2	4	1	1	4	3	4	29
Sage Thrasher	3	2	4	3	3	2	3	29
Mountain Chickadee	3	2	3	3	3	3	3	29
Vermilion Flycatcher	3	3	1	2	4	2	3	28
White-tailed Ptarmigan	3	4	3	3	2	2	3	28
Rufous-crowned Sparrow	2	5	3	3	3	3	2	28
Black-chinned Hummingbird	3	2	4	4	2	2	3	28
Common Poorwill	3	3	3	3	2	3	3	28

SPECIES	IA	RA	BD	WD	TB	TN	PT	UPIFSUM
Greater Roadrunner	2	3	3	3	3	3	3	28
Mountain Bluebird	2	3	3	3	3	3	3	28
Loggerhead Shrike	2	3	2	3	3	4	3	28
Ruffed Grouse	2	5	3	3	3	3	2	28
Willow Flycatcher	2	3	2	4	3	3	3	28
Burrowing Owl	2	4	2	1	4	3	3	28
Cactus Wren	2	3	3	3	3	3	3	28
White-throated Swift	4	2	3	3	2	2	3	28
Western Wood-Pewee	3	2	2	4	3	2	3	28
Golden-crowned Kinglet	2	3	3	2	3	2	4	28
Scaled Quail	1	5	3	3	2	2	4	27
Black-throated Sparrow	2	3	4	3	2	3	3	27
Western Bluebird	3	3	3	2	2	3	3	27
Phainopepla	2	3	3	3	3	2	3	27
Clark's Nutcracker	3	2	3	3	3	3	2	27
Black-headed Grosbeak	2	2	3	3	3	3	3	27
Canyon Wren	3	3	3	3	2	2	3	27
Flammulated Owl	3	2	3	4	2	2	3	27
Bullock's Oriole	2	2	2	4	3	3	3	27
Lark Sparrow	2	3	2	3	3	3	3	27
Black Phoebe	2	3	4	1	3	3	3	27
Common Moorhen	2	4	2	2	3	3	3	27
Yellow-headed Blackbird	3	1	2	3	3	3	3	27
Northern Harrier	2	3	1	1	4	4	3	27
Lazuli Bunting	2	2	3	4	3	2	3	27
Ring-necked Pheasant	2	2	2	2	3	3	4	27
Lark Bunting	1	4	2	2	4	3	3	27
Verdin	2	2	3	3	3	3	3	27
Wild Turkey (Merriam's)	3	3	2	2	3	2	3	27
Cassin's Finch	3	2	3	2	3	2	3	27
White-faced Ibis	3	3	2	2	3	2	3	27
Wild Turkey (Rio Grande)	3	3	2	2	3	2	3	27
Bald Eagle	2	5	3	3	2	2	3	27
Yellow-rumped Warbler	3	2	3	3	2	2	3	26
Green Heron	1	4	2	2	3	2	4	26
Hooded Oriole	1	3	3	3	3	3	3	26
Cooper's Hawk	2	3	1	2	3	4	3	26
Yellow-breasted Chat	2	2	2	3	3	3	3	26
Pied-billed Grebe	2	2	2	2	3	2	4	26
Gray Jay	2	3	2	2	3	3	3	26
Bewick's Wren	2	3	2	2	3	3	3	26
Violet-green Swallow	3	2	2	3	2	3	3	26

SPECIES	IA	RA	BD	WD	TB	TN	PT	UPIFSUM
Common Bushtit	3	2	3	3	2	2	3	26
Forster's Tern	2	2	3	3	3	2	3	26
Western Scrub-Jay	3	2	3	3	2	2	3	26
Virginia Rail	3	2	1	2	3	3	3	26
Marsh Wren	1	2	2	2	4	4	3	26
Purple Martin	2	2	2	3	3	3	3	26
Orange-crowned Warbler	2	2	2	3	3	2	3	25
Pine Grosbeak	2	3	3	3	2	2	3	25
Western Kingbird	2	2	2	4	2	3	3	25
Rock Wren	2	3	3	3	2	2	3	25
Indigo Bunting	1	4	2	2	3	3	3	25
Great-tailed Grackle	2	3	3	3	2	2	3	25
Eastern Kingbird	2	3	2	3	2	3	3	25
Band-tailed Pigeon	2	3	3	3	2	2	3	25
MacGillivray's Warbler	2	2	3	3	2	3	3	25
American Redstart	1	4	2	2	3	3	3	25
Cedar Waxwing	2	3	2	2	3	2	3	25
Swainson's Thrush	2	1	2	2	3	4	3	25
Fox Sparrow	2	3	2	2	3	2	3	25
Blue-gray Gnatcatcher	2	2	2	3	3	2	3	25
Wilson's Warbler	3	2	2	3	2	2	3	25
Hermit Thrush	2	2	2	2	3	3	3	25
Great Blue Heron	2	2	2	2	3	3	3	25
Brown Creeper	2	3	2	1	3	3	3	25
Black-billed Magpie	2	2	3	3	2	2	3	24
Chukar	3	3	3	3	1	1	3	24
Bank Swallow	2	3	2	3	2	2	3	24
Inca Dove	1	4	4	4	2	2	2	24
California Quail	2	2	4	4	2	2	2	24
American Pipit	2	2	3	2	2	3	3	24
Lesser Goldfinch	2	2	3	3	2	2	3	24
Steller's Jay	2	2	3	3	2	2	3	24
Merlin	1	4	3	3	2	2	3	24
Western Meadowlark	3	1	2	2	3	3	2	24
Spotted Towhee (Rufous-sided)	2	2	2	2	3	2	3	24
Least Flycatcher	1	5	2	2	3	3	2	24
Northern Saw-whet Owl	2	3	2	1	3	2	3	24
Sora	2	2	2	2	3	2	3	24
Common Barn Owl	2	3	1	1	3	3	3	24
Black-crowned Night-Heron	2	2	1	2	3	3	3	24
Gray Partridge	2	4	3	3	1	1	3	23
Ash-throated Flycatcher	2	3	3	3	2	2	2	23

SPECIES	IA	RA	BD	WD	TB	TN	PT	UPIFSUM
Swainson's Hawk	2	3	2	3	3	3	1	23
Osprey	2	3	2	1	3	3	2	23
Evening Grosbeak	2	2	3	2	2	2	3	23
Common Nighthawk	2	2	1	2	3	2	3	23
Belted Kingfisher	2	3	1	1	3	2	3	23
Golden Eagle	2	3	2	2	3	2	2	23
Warbling Vireo	2	2	1	3	2	3	3	23
Tree Swallow	2	2	1	2	3	2	3	23
Common Snipe	2	2	1	1	3	3	3	23
Common Grackle	2	4	2	3	1	1	3	22
Savannah Sparrow	2	2	1	2	3	3	2	22
Western Tanager	2	2	2	3	2	3	2	22
N. Rough-winged Swallow	2	2	1	3	2	2	3	22
Black-capped Chickadee	2	2	2	2	2	2	3	22
Sharp-shinned Hawk	2	3	1	1	4	3	1	22
Ruby-crowned Kinglet	2	2	2	2	2	2	3	22
Spotted Sandpiper	2	2	1	3	2	2	3	22
Lincoln's Sparrow	2	2	2	2	2	2	3	22
Long-eared Owl	2	3	1	1	2	3	3	22
Ladder-backed Woodpecker	1	3	2	2	2	2	3	21
Red Crossbill	2	2	2	2	2	3	2	21
Ring-billed Gull	2	4	2	2	1	1	3	21
Say's Phoebe	2	3	2	3	2	3	1	21
Brewer's Blackbird	2	2	3	2	2	2	2	21
White-breasted Nuthatch	2	3	1	1	2	2	3	21
California Gull	3	2	3	3	2	1	1	21
Downy Woodpecker	2	3	1	1	2	2	3	21
American Goldfinch	2	2	2	2	2	1	3	21
Common Yellowthroat	2	2	1	2	3	2	2	21
Hairy Woodpecker	2	3	1	1	2	2	3	21
Cliff Swallow	2	1	1	3	2	2	3	21
Chipping Sparrow	2	2	1	2	2	2	3	21
Song Sparrow	2	2	1	1	3	1	3	21
Lesser Nighthawk	1	2	2	2	2	2	3	20
Double-crested Cormorant	2	2	2	2	2	2	2	20
Red-tailed Hawk	2	3	1	1	2	1	3	20
White-winged Dove	1	2	3	3	2	2	2	20
Yellow Warbler	3	2	1	1	2	2	2	20
White-crowned Sparrow	3	1	1	2	1	2	3	20
House Wren	2	2	1	2	2	1	3	20
American Kestrel	2	2	1	1	2	2	3	20
Vesper Sparrow	2	1	2	2	2	2	2	19

SPECIES	IA	RA	BD	WD	TB	TN	PT	UPIFSUM
Snowy Egret	2	2	2	1	3	2	1	19
Northern Mockingbird	2	2	2	2	1	1	3	19
Northern Flicker (Red-shafted)	1	2	2	2	2	1	3	19
American Coot	2	1	1	1	2	2	3	19
Great Horned Owl	1	2	2	2	1	1	4	19
Eared Grebe	2	2	2	2	2	2	1	18
Turkey Vulture	2	2	1	1	2	2	2	18
Pine Siskin	2	2	2	1	1	1	3	18
Barn Swallow	2	2	1	1	1	2	3	18
Red-winged Blackbird	2	1	1	1	2	1	3	18
Dark-eyed Junco (Gray-headed)	2	1	1	1	2	1	3	18
Red-breasted Nuthatch	2	2	2	1	2	2	1	17
Rock Dove	2	2	1	1	1	1	3	17
Killdeer	1	2	1	1	2	1	3	17
Common Raven	2	2	1	1	1	1	3	17
Cattle Egret	2	3	1	1	1	1	2	16
American Crow	2	2	1	2	1	1	2	16
European Starling	2	1	1	1	1	1	3	16
American Robin	2	1	1	1	1	1	3	16
Brown-headed Cowbird	2	1	1	2	1	1	2	15
House Finch	1	1	2	2	1	1	2	14
Horned Lark	1	1	1	1	1	1	3	14
House Sparrow	1	1	1	1	1	1	3	14
Mourning Dove	1	1	1	1	1	1	3	14

APPENDIX C. SCIENTIFIC NAMES FOR UTAH'S NATIVE LANDBIRDS

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
Abert's Towhee	*Pipilo aberti*	Chukar	*Alectoris chukar*
Acorn Woodpecker	*Melanerpes formicivorus*	Clark's Grebe	*Aechmophorus clarkii*
American Avocet	*Recurvirostra americana*	Clark's Nutcracker	*Nucifraga columbiana*
American Bittern	*Botaurus lentiginosus*	Cliff Swallow	*Hirundo pyrrhonota*
American Coot	*Fulica americana*	Common Black-Hawk	*Buteogallus anthracinus*
American Crow	*Corvus brachyrhynchos*	Common Grackle	*Quiscalus quiscula*
American Dipper	*Cinclus mexicanus*	Common Moorhen	*Gallinula chloropus*
American Goldfinch	*Carduelis tristis*	Common Nighthawk	*Chordeiles minor*
American Kestrel	*Falco sparverius*	Common Poorwill	*Phalaenoptilus nuttallii*
American Pipit	*Anthus rubescens*	Common Raven	*Corvus corax*
American Redstart	*Setophaga ruticilla*	Common Snipe	*Gallinago gallinago*
American Robin	*Turdus migratorius*	Common Yellowthroat	*Geothlypis trichas*
American White Pelican	*Pelecanus erythrorhynchos*	Cooper's Hawk	*Accipiter cooperii*
Ash-throated Flycatcher	*Myiarchus cinerascens*	Cordilleran Flycatcher	*Empidonax occidentalis*
Bald Eagle	*Haliaeetus leucocephalus*	Costa's Hummingbird	*Calypte costae*
Band-tailed Pigeon	*Columba fasciata*	Crissal Thrasher	*Toxostoma crissale*
Bank Swallow	*Riparia riparia*	Dark-eyed Junco(Gray-headed)	*Junco hyemalis*
Barn Owl	*Tyto alba*	Double-crested Cormorant	*Phalacrocorax auritus*
Barn Swallow	*Hirundo rustica*	Downy Woodpecker	*Picoides pubescens*
Bell's Vireo	*Vireo bellii*	Dusky Flycatcher	*Empidonax oberholseri*
Belted Kingfisher	*Ceryle alcyon*	Eared Grebe	*Podiceps nigricollis*
Bendire's Thrasher	*Toxostoma bendirei*	Eastern Kingbird	*Tyrannus tyrannus*
Bewick's Wren	*Thryomanes bewickii*	European Starling	*Sturnus vulgaris*
Black Phoebe	*Sayornis nigricans*	Evening Grosbeak	*Coccothraustes vespertinus*
Black Rosy-Finch	*Leucosticte atrata*	Ferruginous Hawk	*Buteo regalis*
Black Swift	*Cypseloides niger*	Flammulated Owl	*Otus flammeolus*
Black Tern	*Chlidonias niger*	Forster's Tern	*Sterna forsteri*
Black-billed Magpie	*Pica pica*	Fox Sparrow	*Passerella iliaca*
Black-capped Chickadee	*Parus atricapillus*	Franklin's Gull	*Larus pipixcan*
Black-chinned Hummingbird	*Archilochus alexandri*	Gambel's Quail	*Callipepla gambelii*
Black-chinned Sparrow	*Spizella atrogularis*	Golden Eagle	*Aquila chrysaetos*
Black-crowned Night-Heron	*Nycticorax nycticorax*	Golden-crowned Kinglet	*Regulus satrapa*
Black-headed Grosbeak	*Pheucticus melanocephalus*	Grace's Warbler	*Dendroica graciae*
Black-necked Stilt	*Himantopus mexicanus*	Grasshopper Sparrow	*Ammodramus savannarum*
Black-tailed Gnatcatcher	*Polioptila melanura*	Gray Catbird	*Dumetella carolinensis*
Black-throated Gray Warbler	*Dendroica nigrescens*	Gray Flycatcher	*Empidonax wrightii*
Black-throated Sparrow	*Amphispiza bilineata*	Gray Jay	*Perisoreus canadensis*
Blue Grosbeak	*Guiraca caerulea*	Gray Partridge	*Perdix perdix*
Blue Grouse	*Dendragapus obscurus*	Gray Vireo	*Vireo vicinior*
Blue-gray Gnatcatcher	*Polioptila caerulea*	Great Blue Heron	*Ardea herodias*
Bobolink	*Dolichonyx oryzivorus*	Great Horned Owl	*Bubo virginianus*
Brewer's Blackbird	*Euphagus cyanocephalus*	Greater Roadrunner	*Geococcyx californianus*
Brewer's Sparrow	*Spizella breweri*	Greater Sage-grouse	*Centrocercus urophasianus*
Broad-tailed Hummingbird	*Selasphorus platycercus*	Great-tailed Grackle	*Quiscalus mexicanus*
Brown Creeper	*Certhia americana*	Green Heron	*Butorides vivescens*
Brown-crested Flycatcher	*Myiarchus tyrannulus*	Green-tailed Towhee	*Pipilo chlorurus*
Brown-headed Cowbird	*Molothrus ater*	Gunnison Sage-grouse	*Centrocercus minimus*
Bullock's Oriole	*Icterus bullockii*	Hairy Woodpecker	*Picoides villosus*
Burrowing Owl	*Speotyto cunicularia*	Hammond's Flycatcher	*Empidonax hammondii*
Bushtit	*Psaltriparus minimus*	Hermit Thrush	*Catharus guttatus*
Cactus Wren	*Campylorhynchus brunneicapillus*	Hooded Oriole	*Icterus cucullatus*
California Gull	*Larus californicus*	Horned Lark	*Eremophila alpestris*
California Quail	*Callipepla californica*	House Finch	*Carpodacus mexicanus*
Calliope Hummingbird	*Stellula calliope*	House Sparrow	*Passer domesticus*
Canyon Wren	*Catherpes mexicanus*	House Wren	*Troglodytes aedon*
Caspian Tern	*Sterna caspia*	Inca Dove	*Columbina inca*
Cassin's Finch	*Carpodacus cassinii*	Indigo Bunting	*Passerina cyanea*
Cassin's Kingbird	*Tyrannus vociferans*	Juniper Titmouse	*Baeolophus ridgewayi*
Cattle Egret	*Bubulcus ibis*	Killdeer	*Charadrius vociferus*
Cedar Waxwing	*Bombycilla cedrorum*	Ladder-backed Woodpecker	*Picoides scalaris*
Chipping Sparrow	*Spizella passerina*	Lark Bunting	*Calamospiza melanocorys*

Lark Sparrow	*Chondestes grammacus*
Lazuli Bunting	*Passerina amoena*
Le Conte's Thrasher	*Toxostoma lecontei*
Least Flycatcher	*Empidonax minimus*
Lesser Goldfinch	*Carduelis psaltria*
Lesser Nighthawk	*Chordeiles acutipennis*
Lewis's Woodpecker	*Melanerpes lewis*
Lincoln's Sparrow	*Melospiza lincolnii*
Loggerhead Shrike	*Lanius ludovicianus*
Long-billed Curlew	*Numenius americanus*
Long-eared Owl	*Asio otus*
Lucy's Warbler	*Vermivora luciae*
MacGillivray's Warbler	*Oporornis tolmiei*
Marsh Wren	*Cistothorus palustris*
Merlin	*Falco columbarius*
Mountain Bluebird	*Sialia currucoides*
Mountain Chickadee	*Parus gambeli*
Mountain Plover	*Charadrius montanus*
Mourning Dove	*Zenaida macroura*
N. Rough-winged Swallow	*Stelgidopteryx serripennis*
Northern Flicker (Red-shafted)	*Colaptes auratus*
Northern Goshawk	*Accipiter gentilis*
Northern Harrier	*Circus cyaneus*
Northern Mockingbird	*Mimus polyglottos*
Northern Pygmy-Owl	*Glaucidium gnoma*
Northern Saw-whet Owl	*Aegolius acadicus*
Olive-sided Flycatcher	*Contopus borealis*
Orange-crowned Warbler	*Vermivora celata*
Osprey	*Pandion haliaetus*
Peregrine Falcon	*Falco peregrinus*
Phainopepla	*Phainopepla nitens*
Pied-billed Grebe	*Podilymbus podiceps*
Pine Grosbeak	*Pinicola enucleator*
Pine Siskin	*Carduelis pinus*
Pinyon Jay	*Gymnorhinus cyanocephalus*
Plumbeous Vireo	*Vireo plumbeus*
Prairie Falcon	*Falco mexicanus*
Purple Martin	*Progne subis*
Pygmy Nuthatch	*Sitta pygmaea*
Red Crossbill	*Loxia curvirostra*
Red-breasted Nuthatch	*Sitta canadensis*
Red-naped Sapsucker	*Sphyrapicus nuchalis*
Red-tailed Hawk	*Buteo jamaicensis*
Red-winged Blackbird	*Agelaius phoeniceus*
Ring-billed Gull	*Larus delawarensis*
Ring-necked Pheasant	*Phasianus colchicus*
Rock Dove	*Columba livia*
Rock Wren	*Salpinctes obsoletus*
Ruby-crowned Kinglet	*Regulus calendula*
Ruffed Grouse	*Bonasa umbellus*
Rufous-crowned Sparrow	*Aimophila ruficeps*
Sage-grouse	*Centrocercus urophasianus*
Sage Sparrow	*Amphispiza belli*
Sage Thrasher	*Oreoscoptes montanus*
Sandhill Crane	*Grus canadensis*
Savannah Sparrow	*Passerculus sandwichensis*
Say's Phoebe	*Sayornis saya*
Scaled Quail	*Callipela squamata*
Scott's Oriole	*Icterus parisorum*
Sharp-shinned Hawk	*Accipiter striatus*
Sharp-tailed Grouse	*Tympanuchus phasianellus*
Short-eared Owl	*Asio flammeus*
Snowy Egret	*Egretta thula*
Snowy Plover	*Charadrius alexandrinus*
Song Sparrow	*Melospiza melodia*
Sora	*Porzana carolina*
Spotted Owl	*Strix occidentalis*
Spotted Sandpiper	*Actitis macularia*
Spotted Towhee (Rufous-sided)	*Pipilo maculatus*
Steller's Jay	*Cyanocitta stelleri*
Summer Tanager	*Piranga rubra*
Swainson's Hawk	*Buteo swainsoni*
Swainson's Thrush	*Catharus ustulatus*
Three-toed Woodpecker	*Picoides tridactylus*
Townsend's Solitaire	*Myadestes townsendi*
Tree Swallow	*Tachycineta bicolor*
Turkey Vulture	*Cathartes aura*
Veery	*Catharus fuscescens*
Verdin	*Auriparus flaviceps*
Vermilion Flycatcher	*Pyrocephalus rubinus*
Vesper Sparrow	*Pooecetes gramineus*
Violet-green Swallow	*Tachycineta thalassina*
Virginia Rail	*Rallus limicola*
Virginia's Warbler	*Vermivora virginiae*
Warbling Vireo	*Vireo gilvus*
Western Bluebird	*Sialia mexicana*
Western Grebe	*Aechmophorus occidentalis*
Western Kingbird	*Tyrannus verticalis*
Western Meadowlark	*Sturnella neglecta*
Western Screech-Owl	*Otus kennicottii*
Western Scrub-Jay	*Aphelocoma californica*
Western Tanager	*Piranga ludoviciana*
Western Wood-Pewee	*Contopus sordidulus*
White-breasted Nuthatch	*Sitta carolinensis*
White-crowned Sparrow	*Zonotrichia leucophrys*
White-faced Ibis	*Plegadis chihi*
White-tailed Ptarmigan	*Lagopus leucurus*
White-throated Swift	*Aeronautes saxatalis*
White-winged Dove	*Zenaida asiatica*
Wild Turkey (Merriam's)	*Meleagris gallopavo*
Wild Turkey (Rio Grande)	*Meleagris gallopavo*
Willet	*Catoptrophorus semipalmatus*
Williamson's Sapsucker	*Sphyrapicus thyroideus*
Willow Flycatcher	*Empidonax traillii*
Wilson's Phalarope	*Phalaropus tricolor*
Wilson's Warbler	*Wilsonia pusilla*
Yellow Warbler	*Dendroica petechia*
Yellow-billed Cuckoo	*Coccyzus americanus*
Yellow-breasted Chat	*Icteria virens*
Yellow-headed Blackbird	*Xanthocephalus -xanthocephalus*
Yellow-rumped Warbler	*Dendroica coronata*