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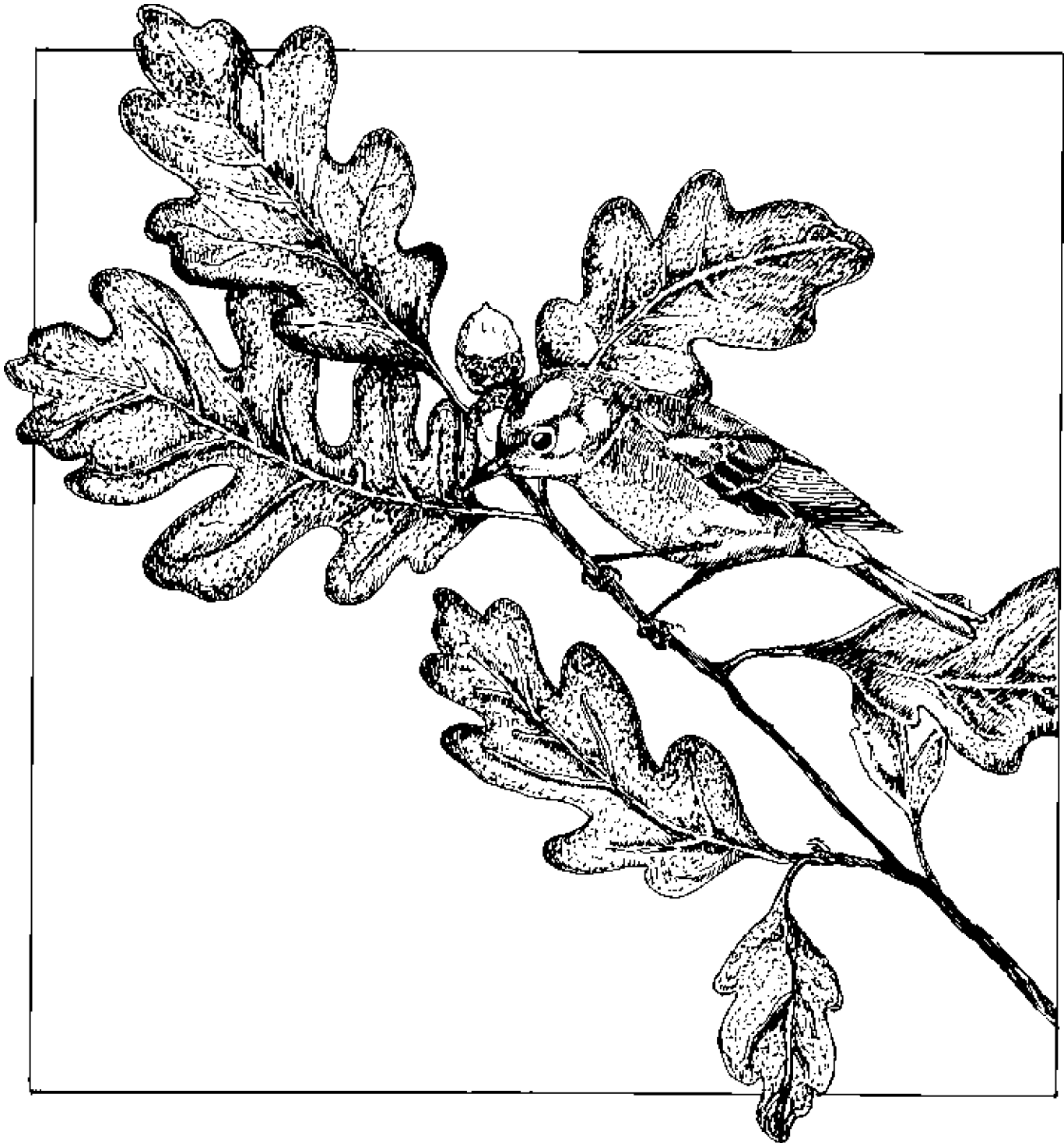
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Bird Communities of Gambel Oak: A Descriptive Analysis

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Abstract

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Gambel oak (*Quercus gambelii* Nutt.) covers 3.75 million hectares (9.3 million acres) of the western United States. This report synthesizes current knowledge on the composition, structure, and habitat relationships of gambel oak avian communities. It lists life history attributes of 183 bird species documented from gambel oak habitats of the western United States. Structural habitat attributes important to bird-habitat relationships are identified, based on 12 independent studies. This report also highlights species of special concern, provides recommendations for monitoring, and gives suggestions for management and future research.

Keywords: Avian ecology, bird-habitat relationships, neotropical migrant, oakbrush, oak woodlands, scrub oak, *Quercus gambelii*, Western United States

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Cover art of Virginia's warbler in gambel oak by Joyce VanDeWater.

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Introduction

Gambel oak (*Quercus gambelii* Nutt.) covers 3.75 million hectares (9.3 million acres) of the western United States (Harper and others 1985). In the past, range and wildlife managers considered the abundant gambel oak to be a nuisance species occupying valuable rangeland (Engle and others 1983). Managers often targeted this plant species for eradication. Investigations of gambel oak-wildlife relationships to date have been largely limited forage and cover value for mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*; Harper and others 1985).

Recent declines in bird populations (Robbins and others 1989) have prompted renewed research interest in bird communities. Declines are most pronounced for forest-interior species but are also prominent among grassland and shrubland birds (Askins 1993; Robbins and others 1993). Avian communities of gambel oak have received little attention by researchers and, as a result, are still poorly understood. Gambel oak avifaunas, like those of the sagebrush (*Artemisia*) and pinyon (*Pinus*)-juniper (*Juniperus*) vegetation types, occupy a habitat largely comprised of a single plant species (Marti 1977).

This review synthesizes current knowledge of bird communities of the gambel oak vegetation type. We hope this review will be useful to natural resource professionals in making more informed decisions. At the same time, we hope that by identifying relationships between gambel oak and birds for which our knowledge is yet incomplete, others may be encouraged to conduct further research.

Ecology of Gambel Oak: An Overview

Gambel oak woodlands and shrublands usually occur at elevations ranging from 1500 to 2800 m (4900 to 9200 ft; Brown 1958; McKell 1950) in Arizona, Colorado, New Mexico, and Utah (figure 1; Clary and Tiedemann 1986; Little 1971). Extremes of 1000 and 3100 m (3300 to 10200 ft) have been recorded in Utah, the central part of its range (Christensen 1949). The growth form of gambel oak is exceedingly variable. It grows as a tall shrub or small tree over much of its range. However, it may also occur in dense shrub patches to 1 m (3.3 ft) high or as widely dispersed trees to 23 m (75 ft) tall and 90 cm (35 inches) in diameter at breast height (d.b.h.=1.4 m [4.5 ft]; Clary and Tiedemann 1986; Reynolds and others 1970). Gambel oak reproduces both by seed and vegetatively. However, reproduction by seed is less evident (Christensen 1955; Reynolds and others 1970), especially in the northern part of its range (Clary and Tiedemann 1992; but see Neilson 1981; Rogers 1982).

Gambel oak may occur in either mixed or pure stands. Where it occurs in mixed stands, it is usually associated

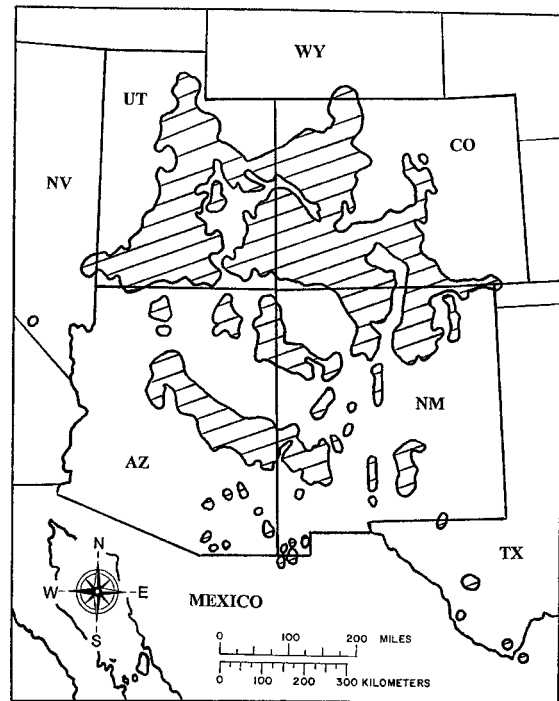


Figure 1—Biogeographic distribution of gambel oak (*Quercus gambelii* Nutt.) (redrawn from Little 1971).

with conifers such as white fir (*Abies concolor* [Gordon & Glend.] Lindl.), Rocky Mountain juniper (*Juniperus scopulorum* Sarg.), Utah juniper (*J. osteosperma* [Torr.] Little), ponderosa pine (*Pinus ponderosa* Lawson and C. Lawson), two-needle pinyon (*P. edulis* Engelm. in Wisl.), and Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco; Clary and Tiedemann 1986; Harper and others 1985; West 1989). In both mixed and pure stands, gambel oak can also be associated with a variety of shrubs, forbs, and graminoids (that is, grasses, sedges, and rushes). Herbaceous vegetation is sparse under gambel oak but commonly occurs in open areas between individual oak clumps (Allman 1953; Brown 1958). Although over 250 plant taxa have been reported from different gambel oak habitats (Allman 1953; Arnow 1971; Berrett 1958; Brown 1958; Christensen 1949; Forsling and Storm 1929; Hayward 1948; Kunzler and others 1981; McKell 1950; Shultz and Hysell 1996), it should be noted that any given gambel oak stand is likely to contain considerably fewer species. Kunzler and others (1981) found that gambel oak stands in central Utah supported only 25 plant species on average.

Gambel oak provides for a variety of uses and values. Because of its good heat-yielding qualities and prolific sprouting habit, it is of particular interest as fuelwood (Clary and Tiedemann 1992; Wagstaff 1984). Gambel oak also plays an important role in watershed protection by stabilizing soil, controlling erosion, and retarding snow melt (Brown 1958; Clary and Tiedemann 1992; Wright

and Bailey 1982). Numerous animal species use gambel oak to satisfy one or more of their habitat requirements, including food, food storage, refuge, and nesting (Hayward 1948; Marti 1977; Reynolds and others 1970). Gambel oak provides ample browse and hard mast for many game species, such as mule deer, white-tailed deer (*Odocoileus virginianus*), elk, peccary (*Pecari angulatus*), tassel-eared squirrel (*Sciurus aberti*), Merriam's wild turkey (*Meleagris gallopavo merriami*), band-tailed Pigeon (*Columba fasciata*), and montezuma quail (*Cyrtonyx montezumae*; Brown 1958; Clary and Tiedemann 1986; Reynolds and others 1970; Wright and Bailey 1982). In addition, it is used by many non-game species such as Lewis' woodpecker (*Melanerpes lewis*; Hayward 1948; Marti 1977).

Avian Communities of Gambel Oak

Community Composition

The earliest, although somewhat anecdotal, account of gambel oak bird communities was given by Tanner and Hayward (1934), who cite 13 species as occurring in this habitat. Since then, several authors have investigated bird community composition and structure in different gambel oak habitats in varying degrees of detail (Behle and Perry 1975; Berrett 1958; Block and others 1992; Frost 1947; Hayward 1948; LaRue 1994; Marti 1977; Perry 1973; Steinhoff 1978; Tatschl 1967; Walters 1981; Woodbury and Cottam 1962). Although most of these studies are not quantitative in nature, they do provide descriptive information on bird-habitat relationships in this vegetation type.

Compilation of results from these studies reveals 183 bird species that use gambel oak for at least part of the year (appendix A). Authors of Utah studies reported that between 49 and 140 (13 to 38 percent) of the 367 bird species known to occur in Utah could be found in gambel oak woodland and submontane shrub habitats (Behle and Perry 1975; Berrett 1958; Frost 1947; Hayward 1948; Marti 1977; Perry 1973; Walters 1981; Woodbury and Cottam 1962). The large variation in total number of species observed is likely a function of sampling area and effort. Reporting on bird communities of different gambel oak vegetation types in western Colorado, Steinhoff (1978) documented 62 species in gambel oak woodlands, 40 species in ponderosa pine/gambel oak forests, and 37 species in mixed conifer/gambel oak forests. Tatschl (1967), reporting only on residents and breeding migrants, documented a total of 50 bird species in a ponderosa pine/gambel oak forest in north-central New Mexico, as opposed to 20 species in woodland dominated by gambel oak. Block and others (1992), in an investigation of neotropical migrants, documented 45 species in a mixed

conifer forest in southeastern Arizona, where gambel oak comprised the understory component. LaRue (1994), in his investigation of a similar vegetation type in northern Arizona, found 64 species, as opposed to only six in submontane shrub dominated by gambel oak (appendix A).

The most common bird species of gambel oak (table 1) vary by geographic (northern vs. southern distribution limit of gambel oak) and habitat range (gambel oak woodland vs. mixed conifer-gambel oak forest). Species most characteristic of gambel oak woodlands in the northern part of the range include spotted towhee (*Pipilo maculatus*), Virginia's warbler (*Vermivora virginiae*), mourning dove (*Zenaida macroura*), and lazuli bunting (*Passerina amoena*). Species commonly found in the southern part of the range are hermit thrush (*Catharus guttatus*), red-faced warbler (*Cardellina rubrifrons*), Grace's warbler (*Dendroica graciae*), painted redstart (*Myioborus pictus*), and plumbeous vireo (*Vireo plumbeus*). Species common across the range include black-headed grosbeak (*Pheucticus melanocephalus*) and broad-tailed hummingbird (*Selasphorus platycercus*; table 1).

Although some species are extremely abundant in gambel oak, it should be noted that none of the species listed in appendix A and table 1 are confined to this vegetation type. Rather, gambel oak is the most characteristic habitat for many of these species.

Community Structure

Despite numerous accounts of avian community composition in gambel oak habitat, investigations of residency and guild structure are few. Several studies, however, suggest that gambel oak avian communities are characterized by a high proportion of breeding birds, a marked seasonality of use, and a guild structure dominated by shrub/tree nesting, ground feeding, and insectivorous birds. Breeding birds, the majority of which are migrants, constitute 79-95% of the gambel oak avian community; non-breeding birds, i.e., winter migrants, comprise 5-21%. From 53 to 87% of birds use gambel oak seasonally as either breeding (67-89%) or winter migrants (11-33%); 13-47% are residents, i.e., they occupy gambel oak year-round (Behle and Perry 1975; Berrett 1958; Hayward 1948; LaRue 1994; Marti 1977; Perry 1973; Walters 1981; table 2). Thus, large numbers of species use gambel oak throughout the year, although the number of species present within one season is low. Bird species richness is highest during summer, with a maximum of 63 different species having been reported from a particular site (Hayward 1948; appendix A).

We applied life history information from Ehrlich and others (1988) to bird species using gambel oak (appendix B), and subsequently grouped them into categories based on similarities in use of three resources: nesting

Table 1–List of most frequent/abundant bird species in three gambel oak (*Quercus gambelii* Nutt.) community studies.

Gambel oak woodland (North-central Utah)				Mixed conifer-Gambel oak forest (Southeast Arizona)	
Hayward (1948)		Wolfe and Reynolds (1996)		Block and others (1992)	
Species ^a	% Frequency ^b	Species	% Abundance	Species	% Frequency ^c
Spotted towhee	93.3	Spotted towhee	34.8	Hermit thrush	70.9
Virginia’s warbler	80.0	Blue-gray gnatcatcher	10.2	Red-faced warbler	70.9
Black-headed grosbeak	73.3	Virginia’s warbler	8.6	Black-headed grosbeak	65.8
Black-billed magpie	73.3	Lazuli bunting	4.9	Grace’s warbler	63.3
Broad-tailed hummingbird	56.6	Warbling vireo	4.3	Painted redstart	60.8
Green-tailed towhee	53.3	Lark sparrow	3.1	Plumbeous vireo	60.8
Mourning dove	50.0	Brown-headed cowbird	3.1	Western tanager	57.0
Red-tailed hawk	50.0	Gray flycatcher	2.5	American robin	54.4
Western scrub-jay	50.0	Mourning dove	2.2	Yellow-rumped warbler	46.8
Lazuli bunting	36.6	Rock wren	2.2	Broad-tailed hummingbird	45.6
		Dark-eyed junco	2.2		

^a Common names follow American Ornithologists’ Union (1998).
^b Expressed as percent of times a species was observed (n=30).
^c Expressed as percent of census stations where a species was observed (n=79).

substrate, foraging substrate, and food type. For selected studies (Behle and Perry 1975; Hayward 1948; Marti 1977; Perry 1973), we then summarized life history traits of all species to describe nesting and feeding guild structure for this community (figure 2). Nesting guild is dominated by species nesting in shrubs and trees (56%), followed by ground (23%) and snag nesters (9%; figure 2A). The feeding guild consists of primarily ground feeders (56%), followed by birds feeding in shrubs and trees (23%) and aerial feeders (18%; figure 2B). Ground-feeding birds are especially prominent among permanent residents and less pronounced among summer residents. Aerial feeders are restricted almost exclusively to summer residents and are absent during winter. Species feeding

on herbaceous vegetation or in the water are extremely rare (3% and 1%, respectively; figure 2B). Most birds are insectivores (58%), followed by granivores (16%), carnivores (13%), and omnivores (5%; figure 2C). Insectivores are especially prominent among summer residents and less pronounced among permanent residents. Granivores are most prominent during winter, whereas carnivores are most pronounced among permanent residents. Omnivores, which account for only a small portion of the overall bird community, assume a more prominent role among permanent residents (15%; figure 2C). The pronounced seasonal variation of food habits is supported by Frost (1947), who examined 278 stomachs of 56 bird species in gambel oak (figure 3).

Table 2–Proportion of breeding/non-breeding and resident/migrant birds in different gambel oak (*Quercus gambelii* Nutt.) communities.

	Gambel oak woodland				Submontane shrub			Mixed conifer
	Hayward (1948)	Berrett (1958)	Perry (1973)	Marti (1977)	Behle and Perry (1975)	Walters (1981)	LaRue (1994)	LaRue (1994)
Breeding birds	0.83	0.79	0.88	0.83	0.93	0.80	0.80	0.95
Residents	0.43	0.35	0.39	0.25	0.51	0.17	0.50	0.55
Migrants	0.57	0.65	0.61	0.75	0.49	0.83	0.50	0.45
Non-breeding birds (winter migrants)	0.17	0.21	0.12	0.17	0.07	0.20	0.20	0.05
Residents	0.36	0.28	0.35	0.21	0.47	0.13	0.40	0.52
Migrants	0.64	0.72	0.65	0.79	0.53	0.87	0.60	0.48
Breeding migrant	0.73	0.71	0.82	0.78	0.88	0.77	0.67	0.89
Winter migrants	0.27	0.29	0.18	0.22	0.12	0.23	0.33	0.11

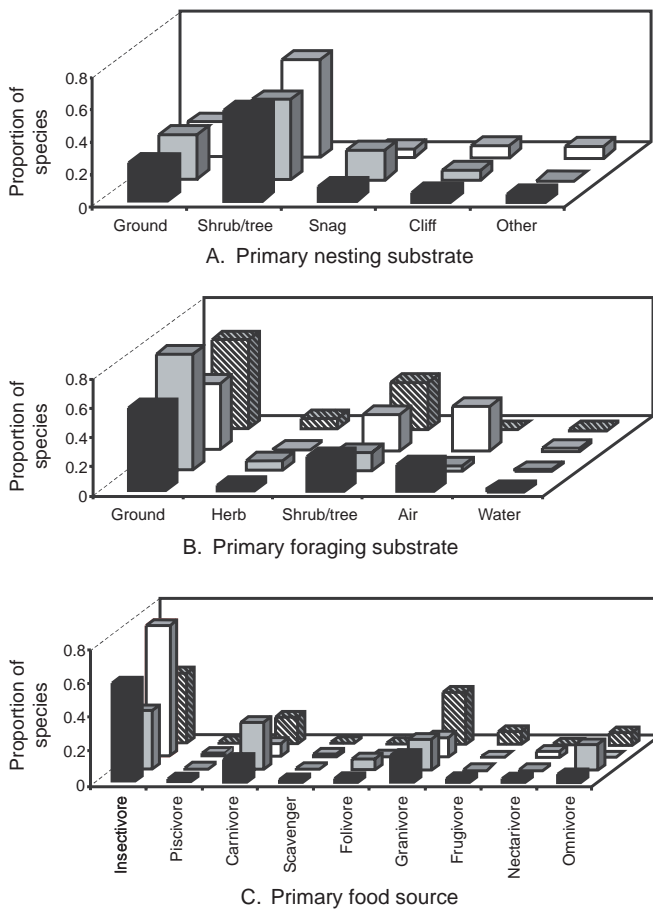


Figure 2—Proportion of overall (white, $S = 135$), resident (gray, $S = 33$), breeding migrant (black, $S = 75$), and winter migrant (hatched, $S = 27$) bird species in different nesting (A) and feeding (B, C) guilds for gambel oak (*Quercus gambelii* Nutt.) woodlands/shrublands in north-central Utah (life history information from Ehrlich and others 1988; occurrence data from Hayward 1948, Perry 1973, Behle and Perry 1975, and Marti 1977). Where authors differed on residency status, personal knowledge of gambel oak avian communities in north-central Utah was used to determine residency status.

Bird-Habitat Relationships

Feeding relationships—Gambel oak provides birds with a variety of food resources on a year-round basis, including acorns, fruits, buds, seeds, insects, and mammalian and avian prey (Woodbury and Cottam 1962). In fall and winter, acorns are used by several species, including montezuma quail, Merriam’s wild turkey, band-tailed pigeon, Lewis’ woodpecker, Steller’s jay (*Cyanocitta stelleri*), western scrub-jay (*Aphelocoma californica*), pinyon jay (*Gymnorhinus cyanocephalus*), black-billed magpie (*Pica pica*), and spotted towhee (Christensen 1949; Frost 1947; Harper and others 1978; Hayward 1948; Hoffman 1962; Reynolds and others 1970). Neff (1947) found that the inland range of the

band-tailed pigeon closely coincides with the range of gambel oak. Ligon (1946) noted that gambel oak is the most dependable and preferred acorn producer within Merriam’s wild turkey range.

Shrubs associated with gambel oak (for example, serviceberry, *Amelanchier alnifolia* [Nutt.] Nutt. ex M.Roem.; chokecherry, *Prunus virginiana* L.; and netleaf hackberry, *Celtis laevigata* Willd. var. *reticulata* [Torr.] L.D.Benson) provide fruits that are used by northern flicker (*Colaptes auratus*), American robin (*Turdus migratorius*), Townsend’s solitaire (*Myadestes townsendi*), waxwings (*Bombocilla* spp.), and spotted towhee throughout fall and winter. The winter buds of many shrubs are eaten by blue grouse (*Dendragapus obscurus*), ruffed grouse (*Bonasa umbellus*), evening grosbeak (*Coccothraustes vespertinus*), and pine grosbeak (*Pinicola enucleator*).

Ground-feeding birds, such as California quail (*Callipepla californica*), ring-necked pheasant (*Phasianus colchicus*), western meadowlark (*Sturnella neglecta*), house finch (*Carpodacus mexicanus*), rosy finch (*Leucosticte arctoa*), pine siskin (*Carduelis pinus*), American goldfinch (*C. tristis*), spotted towhee, dark-eyed junco (*Junco hyemalis*), and white-crowned sparrow (*Zonotrichia leucophrys*) glean a variety of seeds from the herbaceous plant layer and the well-developed litter layer found under gambel oak during late summer, fall, and winter (Frost 1947; Hayward 1948).

Invertebrates from vegetation, ground, and air represent the primary food source for many birds during spring and summer, including black-capped chickadee (*Poecile atricapillus*), rock wren (*Salpinctes obsoletus*), warbling

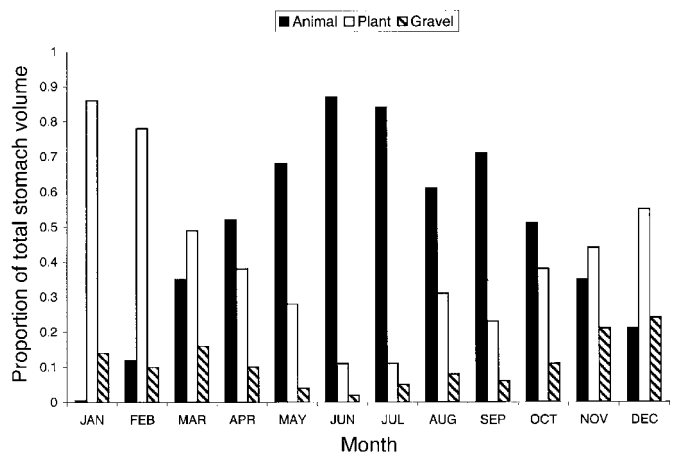


Figure 3—Proportion of animal matter, plant matter, and gravel by month in 278 stomachs of 56 bird species collected from gambel oak (*Quercus gambelii* Nutt.) woodland in north-central Utah (Frost 1947).

vireo (*Vireo gilvus*), orange-crowned warbler (*Vermivora celata*), Virginia's warbler, yellow-rumped warbler (*Dendroica coronata*), and lazuli bunting (Frost 1947). Hayward (1948) compared invertebrate densities among different layers of gambel oak vegetation. He found six times fewer invertebrates on the ground in open areas than under oak, where invertebrates were protected and able to move more freely, and 30 times as many invertebrates on the ground under oak than in either the herb/low shrub or the tall shrub layer (table 3). In winter, dormant invertebrates found on twig surfaces are used by black-capped chickadee and mountain chickadee (*Poecile gambeli*), whereas insect larvae found in twig and leaf galls of gambel oak and netleaf hackberry (Brewster 1951; Hayward 1948) are used by western scrub-jay, Steller's jay, and northern flicker.

The gambel oak vegetation type also provides a variety of mammalian and avian prey for carnivorous birds. Raptors such as red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), and long-eared owl (*Asio otus*) take advantage of high rodent and lagomorph densities associated with gambel oak (Hayward 1948), whereas sharp-shinned and Cooper's hawk (*Accipiter striatus*, *A. cooperii*) are able to prey on an abundance of avian species.

Nesting relationships—The lack in structural diversity of gambel oak reported by some authors (Marti 1977; Woodbury and Cottam 1962) suggests limited opportunities for bird diversity. Nonetheless, this habitat offers a variety of nesting opportunities for breeding birds. Ground-nesting birds, such as Virginia's warbler and spotted towhee, are known to take advantage of the dense litter layer and abundant roots under oak thickets to conceal their nests. The herbaceous layer, which is too sparse and fragile to support any nests itself, affords additional protection to ground nests (Hayward 1948). The dense branching habit of gambel oak also provides ample substrate for shrub-nesting birds, such as gray flycatcher (*Empidonax wrightii*), western scrub-jay, black-billed magpie, MacGillivray's warbler (*Oporornis tolmiei*), green-tailed towhee (*Pipilo chlorurus*), black-headed grosbeak, and lazuli bunting (Hayward 1941, 1948). These bird species rely exclusively on dense foliage for protection. Clary and Tiedemann (1986, 1987) found that snags comprised 12.3% and 7.6% of aboveground standing biomass in shrub/small tree and large tree gambel oak stands, respectively. This apparent abundance of snags provides opportunities for cavity-nesting birds, such as Lewis' woodpecker, northern flicker, black-capped chickadee, and mountain bluebird (*Sialia currucoides*). The rocky substrate often associated with this vegetation type also features an abundance of crevices, which are used for nesting by canyon wren (*Catherpes mexicanus*) and rock wren (Ehrlich and others 1988).

Table 3—Invertebrate densities in different layers of gambel oak (*Quercus gambelii* Nutt.) woodland in north-central Utah, 1940-1945 (Hayward 1948).

Layer	Average no. of invertebrates/m ²
Ground, open	255.9
Ground, under oak	1641.4
Herb/low shrub	54.3
Tall shrub	48.4

The dense branches and foliage of gambel oak are well-suited as escape cover for many bird species (Woodbury and Cottam 1962). Hayward (1948) noted that rather than fleeing from shrub to shrub, birds in gambel oak habitat often rely on the protection offered by the interior of individual oak clumps, from which they are difficult to dislodge. Birds that exemplify this behavior include Virginia's warbler, western scrub-jay, and spotted towhee (Hayward 1948). Ground-feeding birds, such as dark-eyed junco or chipping sparrow (*Spizella passerina*), often use exposed branches to watch for predators between feeding bouts, and when disturbed, also seek refuge in clumps of gambel oak (Hayward 1948).

Gambel oak also provides birds with perch sites for singing and displaying. Although some species, such as black-headed grosbeak, sing from well within the protection of dense foliage, many birds, including the spotted towhee and lazuli bunting, prefer exposed positions. These snags and dead branches (Hayward 1948) can make up 18.9-23.4% of aboveground standing biomass in gambel oak stands (Clary and Tiedemann 1986, 1987).

Spatial distribution of bird-habitat relationships—Using mostly anecdotal evidence, Hayward (1948) investigated relationships between birds and gambel oak habitat by recognizing three layers used by birds: ground layer, shrub layer, and aerial layer. He found that many bird species used different layers for different activities, such as nesting and feeding (table 4). The spotted towhee uses the ground layer for nesting, feeding, and escape cover, but perches and sings from exposed branches in the shrub layer. The Virginia's warbler nests on the ground, but uses the shrub layer for feeding and cover. Lazuli bunting and black-headed grosbeak are entirely confined to the shrub layer. Both western scrub-jay and black-billed magpie nest in the shrub layer; however, the western scrub-jay feeds in the shrub layer and seeks cover on the ground, whereas the black-billed magpie feeds on the ground and escapes into the shrub layer when disturbed. The common poorwill (*Phalaenoptilus nuttallii*) nests and hides on the ground but feeds exclusively in the aerial layer.

Table 4—Principal nesting and feeding layers of 30 bird species found in gambel oak (*Quercus gambelii* Nutt.) woodland in north-central Utah (Hayward 1948).

Species ^a	Principal nesting layer	Principal feeding layer
Turkey vulture	Ground	Ground
Sharp-shinned hawk	Shrub	Shrub
Red-tailed hawk	Ground	Ground
American kestrel	Ground	Ground
Prairie falcon	Ground	Ground
Ring-necked pheasant	Ground	Ground
Ruffed grouse	Ground	Ground
Mourning dove	Shrub	Ground
Common poorwill	Ground	Aerial
White-throated swift	Ground	Aerial
Broad-tailed hummingbird	Shrub	Ground
Northern flicker	Shrub	Ground
Warbling vireo	Shrub	Shrub
Steller's jay	Shrub	Shrub
Western scrub-jay	Shrub	Shrub
Black-billed magpie	Shrub	Ground
Black-capped chickadee	Shrub	Shrub
Rock wren	Ground	Ground
Canyon wren	Ground	Ground
American robin	Shrub	Ground
Orange-crowned warbler	Ground	Shrub
Virginia's warbler	Ground	Shrub
Yellow-rumped warbler	Shrub	Shrub
MacGillivray's warbler	Shrub	Shrub
Green-tailed towhee	Ground	Ground
Spotted towhee	Ground	Ground
Chipping sparrow	Shrub	Shrub
Dark-eyed junco	Ground	Ground
Black-headed grosbeak	Shrub	Shrub
Lazuli bunting	Shrub	Shrub

^a Common names and order in which species are presented follow American Ornithologists' Union (1998).

Table 5—Bird species occurring in the gambel oak (*Quercus gambelii* Nutt.) vegetation type listed as endangered (E), threatened (T), or of special concern (SC) by the U.S. Fish and Wildlife Service (Fed) under the Endangered Species Act (16 U.S.C.A. §§ 1531-1543), or by the responsible state agency in the four principal states of gambel oak range.

Species ^a	Category	Listing Agency ^b
Bald eagle	T	Fed, CO, NM, UT
	SC	AZ
American peregrine falcon	E	UT
	T	NM
*Southwestern willow flycatcher	E	Fed, NM, UT
	SC	AZ
*Northern goshawk	SC	AZ, UT
*Swainson's hawk	SC	AZ, UT
*Ferruginous hawk	T	UT
	SC	AZ, CO
*Northern sage grouse	SC	CO, UT
*Gunnison's sage grouse	SC	CO
*Burrowing owl	T	CO
	SC	UT
*Short-eared owl	SC	UT
*Lewis's woodpecker	SC	UT
*Williamson's sapsucker	SC	UT
*Bell's vireo	T	NM
	SC	UT
*Blue grosbeak	SC	UT
*Veery	SC	AZ
*Gray catbird	SC	AZ

^a Nomenclature for common and scientific names, as well as order in which species are presented, follow American Ornithologists' Union (1998).

^b Sources: U.S. Fish and Wildlife Service Database; Arizona Game and Fish Department (*In prep.*); Colorado Division of Wildlife Database; New Mexico Department of Game and Fish Database; Messmer and others (1998). Arizona does not list threatened or endangered species; New Mexico does not list species of special concern.

^c Asterisks denote species for which oak is a primary nesting habitat.

Bird Species of Concern

A number of species occurring in gambel oak habitat require special management consideration, either because they are listed as endangered or threatened under the federal Endangered Species Act (ESA; 16 U.S.C.A. §§ 1531-1543), or because they are listed as endangered, threatened, or of special concern by a state wildlife agency (table 5). Currently, only two species likely to be found in gambel oak are listed under ESA by the United States Fish and Wildlife Service: bald eagle (*Haliaeetus leucocephalus*), and southwestern willow flycatcher (*Empidonax traillii extimus*; table 5). A third, the American peregrine falcon (*Falco peregrinus anatum*), was recently delisted (effective date August 25, 1999). The bald

eagle and American peregrine falcon forage in a wide variety of vegetation types, including gambel oak. The southwestern willow flycatcher is found in riparian areas, including those within the gambel oak vegetation type. In addition to these species, 12 others are listed as endangered, threatened, or of special concern by individual states. These listings are usually the responsibility of the state wildlife agency and may afford legal protection to the species in question. Species may also be listed to characterize their conservation status only, with no special protection afforded, such as in Utah (Messmer and others 1998).

Conservation concerns have also been identified for species experiencing population declines, as determined

by Breeding Bird Survey data (DeGraaf and Rappole 1995; appendix C). Twelve species known to nest and feed in the gambel oak vegetation type experienced significant ($P < 0.05$) declines within the physiographic provinces of gambel oak range. Five species (western wood-pewee [*Contopus sordidulus*], horned lark [*Eremophila alpestris*], MacGillivray's warbler, chipping sparrow, and savannah sparrow [*Passerculus sandwichensis*]) show significant, long-term declines between 1966 and 1994. Of these, western wood-pewee, horned lark, and chipping sparrow also declined throughout Western North America. Four additional species (American kestrel [*Falco sparverius*], common night-hawk [*Chordeiles minor*], yellow-rumped warbler, and vesper sparrow [*Pooecetes gramineus*]) show a more recent, short-term decline over the period of 1980 to 1994. Of these, American kestrel declined across Western North America during the same time period. Three species (loggerhead shrike [*Lanius ludovicianus*], violet-green swallow [*Tachycineta thalassina*], and Brewer's blackbird [*Euphagus cyanocephalus*]) declined over both periods, with Brewer's blackbird showing a similar decrease throughout Western North America. An additional 18 species known to use gambel oak that do not show a significant trend within gambel oak range show a significant decline across Western North America (appendix C).

Eleven species within the physiographic provinces or states comprising the Gambel oak vegetation zone are accorded a very high conservation priority by Partners in Flight (PIF; tables 6 and 7; figure 4), based on cumulative concern scores ranging from 7 to 35 (appendix C). Three of these, the Virginia's warbler, Grace's warbler, and red-faced warbler, are common species of gambel oak vegetation (table 1). All three are neotropical migratory birds that use gambel oak extensively for both nesting and feeding. An additional two species, the Lewis' woodpecker, which is also considered to be of special concern in Utah (table 5), and the ferruginous hawk (*Buteo regalis*), are considered characteristic of gambel oak and mixed gambel oak woodlands (Steinhoff 1978). The Bell's vireo (*Vireo bellii*), which is listed as threatened in New Mexico (table 5), is a breeding migrant in the southern portion of gambel oak range (tables 6 and 7).

An additional 76 species are given high conservation priority by PIF (tables 6 and 7). Of these, the most common or characteristic of gambel oak and mixed gambel oak/conifer woodlands include California quail, broad-tailed hummingbird, western wood-pewee, gray flycatcher, cordilleran flycatcher (*Empidonax occidentalis*), ash-throated flycatcher (*Myiarchus cinerascens*), plumbeous vireo, warbling vireo, western scrub-jay, rock wren, western bluebird (*Sialia mexicana*), mountain bluebird, black-throated gray warbler (*Dendroica nigrescens*), painted redstart, western tanager (*Piranga ludoviciana*),

green-tailed towhee, lark sparrow (*Chondestes grammacus*), black-headed grosbeak, and lazuli bunting. Ten of the 76 species are listed by Steinhoff (1978) as being dependent on (dusky flycatcher [*Empidonax oberholseri*] and pinyon jay) or influenced by (pygmy nuthatch [*Sitta pygmaea*]) mixed oak/conifer woodlands, or as strongly influenced by all gambel oak vegetation types (blue grouse, band-tailed pigeon, common night-hawk, common poorwill, violet-green swallow, Townsend's solitaire, and MacGillivray's warbler).

Implications for Management and Future Research

Oak woodlands provide a variety of resources including watershed protection, grazing, and recreation (Harper and others 1985; Thomas 1997). Recent publications indicate an increasing concern over loss of oak habitat in states bordering the Pacific coast, as a burgeoning population puts increasing pressure on oak vegetation through recreation and urban expansion (Pillsbury and others 1997; Saab and Rich 1997). The gambel oak vegetation type, with its foothill location and proximity to many urban centers, is likely to suffer a similar fate. Residential and commercial development and a concomitant increase in recreation from expanding populations may result in substantial habitat loss, fragmentation, and successional changes over the next decade. Issues of land ownership and public perceptions regarding management options may further exacerbate these changes.

Gambel oak vegetation is particularly vulnerable to damage and loss. For example, Utah Gap analysis (Edwards and others 1997) reveals that fully one-third (36%) of the 800,000 ha (2 million acres) dominated by oak are privately owned and designated as category 4 management status; that is, they have little or no government protection from development. Much of this land may thus be lost to urbanization and commercial development in the near future. Another 58% of oak woodlands in Utah are accorded limited protection as public lands with unrestricted access (category 3). These lands will be subject to increased fragmentation due to recreational activities, trail building, and campground development. Currently, only 0.01% of oak woodlands in Utah are strictly protected (category 1).

Traditional management practices are aimed at increasing understory vegetation to provide for grazing of domestic livestock and big game species. Gambel oak can provide up to 75% of the forage available to overwintering deer populations (Harper and others 1985). Grazing and the suppression of natural fire cycles have resulted in a decrease in herbaceous undergrowth and an increase in less fire-tolerant woody species such

Table 6—Species occurring in the gambel oak (*Quercus gambelii* Nutt.) vegetation type that are of conservation concern, based on Partners in Flight (PIF) state scores^a.

Range in PIF concern score and definition (Hunter and others 1993)	Species ^b and PIF concern score, in decreasing order of concern, by state			
	Arizona ^c	Colorado ^c	New Mexico ^c	Utah ^d
30-35 Extremely high conservation priority	none	none	none	none
24-29 Very high conservation priority	Red-faced warbler - 28 Virginia's warbler - 26 Cassin's kingbird - 25 Bell's vireo - 25 Lewis' woodpecker - 24	Sage grouse - 25 Ferruginous hawk - 24 Virginia's warbler - 24	Red-faced warbler - 26 Virginia's warbler - 25 Sage grouse - 24	Lewis' woodpecker - 28 Virginia's warbler - 26 Sage grouse - 25 Bell's vireo - 25 Black rosy-finch - 25
19-23 High conservation priority	Willow flycatcher - 23 Gray flycatcher - 23 Western bluebird - 23 Painted redstart - 23 Swainson's hawk - 22 Ferruginous hawk - 22 Prairie falcon - 22 Flammulated owl - 22 Greater pewee - 22 Olive warbler - 22 Black-throated gray warbler - 22 Grace's warbler - 22 Rufous-crowned sparrow - 22 Scott's oriole - 22 Blue grouse - 21 Common poorwill - 21 Black-chinned hummingbird - 21 Williamson's sapsucker - 21 Red-naped sapsucker - 21 Dusky flycatcher - 21 Cordilleran flycatcher - 21 Pygmy nuthatch - 21 Mountain bluebird - 21 Sage sparrow - 21 Band-tailed pigeon - 20 Broad-tailed hummingbird - 20 Hammond's flycatcher - 20 Hutton's vireo - 20 Pinyon jay - 20 Juniper titmouse - 20 Bald eagle - 19 Northern goshawk - 19 Peregrine falcon - 19 Olive-sided flycatcher - 19 Western wood-pewee - 19 Sulphur-bellied flycatcher - 19 Plumbeous vireo - 19 Rock wren - 19 Canyon wren - 19 MacGillivray's warbler - 19 Green-tailed towhee - 19 Black-throated sparrow - 19 Black-headed grosbeak - 19	Black-chinned hummingbird - 23 Bell's vireo - 23 Burrowing owl - 22 Lewis' woodpecker - 22 Williamson's sapsucker - 22 Grace's warbler - 22 Flammulated owl - 21 Red-naped sapsucker - 21 Cordilleran flycatcher - 21 Black-throated gray warbler - 21 Northern harrier - 20 Swainson's hawk - 20 Prairie falcon - 20 Blue grouse - 20 Short-eared owl - 20 Common poorwill - 20 Broad-tailed hummingbird - 21 Gray flycatcher - 20 Dusky flycatcher - 20 Cassin's kingbird - 20 Plumbeous vireo - 20 Juniper titmouse - 20 MacGillivray's warbler - 20 Western tanager - 20 Sage sparrow - 20 Scott's oriole - 20 Peregrine falcon - 19 Band-tailed pigeon - 19 Olive-sided flycatcher - 19 Hammond's flycatcher - 19 Western scrub-jay - 19 Violet-green swallow - 19 Pygmy nuthatch - 19 Western bluebird - 19 Green-tailed towhee - 19 Rufous-crowned sparrow - 19 Brewer's sparrow - 19 Lazuli bunting - 19	Prairie falcon - 23 Lewis's woodpecker - 23 Greater pewee - 23 Cassin's kingbird - 23 Bell's vireo - 23 Olive warbler - 23 Ferruginous hawk - 22 Flammulated owl - 22 Black-chinned hummingbird - 22 Williamson's sapsucker - 22 Loggerhead shrike - 22 Black-throated gray warbler - 22 Grace's warbler - 22 Painted redstart - 22 Swainson's hawk - 21 Blue grouse - 21 Broad-tailed hummingbird - 20 Red-naped sapsucker - 21 Hammond's flycatcher - 21 Gray flycatcher - 21 Violet-green swallow - 21 Juniper titmouse - 21 Mountain bluebird - 21 Rufous-crowned sparrow - 21 Sage sparrow - 21 Scott's oriole - 21 Peregrine falcon - 20 Dusky flycatcher - 20 Cordilleran flycatcher - 20 Plumbeous vireo - 20 Hutton's vireo - 20 Warbling vireo - 20 Pygmy nuthatch - 20 Green-tailed towhee - 20 Northern goshawk - 19 Peregrine falcon - 19 Band-tailed pigeon - 19 Burrowing owl - 19 Common nighthawk - 19 Western wood-pewee - 19 Pinyon jay - 19 Western bluebird - 19 MacGillivray's warbler - 19 Black-headed grosbeak - 19 Bullock's oriole - 19	Ferruginous hawk - 23 Broad-tailed hummingbird - 23 Gray flycatcher - 23 Cordilleran flycatcher - 23 Black-throated gray warbler - 23 Brewer's sparrow - 23 Franklin's gull - 22 Western screech-owl - 22 Calliope hummingbird - 22 Williamson's sapsucker - 22 Olive-sided flycatcher - 22 Hammond's flycatcher - 22 Northern goshawk - 21 Peregrine falcon - 21 Prairie falcon - 21 Ruffed grouse - 21 Blue grouse - 21 Northern pygmy-owl - 21 Red-naped sapsucker - 21 Dusky flycatcher - 21 Cassin's kingbird - 21 Plumbeous vireo - 21 Pinyon jay - 21 Juniper titmouse - 21 Pygmy nuthatch - 21 Townsend's solitaire - 21 Veery - 21 Grace's warbler - 21 Rufous-crowned sparrow - 21 Blue grosbeak - 21 Scott's oriole - 21 Bald eagle - 20 Common poorwill - 20 Black-chinned hummingbird - 20 Willow flycatcher - 20 Loggerhead shrike - 20 Mountain chickadee - 20 Mountain bluebird - 20 Gray catbird - 20 Sage thrasher - 20 Green-tailed towhee - 20 Black-throated sparrow - 20 Sage sparrow - 20 White-throated swift - 19 Flammulated owl - 19 Burrowing owl - 19 Short-eared owl - 19 Western wood-pewee - 19 Clark's nutcracker - 19 Canyon wren - 19 Golden-crowned kinglet - 19 Western bluebird - 19 Lark sparrow - 19 Black-headed grosbeak - 19 Lazuli bunting - 19 Bullock's oriole - 19

^a PIF assigns species concern scores using a geographically based prioritization scheme that can be defined either ecologically (by physiographic province) or politically (by state). Species are assigned a rank score from 1 (low concern) to 5 (high concern) in seven criteria that reflect a species' potential to become extirpated: global abundance, global breeding distribution, global wintering distribution, threats to breeding within state or physiographic province, threats to non-breeding within state or physiographic province, state or physiographic province population trend, and area importance (abundance and distribution relative to global range). The cumulative concern score thus ranges from 7 to 35 (Hunter and others 1993).

^b Common names follow American Ornithologists' Union (1998).

^c Source: Colorado Bird Observatory Database.

^d Source: Utah Division of Wildlife Resources Database.

Table 7–Species occurring in the gambel oak (*Quercus gambelii* Nutt.) vegetation type that are of conservation concern, based on Partners in Flight (PIF) physiographic province scores^a.

Range in PIF concern score and definition (Hunter and others 1993)	Species ^b and PIF concern score ^c , in decreasing order of concern, by physiographic province number and name				
	62 Southern Rocky Mountains	69 Utah Mountains	80 Basin and Range	84 Mogollon Rim	87 Colorado Plateau
30-35 Extremely high conservation priority	none	none	none	none	none
24-29 Very high conservation priority	none Virginia's warbler - 24	Lewis' woodpecker - 24 Prairie falcon - 24 Franklin's gull - 24	Sage grouse - 25 Virginia's warbler - 26 Cassin's kingbird - 24 Grace's warbler - 24	Red-faced warbler - 27	Red-faced warbler - 25
19-23 High conservation priority	Lewis' woodpecker - 23 Williamson's sapsucker - 23 Virginia's warbler - 23 Grace's warbler - 23 Flammulated owl - 22 Swainson's hawk - 21 Ferruginous hawk - 21 Red-naped sapsucker - 21 Cordilleran flycatcher - 21 Prairie falcon - 20 Blue grouse - 20 Broad-tailed hummingbird - 20 Hammond's flycatcher - 20 Plumbeous vireo - 20 Black-throated gray warbler - 20 Sage sparrow - 20 Lazuli bunting - 20 Peregrine falcon - 19 Band-tailed pigeon - 19 Common poorwill - 19 Dusky flycatcher - 19 Cassin's kingbird - 19 Pinyon jay - 19 Violet-green swallow - 19 Pygmy nuthatch - 19 Wilson's warbler - 19 Green-tailed towhee - 19 Brewer's sparrow - 19	Gray flycatcher - 22 Dusky flycatcher - 22 Black-throated gray warbler - 22 Prairie falcon - 21 Calliope hummingbird - 21 Pinyon jay - 21 Lazuli bunting - 21 Swainson's hawk - 20 Scott's oriole - 20 Golden eagle - 19 Common poorwill - 19 Clark's nutcracker - 19 Juniper titmouse - 19 Canyon wren - 19 Western bluebird - 19 Townsend's solitaire - 19 Green-tailed towhee - 19	Ferruginous hawk - 23 Virginia's warbler - 23 Sage sparrow - 23 Black rosy-finch - 23 Flammulated owl - 22 Short-eared owl - 22 Calliope hummingbird - 22 Lewis' woodpecker - 22 Williamson's sapsucker - 22 Gray flycatcher - 22 Pinyon jay - 22 California quail - 21 Black-chinned hummingbird - 21 Red-naped sapsucker - 21 Hammond's flycatcher - 21 Black-throated gray warbler - 21 Scott's oriole - 21 Blue grouse - 20 Broad-tailed hummingbird - 20 Rufous hummingbird - 20 Cordilleran flycatcher - 20 Loggerhead shrike - 20 Sage thrasher - 20 Brewer's sparrow - 20 Northern harrier - 19 Northern goshawk - 19 Swainson's hawk - 19 Peregrine falcon - 19 California gull - 19 Northern pygmy-owl - 19 Common poorwill - 19 Dusky flycatcher - 19 Plumbeous vireo - 19 Juniper titmouse - 19 Veery - 19 Black-headed grosbeak - 19 Lazuli bunting - 19 Bullock's oriole - 19	Flammulated owl - 23 Lewis' woodpecker - 23 Gray flycatcher - 23 Bell's vireo - 23 Western bluebird - 23 Black-throated gray warbler - 23 Painted redstart - 23 Black-chinned hummingbird - 22 Broad-tailed hummingbird - 22 Williamson's sapsucker - 22 Red-naped sapsucker - 22 Greater pewee - 22 Rufous-crowned sparrow - 22 Scott's oriole - 22 Swainson's hawk - 21 Ferruginous hawk - 21 Willow flycatcher - 21 Dusky flycatcher - 21 Cordilleran flycatcher - 21 Juniper titmouse - 21 Pygmy nuthatch - 21 Black-headed grosbeak - 21 Northern goshawk - 20 Blue grouse - 20 Band-tailed pigeon - 20 Hutton's vireo - 20 Pinyon jay - 20 Violet-green swallow - 20 Prairie falcon - 19 Common poorwill - 19 Olive-sided flycatcher - 19 Say's phoebe - 19 Ash-throated flycatcher - 19 Plumbeous vireo - 20 Bewick's wren - 19 Mountain bluebird - 19 MacGillivray's warbler - 19 Green-tailed towhee - 19	Black-chinned hummingbird - 23 Gray flycatcher - 23 Ferruginous hawk - 22 Lewis' woodpecker - 22 Cassin's kingbird - 22 Bell's vireo - 22 Juniper titmouse - 22 Virginia's warbler - 22 Grace's warbler - 22 Swainson's hawk - 21 Flammulated owl - 21 Common poorwill - 21 Williamson's sapsucker - 21 Red-naped sapsucker - 21 Dusky flycatcher - 21 Cordilleran flycatcher - 21 Pinyon jay - 21 Black-throated gray warbler - 21 Scott's oriole - 21 Prairie falcon - 20 Blue grouse - 20 Band-tailed pigeon - 20 White-throated swift - 20 Willow flycatcher - 20 Hammond's flycatcher - 20 Western bluebird - 20 Green-tailed towhee - 20 Sage sparrow - 20 Black-headed grosbeak - 20 Burrowing owl - 19 Short-eared owl - 19 Broad-tailed hummingbird - 19 Western wood-pewee - 19 Western kingbird - 19 Loggerhead shrike - 19 Western scrub-jay - 19 Pygmy nuthatch - 19 Red-naped sapsucker - 21 Mountain bluebird - 19 MacGillivray's warbler - 19 Rufous-crowned sparrow - 19

^a PIF assigns species concern scores using a geographically based prioritization scheme that can be defined either ecologically (by physiographic province) or politically (by state). Species are assigned a rank score from 1 (low concern) to 5 (high concern) in seven criteria that reflect a species' potential to become extirpated: global abundance, global breeding distribution, global wintering distribution, threats to breeding within state or physiographic province, threats to non-breeding within state or physiographic province, state or physiographic province population trend, and area importance (abundance and distribution relative to global range). The cumulative concern score thus ranges from 7 to 35 (Hunter and others 1993).

^b Common names follow American Ornithologists' Union (1998).

^c Source: Colorado Bird Observatory Database.

as bigtooth maple (*Acer grandidentatum* Nutt.) and white fir (Harper and others 1985). Fire, herbicides, and mechanical treatments coupled with seeding programs have been used to reduce the dominance of oak and increase palatable grasses and forbs (Harper and others 1985, and references therein).

More recently, increased emphasis has been placed on recreation management issues, both in gambel oak and other vegetation types. Managers and recreationists are recognizing the importance of non-game species, including birds, both in inherent value and as part of the total “outdoor experience” sought by an urban populace.

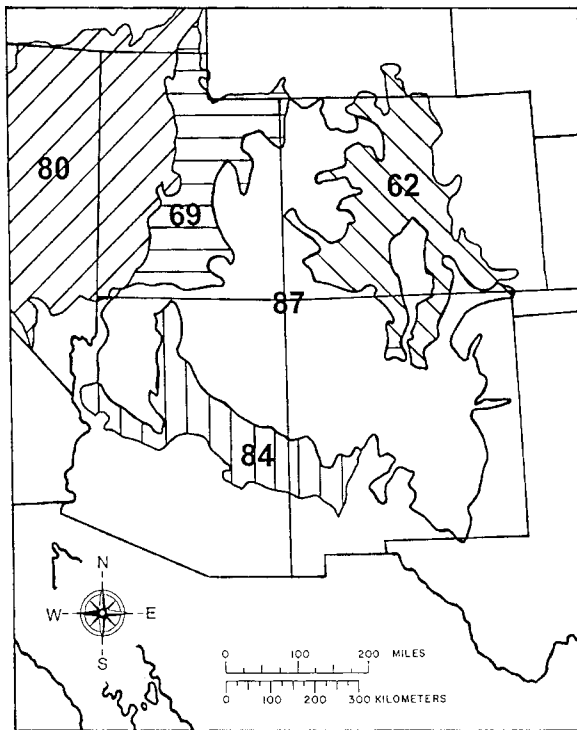


Figure 4—Physiographic provinces in gambel oak (*Quercus gambelii* Nutt.) range used by Partners in Flight for purpose of species prioritization: 62 = Southern Rocky Mountains, 69 = Utah Mountains, 80 = Basin and Range, 84 = Mogollon Rim, 87 = Colorado Plateau.

With over half of gambel oak woodlands occurring on public lands, it will become increasingly important for federal and state managers to consider non-game bird populations in their overall management plan. The effects of management practices on non-game birds must be considered if viable bird populations are to be maintained. Currently, little information exists on the effects of specific management actions on avian communities. Steinhoff (1978) provides some information on individual species' responses to fire, grazing, and cutting for Colorado oak associations; however, this information is not readily available because it is an unpublished report.

Future research of avian ecology in gambel oak should focus on closing apparent gaps in our knowledge of this community. A question that warrants further investigation is the response of gambel oak bird communities to wildfire, browsing by native ungulates, fuelwood harvesting, and management practices commonly associated with oakbrush control such as prescribed burning, herbicide application, or browsing by domestic livestock. In particular, it would be useful to investigate how type, intensity, and frequency of disturbance affects structural characteristics of gambel oak stands.

Other research needs include more basic questions about individual species' life histories and resource and habitat requirements. This includes species for which life history information in general is still sparse (for example, green-tailed towhee), as well as species that have not been studied in the gambel oak vegetation type, even though their life history may be very well known in other vegetation types. This understanding of individual species' relationships with different vegetation types may prove crucial in understanding and managing the dynamics of individual populations.

Increasing anthropogenic pressure predicted for gambel oak associations suggests that managers will need to use active management strategies to mitigate the effects of habitat loss and fragmentation. In the absence of needed definitive studies and until such studies can be completed, a few common-sense suggestions can be made.

The protection of riparian areas within the oak zone is of critical importance. Riparian areas are disproportionately valuable to birds and other wildlife species, particularly in the arid west (Saab and Rich 1997). In addition, some areas of contiguous habitat should be maintained. Where possible, management practices should mimic natural disturbance regimes such that a variety of successional stages, including the mature plant community, are available (Anderson 1980; Saab and Rich 1997). To ensure that this goal is being accomplished, monitoring of population trends of individual bird species may be desirable. Unfortunately, the current state of our knowledge about gambel oak woodlands does not allow us to easily identify species that may serve as indicators of the relative health of this community.

Until such knowledge becomes available, natural resource professionals involved in gambel oak management are referred to the list of frequent and abundant species provided in table 1. Because all species listed in this table are common, monitoring of population trends should be an easy task (for a review of methods, refer to Hamel and others 1996; Ralph and others 1993, 1995). In selecting species from this list, care should be taken to choose a representative sample of the community. A sample might include the following, for example: ground-nesting species requiring an extensive litter layer, such as Virginia's warbler or spotted towhee; shrub-nesting species requiring dense, thicket-like gambel oak stands, such as western scrub-jay, black-billed magpie, or lazuli bunting; and tree-nesting species, requiring tall tree stands of gambel oak characteristic of wetter sites, such as plumbeous vireo, warbling vireo, or chipping sparrow. With this kind of sample, it may be possible to assess the status of individual successional stages/growth forms of gambel oak.

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Appendix A (Con.)

Species ^a	Gambel oak woodland										Submontane shrub						Ponderosa pine/ gambel oak forest						Mixed conifer/ gambel oak forest					
	N.C. UT					W. CO					N.C. NM		UT		AZ		CO		NM		W. CO		N.C. AZ		W. CO		N. AZ	
	A ^b	B	C	D	E	F	G ^c	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
Western bluebird (<i>Sialia mexicana</i>)	-	-	-	-	-	X	-	B	X	B	-	-	-	-	-	-	R	-	-	-	-	-	-	-	-	-	-	-
Mountain bluebird (<i>Sialia currucoides</i>)	X	B	-	B	-	X	-	B	X	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Townsend's solitaire (<i>Myadestes townsendi</i>)	X	W	T	-	-	-	-	B	-	W	-	-	-	-	-	-	R	-	-	-	-	-	-	-	-	-	-	-
Veery (<i>Catharus fuscescens</i>)	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hermit thrush (<i>Catharus guttatus</i>)	X	B	-	-	-	-	-	B	-	-	-	-	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-
American robin (<i>Turdus migratorius</i>)	X	R	B	R	B	X	R	B	X	R	-	-	-	-	-	-	R	X	R	-	-	-	-	-	-	-	-	-
Gray catbird (<i>Dumetella carolinensis</i>)	-	B	-	-	B	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern mockingbird (<i>Mimus polyglottos</i>)	-	-	-	-	-	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sage thrasher (<i>Oreoscoptes montanus</i>)	-	T	T	-	T	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
European starling (<i>Sturnus vulgaris</i>) ⁹	-	-	-	-	T	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bohemian waxwing (<i>Bombycilla garrulus</i>)	X	W	-	-	-	-	-	W	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cedar waxwing (<i>Bombycilla cedrorum</i>)	X	W	-	-	-	-	-	W	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Olive warbler (<i>Peucedramus taeniatus</i>)	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	N/A	N/A	-	-	-	-	-	-	N/A	N/A	-	-	-	-	-	-	-	-	-	-
Tennessee warbler (<i>Vermivora peregrina</i>)	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	N/A	-	-	-	-	-	-	-	-	-	-	-
Orange-crowned warbler (<i>Vermivora celata</i>)	X	B	T	B	-	-	-	B	-	-	-	-	-	-	-	-	-	X	B	B	-	-	-	-	-	-	-	-
Nashville warbler (<i>Vermivora ruficapilla</i>)	X	T	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Virginia's warbler (<i>Vermivora virginiae</i>)	X	B	B	B	B	X	B	B	B	B	-	-	-	-	-	-	B	X	B	B	-	-	-	-	-	-	-	-
Yellow warbler (<i>Dendroica petechia</i>)	-	B	-	B	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-rumped warbler (<i>Dendroica coronata</i>)	X	B	T	B	T	X	-	-	-	-	-	-	-	-	-	-	-	X	B	-	-	-	-	-	-	-	-	-
Black-throated gray warbler (<i>Dendroica nigrescens</i>)	-	-	T	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hermit warbler (<i>Dendroica occidentalis</i>)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grace's warbler (<i>Setophaga graciae</i>)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American redstart (<i>Setophaga ruticilla</i>)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern waterthrush (<i>Seiurus noveboracensis</i>)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MacGillivray's warbler (<i>Oporornis tolmiei</i>)	X	B	T	B	T	X	B	T	T	T	-	-	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-
Wilson's warbler (<i>Wilsonia pusilla</i>)	X	T	-	-	-	-	-	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-faced warbler (<i>Cardellina rubrifrons</i>)	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	N/A	N/A	-	-	-	-	-	-	-	N/A	N/A	-	-	-	-	-	-	-	-	-
Painted redstart (<i>Myioborus pictus</i>)	N/A	N/A	N/A	N/A	N/A	-	-	N/A	N/A	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-breasted chat (<i>Icteria virens</i>)	-	B	B	-	B	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hepatic tanager (<i>Piranga flava</i>)	N/A	N/A	N/A	N/A	N/A	-	-	N/A	N/A	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Western tanager (<i>Piranga ludoviciana</i>)	X	T	T	M/T	T	X	B	T	T	T	-	-	-	-	-	-	B	-	-	-	-	-	-	-	-	-	-	-
Green-tailed towhee (<i>Pipilo chlorurus</i>)	-	B	T	B	T	X	B	B	X	B	-	-	-	-	-	-	B	X	X	-	-	-	-	-	-	-	-	-
Spotted towhee (<i>Pipilo maculatus</i>)	X	R	R	R	R	X	R	B	X	R	-	-	-	-	-	-	R	-	-	-	-	-	-	-	-	-	-	-
Rufous-crowned sparrow (<i>Aimophila ruficeps</i>)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American tree sparrow (<i>Spizella arborea</i>)	-	-	-	-	-	-	-	W	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(con.)

Appendix B—Life history traits (taken from Ehrlich and others 1988) of bird species reported from the gambel oak (*Quercus gambelii* Nutt.) vegetation type in the western United States (occurrence data from Hayward 1948, Woodbury and Cottam 1962, Tatschl 1967, Perry 1973, Behle and Perry 1975, Marti 1977, Steinhoff 1978, Walters 1981, Block and others 1992).

Species ^a	Nesting guild			Foraging guild		Food type ^g
	Activity ^b	Nest location ^c	Nest type ^d	Foraging layer ^e	Foraging method ^f	
Herons and vultures (Ciconiiformes)						
Great blue heron	D	N/A	N/A	WAT	SS	PI
Black-crowned night-heron	D	N/A	N/A	WAT	SS	PI
Turkey vulture	D	CL	-	GR	HS	SC
Waterfowl (Anseriformes)						
Mallard	D	N/A	N/A	WAT	DA	GV
Northern pintail	D	N/A	N/A	WAT	DA	GV
Bufflehead	D	N/A	N/A	WAT	SD	IN
Common goldeneye	D	N/A	N/A	WAT	SD	IN
Raptors (Falconiformes)						
Bald eagle	D	N/A	N/A	GR	HS	CA
Northern harrier	D	GR	PL	GR	LS	CA
Sharp-shinned hawk	D	TR	PL	AIR	AP	CA
Cooper's hawk	D	TR	PL	AIR	AP	CA
Northern goshawk	D	TR	PL	AIR	AP	CA
Swainson's hawk	D	TR	PL	GR	HS	CA
Red-tailed hawk	D	TR	PL	GR	HS	CA
Ferruginous hawk	D	TR	PL	GR	HP	CA
Rough-legged hawk	D	N/A	N/A	GR	HP	CA
Golden eagle	D	CL	PL	GR	HS	CA
American kestrel	D	SN	CA	GR	HP	IN/CA
Merlin	D	N/A	N/A	AIR	AP	CA
Peregrine falcon	D	N/A	N/A	AIR	AP	CA
Prairie falcon	D	CL	SC	AIR	AP	CA
Gallinaceous birds (Galliformes)						
Chukar	D	GR	SC	GR	GG	GV
Gray partridge	D	GR	SC	GR	GG	GV
Ring-necked pheasant	D	GR	SC	GR	GG	OM
Ruffed grouse	D	GR	SC	GR	GG	OM
Sage grouse	D	GR	SC	GR/SH/TR	GG/FG	IN/FO
Blue grouse	D	GR	SC	GR/SH/TR	GG/FG	IN/FO
California quail	D	GR	SC	GR	GG	GV
Shorebirds (Charadriiformes)						
Spotted sandpiper	D	GR	SC	GR	GG	IN
Franklin's gull	D	N/A	N/A	GR	GG	IN
Ring-billed gull	D	GR	SA	GR	GG	OM
California gull	D	N/A	N/A	WAT	LD	IN
Pigeons and doves (Columbiformes)						
Rock dove	D	CL	SA	GR	GG	GV
Band-tailed pigeon	D	TR	PL	SH/TR	FG	GV/FR
Mourning dove	D	SH/TR	SA	GR	GG	GV

(con.)

Appendix B (Con.)

Species ^a	Nesting guild			Foraging guild		
	Activity ^b	Nest location ^c	Nest type ^d	Foraging layer ^e	Foraging method ^f	Food type ^g
Owls (Strigiformes)						
Barn owl	N	SN	CA	GR	LS	CA
Flammulated owl	N	SN	CA	AIR	HA	IN
Western screech-owl	N	SN	CA	GR	SW	CA
Great horned owl	N	TR	-	GR	SW	CA
Northern pygmy-owl	N	SN	CA	GR	SW	CA
Burrowing owl	D/N	GR	BU	GR	SW	IN/CA
Long-eared owl	N	TR	-	GR	LS	CA
Short-eared owl	N	GR	SC	GR	LS	CA
Northern saw-whet owl	N	SN	CA	GR	SW	CA
Nightjars (Caprimulgiformes)						
Common nighthawk	D/N	GR	-	AIR	AF	IN
Common poorwill	N	GR	-	AIR	AF	IN
Swifts and hummingbirds (Apodiformes)						
White-throated swift	D	CL	CR	AIR	AF	IN
Black-chinned hummingbird	D	SH/TR	CU	HERB	HG	NE
Calliope hummingbird	D	SH/TR	CU	HERB	HG	NE
Broad-tailed hummingbird	D	SH/TR	CU	HERB	HG	NE
Rufous hummingbird	D	VN/TR	CU	HERB	HG	NE
Kingfishers (Coraciiformes)						
Belted kingfisher	D	BA	BU	WAT	HD	PI
Woodpeckers (Piciformes)						
Lewis' woodpecker	D	TR/SN	CA	AIR/GR	HA/GG	IN/GV
Williamson's sapsucker	D	TR	CA	TR	BG	IN
Red-naped sapsucker	D	TR	CA	TR	BG	IN
Downy woodpecker	D	SN	CA	TR	BG	IN
Hairy woodpecker	D	TR	CA	TR	BG	IN
Northern flicker	D	SN	CA	GR/TR	GG/BG	IN
Songbirds and passerines (Passeriformes)						
Olive-sided flycatcher	D	TR	CU	AIR	HA	IN
Greater pewee	D	TR	CU	AIR	HA	IN
Western wood-pewee	D	TR	CU	AIR	HA	IN
Willow flycatcher	D	SH	CU	AIR	HA	IN
Hammond's flycatcher	D	TR	CU	AIR	HA	IN
Gray flycatcher	D	SH	CU	AIR	HA	IN
Dusky flycatcher	D	SH	CU	AIR	HA	IN
Cordilleran flycatcher	D	TR	CU	AIR	HA	IN
Say's phoebe	D	CL	CU	AIR	HA	IN
Dusky-capped flycatcher	D	TR	CU	AIR	HA	IN
Ash-throated flycatcher	D	TR	CA	SH/TR	HG	IN
Sulphur-bellied flycatcher	D	TR	CA	AIR	HA	IN
Cassin's kingbird	D	N/A	N/A	AIR	HA	IN
Western kingbird	D	TR	CU	AIR	HA	IN
Eastern kingbird	D	TR	CU	AIR	HA	IN
Loggerhead shrike	D	TR	CU	GR	SW	IN/CA
Northern shrike	D	N/A	N/A	GR	SW	CA

(con.)

Appendix B (Con.)

Species ^a	Nesting guild			Foraging guild		
	Activity ^b	Nest location ^c	Nest type ^d	Foraging layer ^e	Foraging method ^f	Food type ^g
Bell's vireo	D	SH	CU	SH/TR	FG	IN
Plumbeous vireo	D	TR	CU	SH/TR	FG	IN
Hutton's vireo	D	TR	CU	SH/TR	FG	IN
Warbling vireo	D	SH/TR	CU	SH/TR	FG	IN
Red-eyed vireo	D	N/A	N/A	SH/TR	HG	IN
Steller's jay	D	SH/TR	CU	GR	GG	OM
Blue jay	D	N/A	N/A	GR	GG	OM
Western scrub-jay	D	SH/TR	CU	GR	GG	OM
Pinyon jay	D	N/A	N/A	GR	GG	OM
Clark's nutcracker	D	N/A	N/A	SH/TR	FG	OM
Black-billed magpie	D	SH/TR	SP	GR	GG	OM
American crow	D	TR	CU	GR	GG	OM
Common raven	D	CL	CU	GR	GG	OM
Horned lark	D	GR	SA	GR	GG	GV
Tree swallow	D	N/A	N/A	AIR	AF	IN
Violet-green swallow	D	SN	CA	AIR	AF	IN
N. rough-winged swallow	D	BA	BU	AIR	AF	IN
Bank swallow	D	BA	BU	AIR	AF	IN
Cliff swallow	D	VF	SP	AIR	AF	IN
Barn swallow	D	VF	CU	AIR	AF	IN
Black-capped chickadee	D	TR	CA	SH/TR	FG	IN
Mountain chickadee	D	TR	CA	SH/TR	FG	IN
Juniper titmouse	D	TR	CA	SH/TR	FG	IN
Bushtit	D	TR	PN	SH/TR	FG	IN
Red-breasted nuthatch	D	TR	CA	SH/TR	BG	IN
White-breasted nuthatch	D	TR	CA	TR	BG	IN
Pygmy nuthatch	D	TR	CA	TR	BG	IN
Brown creeper	D	TR	CA	TR	BG	IN
Rock wren	D	GR	CR	GR	GG	IN
Canyon wren	D	CL	CR	GR	GG	IN
Bewick's wren	D	TR	CA	GR	GG	IN
House wren	D	TR	CA	GR	GG	IN
Winter wren	D	N/A	N/A	GR	GG	IN
Golden-crowned kinglet	D	N/A	N/A	SH/TR	FG	IN
Ruby-crowned kinglet	D	TR	PN	SH/TR	FG	IN
Blue-gray gnatcatcher	D	TR	CU	SH/TR	FG	IN
Western bluebird	D	SN	CA	AIR	HA	IN
Mountain bluebird	D	SN	CA	GR	SW	IN
Townsend's solitaire	D	GR	CU	AIR	HA	IN
Veery	D	GR	CU	GR	GG	IN
Hermit thrush	D	SH/TR	CU	GR	GG	IN
American robin	D	SH/TR	CU	GR/SH/TR	GG/FG	IN/FR
Gray catbird	D	SH	CU	GR/SH/TR	GG/FG	IN
Northern mockingbird	D	SH	CU	GR/SH/TR	GG/FG	IN/FR
Sage thrasher	D	N/A	N/A	GR	GG	OM
European starling	D	TR	CA	GR	GG	IN
Bohemian waxwing	D	N/A	N/A	SH/TR	FG	FR
Cedar waxwing	D	N/A	N/A	SH/TR	FG	FR
Olive warbler	D	TR	CU	SH/TR	FG	IN
Tennessee warbler	D	GR	CU	SH/TR	FG	IN
Orange-crowned warbler	D	GR/SH	CU	SH/TR	FG	IN

(con.)

Appendix B (Con.)

Species ^a	Nesting guild			Foraging guild		
	Activity ^b	Nest location ^c	Nest type ^d	Foraging layer ^e	Foraging method ^f	Food type ^g
Nashville warbler	D	N/A	N/A	SH/TR	FG	IN
Virginia's warbler	D	GR	CU	SH/TR	FG	IN
Yellow warbler	D	SH	CU	SH/TR	FG	IN
Yellow-rumped warbler	D	TR	CU	SH/TR	FG	IN
Yellow-rumped warbler	D	TR	CU	SH/TR	FG	IN
Black-throated gray warbler	D	TR	CU	SH/TR	FG	IN
Hermit warbler	D	TR	CU	SH/TR	FG	IN
Grace's warbler	D	TR	CU	SH/TR	FG	IN
American redstart	D	TR	CU	SH/TR	HG	IN
Northern waterthrush	D	N/A	N/A	WAT/GR	GG	IN
MacGillivray's warbler	D	SH	CU	SH/TR	FG	IN
Wilson's warbler	D	GR	CU	SH/TR	FG	IN
Red-faced warbler	D	GR	CU	SH/TR	FG	IN
Painted redstart	D	GR	CU	SH/TR	FG	IN
Yellow-breasted chat	D	SH	CU	SH/TR	FG	IN
Hepatic tanager	D	TR	SA	SH/TR	FG	IN
Western tanager	D	TR	CU	SH/TR	FG	IN
Green-tailed towhee	D	GR/SH	CU	GR	GG	IN/OM
Spotted towhee	D	GR/SH	CU	GR	GG	IN/OM
Rufous-crowned sparrow	D	GR	CU	GR	GG	IN
American Tree sparrow	D	N/A	N/A	GR	GG	GV
Chipping sparrow	D	SH/TR	CU	GR	GG	IN/GV
Clay-colored sparrow	D	N/A	N/A	GR	GG	IN/GV
Brewer's sparrow	D	SH	CU	GR	GG	IN/GV
Vesper sparrow	D	GR	CU	GR	GG	IN/GV
Lark sparrow	D	GR/SH	CU	GR	GG	GV/IN
Black-throated sparrow	D	SH	CU	GR	GG	IN/GV
Sage sparrow	D	SH	CU	GR	GG	IN/GV
Savannah sparrow	D	N/A	N/A	GR	GG	IN/GV
Fox sparrow	D	GR/SH	CU	GR	GG	IN/GV
Song sparrow	D	GR/SH	CU	GR	GG	IN/GV
Lincoln's sparrow	D	N/A	N/A	GR	GG	IN/GV
White-throated sparrow	D	N/A	N/A	GR	GG	GV
Harris's sparrow	D	N/A	N/A	GR	GG	GV
White-crowned sparrow	D	N/A	N/A	GR	GG	GV
Golden-crowned sparrow	D	N/A	N/A	GR	GG	GV
Dark-eyed junco	D	GR	CU	GR	GG	GV
Snow bunting	D	N/A	N/A	GR	GG	IN
Rose-breasted grosbeak	D	N/A	N/A	SH/TR	FG	IN
Black-headed grosbeak	D	SH/TR	CU	SH/TR	FG	IN
Blue grosbeak	D	SH	CU	GR	GG	IN
Lazuli bunting	D	SH	CU	GR	GG	IN
Western meadowlark	D	GR	CU	GR	GG	IN/GV
Brewer's blackbird	D	SH/TR	CU	GR	GG	IN
Brown-headed cowbird	D	SH/TR	CU	GR	GG	IN
Bullock's oriole	D	TR	PN	SH/TR	FG	IN
Scott's oriole	D	TR	PN	SH/TR	FG	IN
Black rosy-finch	D	N/A	N/A	GR	GG	GV
Pine grosbeak	D	N/A	N/A	HERB/SH/TR	FG	GV
Cassin's finch	D	TR	CU	GR	GG	GV
House finch	D	SH/TR	CU	GR	GG	GV
Red crossbill	D	TR	CU	SH/TR	FG	GV

(con.)

Appendix B (Con.)

Species ^a	Nesting guild			Foraging guild		
	Activity ^b	Nest location ^c	Nest type ^d	Foraging layer ^e	Foraging method ^f	Food type ^g
Common redpoll	D	N/A	N/A	HERB/SH	FG	GV
Pine siskin	D	TR	SA	HERB/SH/TR	FG	GV
Lesser goldfinch	D	SH/TR	CU	HERB/SH/TR	FG	GV
American goldfinch	D	SH	CU	HERB/SH/TR	FG	GV
Evening grosbeak	D	N/A	N/A	GR/SH/TR	GG/FG	GV/FO
House sparrow	D	TR	CA	GR	GG	GV

^a Common and scientific names, and order in which species are presented, follow American Ornithologists' Union (1998).

^b D = diurnal, N = nocturnal.

^c BA = bank, CL = cliff, GR = ground, SH = shrub, SN = snag, TR = tree, VF = vertical face, VN = vine, N/A = species does not nest in gambel oak habitat.

^d BU = burrow, CA = cavity, CR = crevice, CU = cup, PL = platform, PN = pendant, SA = saucer, SC = scrape, SP = sphere, - = species does not build nest, N/A = species does not nest in gambel oak habitat.

^e AIR = air, GR = ground, HERB = herbaceous vegetation, SH = shrub, TR = tree, WAT = water.

^f AF = aerial feed, AP = aerial pursuit, BG = bark glean, DA = dabble, FG = foliage glean, GG = ground glean, HA = hawk, HD = high dive, HG = hover and glean, HP = hover and pounce, HS = high soar, LD = low dive, LS = low soar, SD = surface dive, SS = stalk and strike, SW = swoop.

^g CA = carnivore (excl. fish, invertebrates), FO = folivore, FR = frugivore, GV = granivore, IN = insectivore (incl. other invertebrates), NE = nectarivore, OM = omnivore, PI = piscivore, SC = scavenger.

Appendix C–Population trends (DeGraaf and Rappole 1995) and Partners in Flight (PIF) concern scores of bird species reported from the gambel oak (*Quercus gambelii* Nutt.) vegetation type in the Western United States (occurrence data from Hayward 1948, Woodbury and Cottam 1962, Tatschl 1967, Perry 1973, Behle and Perry 1975, Marti 1977, Steinhoff 1978, Walters 1981, and Block and others 1992)^a.

Species ^c	Population trend ^b				PIF score by state ^f				PIF score by physiographic region ^g				
	Gambel oak range ^d		Western N. America ^e		AZ ^h	CO ^h	NM ^h	UT ⁱ	62 ^h	69 ^h	80 ^h	84 ^h	87 ^h
	1966-1994	1980-1994	1966-1994	1980-1994									
Hérons and vultures (Ciconiiformes)													
Great blue heron	-	-	-	-	13	12	14	17	12	-	14	14	13
Black-crowned night-heron	-	-	-	-	14	13	14	16	14	-	15	14	14
Turkey vulture	-	-	-	I	12	12	11	12	12	12	10	13	13
Waterfowl (Anseriformes)													
Mallard	-	-	-	-	12	11	10	-	11	-	11	13	11
Northern pintail	-	-	D	D	12	13	14	-	13	-	14	13	13
Bufflehead	-	-	-	-	-	17	-	-	17	-	-	-	-
Common goldeneye	-	-	-	-	-	-	-	-	-	-	-	-	-
Raptors (Falconiformes)													
Bald eagle	-	-	-	-	19	18	-	20	-	-	18	18	18
Northern harrier	-	-	-	-	17	20	17	18	17	-	19	-	17
Sharp-shinned hawk	-	-	I	-	17	15	16	15	15	-	17	16	16
Cooper's hawk	-	-	-	-	18	15	18	18	15	-	17	18	16
Northern goshawk	-	-	-	-	19	17	19	21	17	-	19	20	18
Swainson's hawk	-	-	I	-	22	22	21	17	21	20	19	21	21
Red-tailed hawk	I	-	I	I	12	11	12	13	13	13	12	14	12
Ferruginous hawk	-	-	I	-	22	24	22	23	21	-	23	21	22
Rough-legged hawk	-	-	-	-	-	-	-	-	-	-	-	-	-
Golden eagle	-	-	-	-	18	17	17	16	16	19	17	14	18
American kestrel	-	D	-	D	15	17	14	13	15	13	13	13	15
Merlin	-	-	-	-	-	13	-	18	-	-	16	-	-
Peregrine falcon	-	-	-	-	19	19	19	21	19	-	19	17	18
Prairie falcon	-	-	D	-	22	20	23	21	20	21	24	19	20
Gallinaceous birds (Galliformes)													
Chukar	-	-	-	-	10	10	11	17	10	-	11	-	10
Gray partridge	-	-	-	-	N/A	N/A	N/A	17	-	-	10	-	-
Ring-necked pheasant	-	-	-	-	10	14	11	18	-	-	13	-	11
Ruffed grouse	-	-	-	-	N/A	15	N/A	21	-	-	17	-	-
Sage grouse	-	-	-	-	N/A	25	24	25	-	-	25	-	-
Blue grouse	-	-	-	-	21	20	21	21	20	-	20	20	20
California quail	-	-	-	-	N/A	N/A	N/A	18	-	-	21	-	-

(con.)

Appendix C (Con.)

Species ^c	Population trend ^b						PIF score by state ^f						PIF score by physiographic region ^g						
	Gambel oak range ^d		Western N. America ^e				AZ ^h		CO ^h		NM ^h		UT ⁱ		62 ^h	69 ^h	80 ^h	84 ^h	87 ^h
	1966-1994	1980-1994	1966-1994	1980-1994	1980-1994	1980-1994													
Shorebirds (Charadriiformes)																			
Spotted sandpiper	-	-	-	-	-	-	13	13	12	15	15	12	-	12	-	12	-	12	
Franklin's gull	-	-	-	-	-	-	-	-	-	22	22	-	-	24	-	-	-	-	
Ring-billed gull	-	-	-	-	I	-	-	-	-	15	15	-	-	13	-	-	-	-	
California gull	-	-	-	-	-	-	-	17	N/A	15	15	-	-	19	-	-	-	-	
Pigeons and doves (Columbiformes)																			
Rock dove	-	-	-	-	-	-	11	11	11	11	11	12	-	9	10	10	10	10	
Band-tailed pigeon	-	-	D	D	D	D	20	19	19	18	18	19	-	-	20	20	20	20	
Mourning dove	-	-	D	D	D	D	12	11	14	9	9	13	11	10	12	12	12	12	
Owls (Strigiformes)																			
Barn owl	-	-	-	-	-	-	18	16	17	16	16	-	-	18	16	15	15	15	
Flammulated owl	-	-	-	-	-	-	22	21	22	19	19	22	-	22	23	21	21	21	
Western screech-owl	-	-	-	-	-	-	18	17	18	22	22	15	-	18	18	17	17	17	
Great horned owl	-	-	-	-	-	-	13	11	13	12	12	13	13	11	14	13	13	13	
Northern pygmy-owl	-	-	-	-	-	-	18	17	17	21	21	17	-	19	17	17	17	17	
Burrowing owl	-	-	I	I	I	I	18	22	19	19	19	-	-	17	17	19	19	19	
Long-eared owl	-	-	-	-	-	-	16	16	16	15	15	16	-	16	17	17	17	17	
Short-eared owl	-	-	D	D	D	D	-	20	-	19	19	18	-	22	-	19	19	19	
Northern saw-whet owl	-	-	-	-	-	-	15	15	15	16	16	15	-	15	16	15	15	15	
Nightjars (Caprimulgiformes)																			
Common nighthawk	-	D	-	-	-	-	17	14	19	15	15	13	15	15	16	18	18	18	
Common poorwill	-	-	-	-	-	-	21	20	20	20	20	19	19	19	19	21	21	21	
Swifts and hummingbirds (Apodiformes)																			
White-throated swift	-	-	-	-	-	-	17	18	17	19	19	18	-	16	18	20	20	20	
Black-chinned hummingbird	-	I	-	-	-	-	21	23	22	20	20	-	-	21	22	23	23	23	
Calliope hummingbird	-	-	-	-	-	-	-	-	-	22	22	-	21	22	-	-	-	-	
Broad-tailed hummingbird	-	-	-	-	I	I	20	20	21	23	23	20	-	20	22	19	19	19	
Rufous hummingbird	-	-	-	D	D	D	-	-	-	-	-	-	-	20	-	-	-	-	
Kingfishers (Coraciiformes)																			
Belted kingfisher	-	-	-	-	-	-	15	14	14	15	15	15	15	15	15	15	15	15	
Woodpeckers (Piciformes)																			
Lewis' woodpecker	-	-	-	-	-	-	24	22	23	28	28	23	24	22	23	22	22	22	
Williamson's sapsucker	-	-	-	-	-	-	21	22	22	22	22	23	-	22	22	21	21	21	

(con.)

Appendix C (Con.)

Species ^c	Population trend ^b				PIF score by state ^f						PIF score by physiographic region ^g			
	Gambel oak range ^d		Western N. America ^e		AZ ^h	CO ^h	NM ^h	UT ⁱ	62 ^h	69 ^h	80 ^h	84 ^h	87 ^h	
	1966-1994	1980-1994	1966-1994	1980-1994										
Red-naped sapsucker	-	-	-	-	21	21	21	21	21	-	21	22	21	
Downy woodpecker	-	-	-	-	13	13	14	14	13	-	14	15	14	
Hairy woodpecker	-	-	-	-	17	15	15	14	15	-	14	17	16	
Northern flicker	-	-	-	-	13	12	13	13	14	14	14	14	12	
Songbirds and passerines (Passeriformes)														
Olive-sided flycatcher	-	-	D	D	19	19	17	22	17	-	18	19	18	
Greater pewee	-	-	-	-	22	N/A	23	N/A	-	-	-	22	-	
Western wood-pewee	D	-	D	-	19	17	19	19	17	16	15	18	19	
Willow flycatcher	-	-	-	-	23	18	18	20	18	-	18	21	20	
Hammond's flycatcher	-	-	-	-	20	19	21	22	20	-	21	-	20	
Gray flycatcher	I	-	I	I	23	20	21	23	-	22	22	23	23	
Dusky flycatcher	-	-	-	-	21	20	20	21	19	22	19	21	21	
Cordilleran flycatcher	-	-	-	-	21	21	20	23	21	-	20	21	21	
Say's phoebe	-	-	-	-	17	17	18	16	17	-	16	19	18	
Dusky-capped flycatcher	-	-	-	-	14	-	15	N/A	-	-	-	-	-	
Ash-throated flycatcher	-	-	I	-	17	16	17	17	15	16	15	19	17	
Sulphur-bellied flycatcher	-	-	-	-	19	N/A	N/A	N/A	-	-	-	-	-	
Cassin's kingbird	-	-	-	-	25	20	23	21	19	-	-	24	22	
Western kingbird	-	-	-	-	17	16	17	18	-	-	17	18	19	
Eastern kingbird	-	-	-	-	-	14	14	18	-	-	14	-	-	
Loggerhead shrike	D	D	D	D	17	16	22	20	17	18	20	18	19	
Northern shrike	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bell's vireo	-	-	-	-	25	23	23	25	-	-	-	23	22	
Plumbeous vireo	-	I	I	I	19	20	20	21	20	-	19	19	18	
Hutton's vireo	-	-	-	-	20	N/A	20	N/A	-	-	-	20	-	
Warbling vireo	-	-	I	I	17	18	20	16	18	-	16	18	17	
Red-eyed vireo	-	-	-	D	-	13	N/A	-	13	-	-	-	-	
Steller's jay	-	-	-	-	16	15	17	17	15	-	14	16	17	
Blue jay	-	-	-	-	-	12	13	-	-	-	-	-	12	
Western scrub-jay	-	-	-	-	18	19	17	18	18	17	16	18	19	
Pinyon jay	-	-	-	-	20	18	19	21	19	21	22	20	21	
Clark's nutcracker	-	-	-	-	17	16	18	19	16	19	17	18	17	
Black-billed magpie	-	-	-	-	15	17	17	17	17	16	17	-	15	
American crow	-	-	-	-	10	11	10	11	9	10	10	12	10	
Common raven	-	-	-	-	10	10	12	11	10	12	12	11	12	
Horned lark	D	-	D	D	14	12	16	9	10	-	11	12	14	
Tree swallow	-	-	-	-	15	15	14	15	15	-	16	15	15	
Violet-green swallow	D	-	-	-	18	19	21	18	19	18	16	20	18	
Northern rough-winged swallow	-	-	-	-	17	15	16	15	15	16	17	16	17	

(con.)

Appendix C (Con.)

Species ^c	Population trend ^b						PIF score by state ^f						PIF score by physiographic region ^g				
	Gambel oak range ^d		Western N. America ^e		1966-1994	1980-1994	AZ ^h	CO ^h	NM ^h	UT ⁱ	62 ^h	69 ^h	80 ^h	84 ^h	87 ^h		
	1966-1994	1980-1994	1966-1994	1980-1994													
Bank swallow	-	-	-	-	-	-	13	14	17	13	14	13	-	14			
Cliff swallow	-	I	I	-	-	11	11	12	14	11	13	12	13	13			
Barn swallow	-	-	-	D	-	12	11	10	12	12	12	13	12	12			
Black-capped chickadee	-	-	-	-	-	-	12	14	15	12	14	13	-	15			
Mountain chickadee	-	-	-	-	-	17	15	15	20	16	18	16	18	17			
Juniper titmouse	-	-	-	-	-	20	20	21	21	-	19	19	21	22			
Bush-tit	-	-	-	-	-	15	16	16	18	-	15	15	17	16			
Red-breasted nuthatch	-	-	-	-	-	13	13	14	12	14	-	13	14	14			
White-breasted nuthatch	-	-	-	-	-	14	13	15	14	13	-	14	16	14			
Pygmy nuthatch	-	-	-	-	-	21	19	20	21	19	-	-	21	19			
Brown creeper	-	-	-	-	-	15	15	16	17	15	-	16	16	15			
Rock wren	-	-	-	-	-	19	16	17	18	15	16	16	16	16			
Canyon wren	-	-	-	-	-	19	17	17	18	17	19	18	17	18			
Bewick's wren	I	-	-	D	-	18	16	17	18	16	18	17	19	16			
House wren	-	-	I	I	-	11	13	13	13	13	-	10	14	13			
Winter wren	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Golden-crowned kinglet	-	-	D	-	-	16	16	17	19	16	-	15	17	16			
Ruby-crowned kinglet	-	-	-	-	-	15	16	15	15	16	16	14	16	15			
Blue-gray gnatcatcher	-	-	-	-	-	16	15	15	17	15	16	15	16	14			
Western bluebird	-	-	-	-	-	23	19	19	19	17	19	-	23	20			
Mountain bluebird	-	-	-	-	-	21	17	21	20	18	18	18	19	19			
Townsend's solitaire	-	-	-	-	-	18	17	18	21	17	19	17	18	16			
Veery	-	-	-	-	-	16	17	18	21	17	-	19	17	18			
Hermit thrush	-	-	-	-	-	16	15	18	17	16	15	15	17	16			
American robin	-	-	-	-	-	10	11	10	10	11	12	10	11	11			
Gray catbird	-	-	-	-	-	16	15	16	20	15	-	16	17	14			
Northern mockingbird	-	-	-	-	-	11	13	12	13	11	-	8	11	12			
Sage thrasher	-	-	-	-	-	18	17	18	20	18	-	20	-	18			
European starling	-	-	-	-	-	10	10	9	10	10	10	10	11	10			
Bohemian waxwing	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Cedar waxwing	-	-	-	-	-	-	13	-	17	13	13	-	-	-			
Olive warbler	-	-	-	-	-	22	N/A	23	N/A	-	-	-	-	-			
Tennessee warbler	-	-	-	D	-	-	-	N/A	-	-	-	-	-	-			
Orange-crowned warbler	-	I	-	-	-	13	13	14	17	12	-	14	14	14			
Nashville warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Virginia's warbler	-	I	I	-	-	26	24	25	26	23	24	23	26	22			
Yellow warbler	-	I	-	-	-	14	12	12	13	14	-	13	13	14			
Yellow-rumped warbler	-	D	-	-	-	13	14	12	18	14	-	12	15	14			
Black-throated gray warbler	-	-	-	-	-	22	21	22	23	20	22	21	23	21			

(con.)

Appendix C (Con.)

Species ^c	Population trend ^b						PIF score by state ^f						PIF score by physiographic region ^g				
	Gambel oak range ^d		Western N. America ^e				AZ ^h	CO ^h	NM ^h	UT ⁱ	62 ^h	69 ^h	80 ^h	84 ^h	87 ^h		
	1966-1994	1980-1994	1966-1994	1980-1994	1980-1994												
Hermit warbler	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Grace's warbler	-	-	-	-	-	22	22	22	21	23	-	-	24	22			
American redstart	-	-	-	-	-	14	14	-	18	14	-	13	15	13			
Northern waterthrush	-	-	-	-	-	-	13	-	-	-	-	-	-	-			
MacGillivray's warbler	D	-	-	-	-	19	20	19	18	20	-	18	19	19			
Wilson's warbler	-	-	-	-	-	-	17	16	17	19	-	17	-	-			
Red-faced warbler	-	-	-	-	-	28	N/A	26	N/A	-	-	-	27	25			
Painted redstart	-	-	-	-	-	23	-	22	N/A	-	-	-	23	-			
Yellow-breasted chat	-	-	-	-	I	17	16	16	18	15	-	16	17	16			
Hepatic tanager	-	-	-	-	-	18	14	16	N/A	15	-	-	18	15			
Western tanager	-	-	-	-	I	17	20	17	16	17	-	-	18	16			
Green-tailed towhee	-	-	-	-	-	19	19	20	20	19	19	18	19	20			
Spotted towhee	-	-	-	-	I	16	17	17	16	16	15	15	18	17			
Rufous-crowned sparrow	-	-	-	-	I	22	19	21	21	-	-	-	22	19			
American Tree sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Chipping sparrow	D	-	-	D	-	13	16	16	14	16	-	13	15	16			
Clay-colored sparrow	-	-	-	D	-	-	-	-	-	-	-	-	-	-			
Brewer's sparrow	-	-	-	D	D	18	19	17	23	19	-	20	-	15			
Vesper sparrow	-	D	-	I	-	15	15	15	13	14	-	16	15	17			
Lark sparrow	-	-	-	-	-	18	18	17	19	17	17	15	18	16			
Black-throated sparrow	-	-	-	-	-	19	16	17	20	-	-	16	16	18			
Sage sparrow	-	-	-	-	-	21	20	21	20	20	-	23	-	20			
Savannah sparrow	D	-	-	I	-	13	14	13	15	14	-	12	14	13			
Fox sparrow	-	-	-	-	-	-	15	-	17	15	-	15	-	14			
Song sparrow	-	-	-	-	-	13	11	12	13	11	-	13	13	12			
Lincoln's sparrow	-	-	-	I	-	14	17	15	15	17	-	16	16	15			
White-throated sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Harris's sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
White-crowned sparrow	-	-	-	D	-	12	14	13	13	14	-	12	11	12			
Golden-crowned sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Dark-eyed junco	-	-	-	-	-	12	13	13	11	13	-	12	13	14			
Snow bunting	-	-	-	-	-	N/A	-	-	-	-	-	-	-	-			
Rose-breasted grosbeak	-	-	-	I	-	-	17	-	-	-	-	-	-	-			
Black-headed grosbeak	-	-	-	-	-	19	17	19	19	18	-	19	21	20			
Blue grosbeak	I	-	-	I	-	15	16	15	21	-	-	16	16	15			
Lazuli bunting	-	-	-	-	-	18	19	18	19	20	21	19	18	18			
Western meadowlark	-	-	-	D	D	14	15	15	16	14	-	15	15	16			
Brewer's blackbird	D	D	D	D	D	11	13	12	15	13	-	14	13	13			
Brown-headed cowbird	-	-	-	-	-	13	9	8	10	9	12	10	12	10			
Bullock's oriole	-	-	-	I	-	16	18	19	19	16	-	19	18	18			

(con.)

Appendix C (Con.)

Species ^c	Population trend ^b					PIF score by state ^f					PIF score by physiographic region ^g				
	Gambel oak range ^d		Western N. America ^e			AZ ^h	CO ^h	NM ^h	UT ⁱ	62 ^h	69 ^h	80 ^h	84 ^h	87 ^h	
	1966-1994	1980-1994	1966-1994	1980-1994	1980-1994										
Scott's oriole	-	-	-	-	22	20	21	21	-	20	21	22	21		
Black rosy-finch	-	-	-	-	-	-	-	25	-	-	23	-	-		
Pine grosbeak	-	-	-	-	15	16	16	18	16	-	-	15	16		
Cassin's finch	-	-	-	-	18	18	18	18	18	-	16	18	18		
House finch	-	-	-	-	12	10	14	10	9	-	10	12	11		
Red crossbill	-	-	-	-	15	16	15	15	18	-	16	16	16		
Common redpoll	-	-	-	-	N/A	-	N/A	-	-	-	-	-	-		
Pine siskin	-	-	-	-	12	15	12	12	15	-	11	14	13		
Lesser goldfinch	-	-	-	D	15	15	16	17	15	-	15	16	15		
American goldfinch	-	-	-	-	11	12	13	14	12	-	13	12	13		
Evening grosbeak	-	-	-	-	14	14	13	16	13	-	14	14	14		
House sparrow	-	-	-	-	10	12	8	9	9	10	10	11	9		

^a PIF assigns species concern scores using a geographically based prioritization scheme that can be defined either ecologically (by physiographic province) or politically (by state). Species are assigned a rank score from 1 (low concern) to 5 (high concern) in seven criteria that reflect a species' potential to become extirpated: global abundance, global breeding distribution, global wintering distribution, threats to breeding within state or physiographic province, threats to non-breeding within state or physiographic province, state or physiographic province population trend, and area importance (abundance and distribution relative to global range). The cumulative concern score, which thus ranges from 7 to 35, is then used to assign a species to one of five conservation priority categories: extremely high (30 to 35), very high (24 to 29), high (19 to 23), moderate (13 to 18), and low (7 to 12). Scores are site-specific, that is, they can vary for a given species across different states or physiographic areas based on local conditions (Hunter and others 1993).

^b Species included have shown a statistically significant ($P < 0.05$) change as determined by Breeding Bird Survey data; D = declining, I = increasing, - = trend not significant.

^c Common names and order in which species are presented follow American Ornithologists' Union (1998).

^d Includes the following physiographic regions: Basin and Range, Pinyon-Juniper Woodlands, and Southern Rockies.

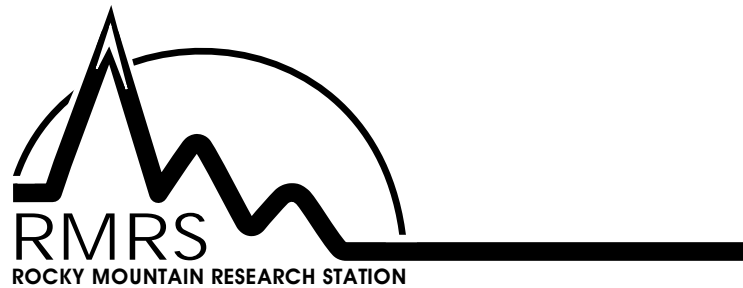
^e Includes U.S. and Canada, from the Rocky Mountains to the Pacific Ocean, excluding Alaska.

^f - = no score reported (e.g., species is winter migrant, vagrant, or transient); N/A = species does not occur in the respective state, as determined by Ligon (1961), Monson and Phillips (1981), Behle and others (1985), and Andrews and Righter (1992).

^g 62 = Southern Rocky Mountains, 69 = Utah Mountains, 80 = Basin and Range, 84 = Mogollon Rim, 87 = Colorado Plateau (figure 4).

^h Source: Colorado Bird Observatory Database.

ⁱ Source: Utah Division of Wildlife Resources Database.



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