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APPENDIX I.

BIRDS OF CONCERN IN SAGEBRUSH SHRUBLANDS

Seventeen bird species that breed in sagebrush shrublands score high on the Partners in Flight priority rankings for one or more of eight western states. We are concerned about the future for these species for several reasons. They are vulnerable to changes in sagebrush shrublands caused by human activities, and information from the continent-wide Breeding Bird Survey indicates that their populations are in decline or their population status is unknown. This section presents brief life history accounts for each of these “species of concern.” Consult field guides for range maps.

We placed these species into several groups. Not all of the species are sagebrush obligates, i.e., using only sagebrush habitat. They all use sagebrush, but to varying extents. The groups are **Sagebrush Obligates**—sage grouse, sage thrasher, sage sparrow, and Brewer’s sparrow; **Shrubland Species**—green-tailed towhee, black-throated sparrow, and lark sparrow; **Shrubland-Grassland Species**—Swainson’s hawk, ferruginous hawk, prairie falcon, sharp-tailed grouse, and loggerhead shrike; **Grassland Species**—long-billed curlew, burrowing owl, short-eared owl, and vesper sparrow; and **Primarily Dry Woodland Species**—gray flycatcher. Tables 2 and 3 (pages 12 and 13) summarize habitat components and nesting substrates for these species.

Information Sources: Except where other sources are cited, the following accounts are based on several major compilations of bird life histories: *Birds of the Great Basin* (Ryser 1985), *The Birder’s Handbook* (Ehrlich et al. 1988), *Conservation and Management of Neotropical Migrant Birds in the Northern Rockies and Great Plains* (Dobkin 1994), *The Sparrows of the United States and Canada* (Rising 1996), *Atlas of Idaho’s Wildlife* (Groves et al. 1997), the Idaho Heritage

Program’s vertebrate characterization abstracts database, and the *Birds of North America* series (A. Poole and F. Gill, editors).

The information given on species population trends is based on the most current Breeding Bird Survey (BBS) trend estimates from the U.S.G.S. Biological Resources Division. The accounts below include brief trend synopses for each species in those states and physiographic regions having extensive sagebrush shrub-steppe. The most current BBS trend results with complete tables and maps are now published on the Breeding Bird Survey World Wide Web site (Sauer et al. 1996).

Be aware of several things when interpreting BBS data. First, although the BBS got its start in 1966, surveys were not run in the West until 1968. Secondly, the BBS is our best source of long-term population information for North American birds, but it does have some shortcomings. In many western states, survey routes are few and far between, so sample sizes are generally low for western birds—particularly in the Intermountain and Great Basin areas we are concerned with here. Also, many species are not sampled well either because their range is restricted, they occur in low densities, or they are found in habitats that are not well sampled, such as riparian woodlands. In short, BBS trend estimates must be interpreted conservatively, but declining trends should not be ignored.

The “centers of abundance” information for each species in the following accounts is based on *The Summer Atlas of North American Birds* (Price et al. 1995). This atlas maps the patterns of abundance for North American birds using a careful interpretation of BBS relative abundance data.

SAGEBRUSH OBLIGATE SPECIES

Sage Grouse (*Centrocercus urophasianus*)

Breeding Habitat - A sagebrush obligate in nearly every way, the sage grouse is found associated with both tall and short species of sagebrush in foothills, sagebrush shrublands, and mountain slopes. Sage grouse also occur in mosaics of sagebrush, grasslands, and aspen, but not in pinyon-juniper woodlands or in shadscale shrublands. Habitat requirements vary during the year. Summer home ranges may be 3 to 7 km² (1 to 2.5 mi²; Connelly and Markham 1983; Gates 1983), and annual home ranges may be as large as 1500 km² (577 mi²; Connelly unpub. data).

Males display on leks in gatherings of a few to a few hundred birds; leks are used exclusively for display and mating. They are in open areas surrounded by sagebrush or where sagebrush density is low, such as on exposed

ridges and knolls.

During early brood-rearing, wet meadows, springs, seeps, and other green areas within gently sloping, sagebrush shrublands (15 to 25% canopy coverage) close to the nest site are important for insect foraging (Idaho Sage Grouse Task Force 1997). As sagebrush areas dry in June and July, sage grouse move to wetter sites with succulent forbs, including wet meadows, irrigated areas, and riparian areas bordered by sagebrush (Connelly et al. 1988). In a Nevada study, broods used meadows with effective cover 7 to 16 cm (3 to 6 in) tall (Klebenow 1982). Broods used upland habitats with big sagebrush ranging from 1 to 25% canopy cover and 15 to 20 cm tall (6 to 8 in; Wallestad 1971; Klebenow 1982).

Nest - The sage grouse nest is a shallow ground depression lined with grass and sage leaves. The hen conceals its nest most often beneath big sagebrush, but sometimes uses other shrubs. Nests under sagebrush are reportedly more successful than those under other plant species (Connelly et al. 1991). For nesting, hens select sagebrush stands with higher canopy cover (15 to 40%) than surrounding stands, and choose one of the tallest shrubs in the stand (36 to 80 cm; 14 to 31 in) with high lateral cover (Roberson 1986; Wakkinen 1990). Grass cover is important for both concealment and for a warmer microclimate (Call and Maser 1985; Gregg et al. 1994). Compared to random sites, sage grouse-selected sites have taller grass cover (>18 cm; 7 in; Gregg et al. 1994; Connelly et al. 1991). A review by Dobkin (1995) indicates good nesting habitat contains 15 to 35% shrub canopy cover and at least 20% herbaceous cover.

Wintering Habitat - Sage grouse may migrate only a short distance, not at all, or as much as 75 km (47 mi) between winter, breeding, and summer habitats (Dalke et al. 1963; Braun et al. 1977; Connelly et al. 1988). Fall movement to winter range can span several months (Connelly et al. 1988). Males and females flock separately. Winter ranges may exceed 140 km² (54 mi²; Robertson 1991). Sage grouse select winter sites based on topography, snow depth, and availability of sagebrush above snow level. They select stands with patches of the highest available canopy cover (10 to 40%) with heights of 25 to 30 cm (10 to 12 in) above the snow (Braun et al. 1977; Call and Maser 1985; Idaho Sage Grouse Task Force 1997). They forage in drainages and on slopes with south and west aspects. Wintering grouse feed almost exclusively on sagebrush, choosing plants containing the most protein. In feeding trials, wintering grouse preferred certain subspecies of big sagebrush—mountain big sagebrush, Wyoming big sagebrush, and basin big sagebrush (Welch et al. 1991). Suitable winter habitat in sagebrush may be the most limiting factor in some areas.

Feeding - Sage grouse are restricted to soft foods by lack of a muscular gizzard. In the breeding season, they eat sagebrush and the leaves, flowers, and buds of associated forbs and grasses. They also eat ants and grasshoppers, focusing almost exclusively on grasshoppers during an irruption. In winter, sage grouse feed almost entirely on the evergreen leaves of sagebrush, most often selecting species and shrubs with high protein levels.

Status - Sage grouse were once widespread, ranging across 14 western states and into three Canadian prov-

inces. Sagebrush conversion to agriculture, grazing, and eradication of sagebrush with herbicides eliminated the sage grouse from much of its former range, particularly in the Northwest. Destruction and degradation of springs, seeps, and wet meadows by overgrazing, and hunting and poaching pressure also took their toll. Populations were seriously reduced by the 1930s. The sage grouse was extirpated in parts of its range, and declined by more than 50% of its former population in Washington, Oregon, California, Nevada, and Utah (DeSante and George 1994). Surveys show a steady and significant decline since 1960 in Idaho and Oregon. A recent summary of sage grouse status by Drut (1994) indicates decreasing populations in Washington, Oregon, Montana, and Wyoming, and stable populations in Idaho, Nevada, and Utah. Idaho Sage Grouse Task Force (1997) states that the number of sage grouse in Idaho is at a record low.

Conservation - Grouse benefit from restoration of native forb and perennial bunchgrass communities and from maintenance of patches of tall and dense big sagebrush within sagebrush shrublands. Prevent sagebrush over-dominance by managing for a mosaic of patchy sagebrush with openings of native grasses and forbs across the landscape. Sagebrush stands should have multiple cover and size classes. During the breeding season, nests and broods may be vulnerable to trampling by livestock.

Springs, seeps, and wet meadows within and adjacent to sagebrush stands should be protected from livestock over-grazing to support the native forb and insect diet of young broods. Sage grouse respond positively to light or moderate grazing strategies that maintain grass and forb cover (Klebenow 1982). Avoid land uses that allow invasion of non-native plants, reduce the diversity and abundance of native forbs, eliminate sagebrush, reduce cover within breeding habitats, or reduce soil moisture (J. Connelly pers. comm.). Water developments, such as wildlife guzzlers, may be useful for sage grouse, but should be located in known summer habitats (Connelly and Doughty 1990). Sage grouse can be adversely affected by organophosphate and carbamate pesticides (Blus et al. 1989). Use of these pesticides should be avoided near breeding and brood-rearing habitats (J. Connelly pers. comm.).

Sage Thrasher (*Oreoscoptes montanus*)

Breeding Habitat - A sagebrush obligate, the sage thrasher is almost always associated with sagebrush shrubland communities dominated by big sagebrush (*A. tridentata*), using shrublands for nesting and security cover. It usually breeds between 1300 and 2000 m (3900 to 6500 ft) elevation (Reynolds and Rich 1978), but in the

Columbia Basin may nest as low as 700 m (2300 ft) (B. and N. LaFramboise pers. comm.). In the northern Great Basin, tall sagebrush/bunchgrass, juniper/sagebrush/bunchgrass, mountain mahogany/shrub, and aspen/sagebrush/bunchgrass communities are primary breeding and feeding habitats (Maser et al. 1984). The sage thrasher

is positively correlated with shrub cover, bare ground, and measures of horizontal habitat heterogeneity, and negatively correlated with the presence of spiny hopsage, budsage, and grass cover (Rotenberry and Wiens 1980; Wiens and Rotenberry 1981). In an Idaho study, the sage thrasher was more likely to occur in sites with higher sagebrush cover and greater spatial similarity (Knick and Rotenberry 1995). In Oregon, sage thrashers are not found in extensive patches of crested wheatgrass or annual grasses and forbs, but a few will be present once sagebrush covers 2 to 5% of the area (A. Bammann pers. comm.). Breeding densities in the Great Basin are rarely more than 30 individuals per km² (78 per mi²; Wiens and Rotenberry 1981; Rotenberry and Wiens 1989).

Nest - The sage thrasher's selection of a nest site is very specific within sagebrush stands: the tallest, densest clump of shrubs available surrounded by little bare ground. The sage thrasher builds its nest in or beneath a shrub, nearly always sagebrush, with dense foliage overhead and almost invariably a nest-to-shrub crown depth of 0.5 m (1.5 ft). It most often orients the nest to the southeast, presumably for morning warmth, afternoon shading, and protection from prevailing winds (Petersen and Best 1991). Males sing and display from the tops of shrubs, as well as displaying in flight. The sage thrasher is known to eject cowbird eggs from the nest (Rich and Rothstein 1985).

Wintering - The sage thrasher winters in the Southwest and southern California, through Baja, and into central Mexico, where it uses arid and semi-arid scrub, brush, and thickets.

Feeding - An insectivore, the sage thrasher especially favors Mormon crickets and their eggs;

Sage Sparrow (*Amphispiza belli*)

Breeding Habitat - The sage sparrow is a sagebrush obligate associated with sagebrush shrublands dominated by big sagebrush with perennial bunchgrasses. It is also sometimes found in shadscale, antelope brush, rabbit-brush, and in black greasewood (the latter in western Colorado; R. Lambeth pers. comm.). The species occurs from sea level up to 2000 m (6500 ft) elevation. Observers have noted that the sage sparrow is not found in all seemingly suitable sagebrush habitats (Rich 1978). Vander Haegan (pers. comm.), in a study in Washington, did not find sage sparrows on patches smaller than about 130 ha (1/2 section), and suggests that they are area-sensitive. On a broad scale, sage sparrows prefer shrublands with tall shrubs and low grass cover, where sagebrush is clumped in a patchy landscape (Petersen and Best 1985a; Wiens et al. 1986). A landscape analysis by Knick and Rotenberry (1995) found sage sparrows most likely to use sites with high sagebrush cover, spatially similar patches, large patch size, low disturbance, and little fragmentation. The species is positively correlated with big sagebrush, shrub cover, bare ground, and above-average shrub height, and

consumes grasshoppers, beetles, weevils, ants, and bees; and will also eat small fruits and berries. It forages on the ground between shrubs and gleans food from foliage.

Status - In 1868 at Carson City, Nevada, Ridgway (King 1877 as referenced in Ryser 1985) noted that the sage thrasher was one of the most common species in that area. BBS trend estimates show populations were more or less stable across the West through the 1968 to 1995 survey period; however, sample sizes are generally too low for accurate state and physiographic region trend estimates. Possible declines are evident from 1980 to 1995 in Wyoming, the Colorado Plateau, Great Basin, Snake River Plain, and Columbia Basin. Centers of abundance are in the northern Great Basin, central Nevada, eastern Idaho, southwestern Wyoming, and northern Colorado.

Conservation - A summary of several studies shows varying responses to grazing in sagebrush; the sage thrasher responded positively to grazing in big sage in two studies and negatively in one study (Saab et al. 1995). Long-term responses to grazing are unknown. Maintaining tall sagebrush in dense clumps with significant amounts of other shrubs, grasses, and forbs to minimize bare ground beneath shrub canopies is important for nest habitat. Some bare ground between shrubs may be important for foraging. The sage thrasher reportedly can help control Mormon crickets and other grasshoppers (Knowlton and Harmston 1943). Saab and Rich (1997) found the sage thrasher to be of high management concern in the Columbia River Basin.

negatively correlated with cottonthorn, greasewood, and grass cover (Rotenberry and Wiens 1980; Wiens and Rotenberry 1981; Larson and Bock 1984). In the northern Great Basin, it uses low and tall sagebrush/bunchgrass, juniper/sagebrush, mountain mahogany/shrub, and aspen/sagebrush/bunchgrass communities as primary breeding and feeding habitats (Maser et al. 1984). Breeding densities average between 50 to 200 individuals per km² (130 to 520 per mi²), and territory size averages 1.5 to 3 ha (3.7 to 7.5 ac; Wiens and Rotenberry 1981; Wiens et al. 1985; Rotenberry and Wiens 1989).

Nest - The sage sparrow builds an open cup nest, usually placed within a sagebrush shrub or on the small branches at the periphery, and occasionally on the ground beneath a shrub. Nest placement appears to be related to the density of cover over the nest, as the sage sparrow will nest higher in taller sagebrush (Rich 1980). A study in southwestern Idaho found that sage sparrows preferred living sagebrush from 50 to 70 cm (20 to 28 in) tall and avoided placing nests in the southwest portion of the shrub (Petersen and Best 1985a). The sage sparrow is an

occasional cowbird host. Before European settlement, the species was probably isolated from cowbird parasitism for the most part, but is now vulnerable to parasitism where fragmentation of sagebrush shrublands and land conversion to agriculture provide contact zones between cowbirds and sagebrush breeders (Rich 1978).

Wintering - After breeding, sage sparrows gather in loose flocks and may move to higher elevations before migration. In winter, they retreat from the northern part of their range and overwinter in southern Oregon, Nevada, Utah, and southern Colorado south into northern Mexico. Sage sparrows use arid, open lands with scattered shrubs, including sagebrush grasslands, coastal chaparral, and weedy scrub.

Feeding - The sage sparrow forages on the ground and in shrubs, feeding on insects (weevils, grasshoppers, crickets, caterpillars, ants, lacewings) and seeds (Wiens and Rotenberry 1979).

Status - Throughout the West, the overall long-term trend is stable: populations apparently declined from 1968 to 1979, but have increased since 1980. The species declined in Wyoming from 1980 to 1995, but sample sizes are too small for reliable trend estimates in other states and physiographic regions. Centers of abundance are in southwestern Wyoming, western and northern Great

Basin, and the Colorado Plateau. Local declines, small sample sizes, and the species' dependence on big sagebrush habitats make it a species of management concern.

Conservation - Males show strong site fidelity to breeding territories and may persist where sagebrush is partially removed within a territory or for a short term where sagebrush is completely removed (Wiens and Rotenberry 1985; Wiens et al. 1986). With complete removal of sagebrush on a broader scale, sage sparrows steadily decline within two years (Wiens and Rotenberry 1985). In fragmented sagebrush shrubsteppe, they may be vulnerable to cowbird parasitism where habitat alteration brings cowbirds into contact with sagebrush breeders (Rich 1978). The sage sparrow will benefit from maintenance of large, continuous stands of sagebrush habitat. Because it is a ground forager, continuous cheatgrass cover is probably detrimental to its foraging success. Saab and Rich (1997) found the sage sparrow to be of high management concern in the Columbia River Basin.

Brewer's Sparrow (*Spizella breweri*)

Breeding Habitat - Considered a sagebrush obligate, the widespread Brewer's sparrow is tightly associated with sagebrush shrublands that have abundant, scattered shrubs and short grass. It can also be found in mountain mahogany, rabbitbrush, pinyon-juniper, or bunchgrass grasslands (Rising 1996). In studies of sagebrush shrubland habitat components, Brewer's sparrows are positively correlated with sagebrush, shrub cover, above-average vegetation height, bare ground, and measures of horizontal habitat heterogeneity, and are negatively correlated with grass cover, spiny hopsage, and budsage (Rotenberry and Wiens 1980; Wiens and Rotenberry 1981; Larson and Bock 1984). The negative correlation with grass cover indicates that they prefer areas dominated by shrubs compared to areas dominated by grass. Brewer's sparrows will avoid burned sagebrush shrublands in favor of unburned sagebrush (Bock and Bock 1987), and an Idaho study found Brewer's sparrows more likely to occur in sites with high shrub cover and large patch size (Knick and Rotenberry 1995). In pinyon-juniper, the species is associated with large openings (Sedgwick 1987). Sagebrush provides perch sites for singing males (Wiens et al. 1987).

The Brewer's sparrow will breed in high densities. Where it occurs, it is usually the most abundant bird species (R. Lambeth pers. comm. citing Reynolds 1981; Rotenberry and Wiens 1989). Breeding territories measured in Washington, Oregon, and Nevada averaged

between 0.63 and 1.25 ha (1.5 to 3 ac) and contracted as population density increased, but did not vary in relation to habitat variables measured (Wiens et al. 1985). In the Great Basin, densities average 150 to 300 individuals per km² (390 to 780 per mi²), but can exceed 500 per km² (1295 per mi²; Wiens and Rotenberry 1981; Rotenberry and Wiens 1989). In Oregon, clutch size increased in wetter years, possibly indicating an ability to adjust reproductive investment with variations in climate and presumably prey productivity (Rotenberry and Wiens 1989, 1991). However, ground squirrels (an important nest predator and the prey of other predators) also increase with increased precipitation but show a two-year lag, complicating the relationship between climate and nest success (Rotenberry and Wiens 1989).

Nest - The Brewer's sparrow builds an open cup nest in a shrub, preferring large, living sagebrush. In an Idaho study, the species selected taller shrubs, averaging 69 cm tall (27 in) and ranging from 42 to 104 cm tall (16.5 to 41 in). Shrubs less than 50 cm tall (19.5 in) were rarely used (Petersen and Best 1985b). Brewer's sparrows construct their nests low in the shrub, from a few cm to 1 m (3 ft) from the ground, and on the finest branches of new growth at the shrub's edge (Rich 1980). Concealment and cover provided by living sagebrush foliage are important (Petersen and Best 1985b). Because Brewer's sparrows are occasional cowbird hosts, their populations are vulnerable to parasitism where land conversion to

agriculture and the fragmentation of sagebrush shrublands provide contact zones between cowbirds and sagebrush breeders (Rich 1978).

Wintering - The Brewer's sparrow winters from the Southwest through Baja into central Mexico where it uses low, arid vegetation, including desert scrub and creosote bush. Outside the breeding season it is usually seen in large, vocal flocks, often with other sparrows.

Feeding - This sparrow forages chiefly in foliage but also on the ground, feeding on alfalfa weevils, aphids, beet leafhoppers, caterpillars, beetles, spiders, grasshoppers, and the seeds of grasses and forbs.

Status - Historically, the Brewer's sparrow may have been the most abundant bird in the Intermountain West. The BBS trend estimates indicate, however, that the Brewer's sparrow is declining steadily and significantly across the West, with sharp declines since 1980. State trends show declines in California, Colorado, Idaho, Montana, Oregon, and Wyoming and apparently an increase in Utah. Sample sizes in Nevada and Washington are too low for reliable trend estimates in those states. Since 1980, there is a steep, significant decline in the Columbia Plateau, and also declines in the Wyoming Basin and Basin and Range physiographic regions. Centers of abundance are in the Wyoming Basin, Snake River Plain, and Great Basin, particularly southeastern Oregon and central Nevada.

Conservation - Many details of the species' biology and ecology are unknown. Brewer's sparrows are sensitive

to sagebrush control, declining with the loss of shrubs and shifting their diet from insects to seeds with changes in food availability. Because they return to the same breeding territories each year, there can be a time-lag in their response to major habitat changes (Wiens and Rotenberry 1985). In the first year following sagebrush control by herbicides, Brewer's sparrow numbers declined by more than 50% (Best 1972; Schroeder and Sturges 1975; Kerley and Anderson 1995), and in the years following, they abandoned the habitat completely as the sagebrush died out (Schroeder and Sturges 1975). Castrale (1982) found similar reductions in Brewer's sparrow numbers on burned plots. In a Wyoming study, 22 years after spraying and 9 years after burning, numbers were less than 50% of the species' abundance in untreated continuous sagebrush (Kerley and Anderson 1995). Where sagebrush is not completely eliminated, Brewer's sparrows may persist (Best 1972; Castrale 1982), but the long-term effects of partial shrub reduction need further study. In short, Brewer's sparrows will thrive best where sagebrush is maintained in tall, clumped, and vigorous stands. Cowbird parasitism is also a concern in areas with fragmentation and cattle. Saab and Rich (1997) found the Brewer's sparrow to be of high management concern in the Columbia River Basin.

SHRUBLAND SPECIES

Green-tailed Towhee (*Pipilo chlorurus*)

Breeding Habitat - The green-tailed towhee is found on mountain slopes, plateaus, and the higher valleys of the arid West, associated with dense shrubs about 0.5 to 1.5 m (1.6 to 5 ft) high. It prefers the ecotones between sagebrush and other shrub habitats, such as mountain mahogany (Knopf et al. 1990). This towhee occurs in dry sagebrush thickets, brushy slopes, riparian scrub in canyons and ravines, and in shrubby openings in woodlands. In pinyon-juniper, it is associated with sagebrush-dominated openings with high shrub species richness (Sedgwick 1987). In the northern Great Basin, the green-tailed towhee uses tall sagebrush/bunchgrass, squaw apple/bunchgrass, mountain mahogany/bunchgrass, mountain mahogany/pinegrass, and aspen/sagebrush/bunchgrass communities as primary breeding and feeding habitat (Maser et al. 1984). In Montana, it is found principally in sagebrush habitats and also higher-elevation, shrubby second-growth (Hutto 1995). The species occurs up to 2400 m (8000 ft) elevation in the Great Basin and 3000 m (10,000 ft) in Arizona (Rising 1996).

Nest - The green-tailed towhee builds a large, open

cup nest on the ground beneath dense shrubs, or close to the ground in a low shrub, often in sagebrush. It also uses shrubs as security cover, making an escape by running across the ground when approached. It is an uncommon cowbird host.

Wintering - This towhee winters from the Southwest and southern California to southern Baja and central Mexico. In winter, it may be found at lower elevations in dry brush and occasionally urban areas.

Feeding - Insects, berries, and particularly the seeds of grasses and forbs are the towhee's mainstay. It feeds by raking through leaf-litter with both feet, usually beneath dense shrubs.

Status - The western BBS trend is relatively stable, showing a slight decline overall from 1968 to 1995, but a small increase since 1980. Trends show declines in Wyoming, Colorado, Oregon, and California, and sample sizes are too small in many other states and physiographic regions for reliable trend estimates. Centers of abundance are in eastern California, southern Oregon, the Snake River Plain, and the southern Rockies from Wyoming into

New Mexico. High trend uncertainty in many areas, in addition to local declines, the species' preference for dense shrubs, and a lack of information on the species' breeding biology make the green-tailed towhee a species of management concern.

Conservation - No quantitative information is available on the green-tailed towhee's biology, ecology, or sensitivity to management activities. The species should benefit from maintenance of dense shrub stands on

Black-throated Sparrow (*Amphispiza bilineata*)

Breeding Habitat - A true desert bird, the black-throated sparrow frequents the arid, hot desert valleys of the West, occurring in areas with sparse xeric shrubs. It is not closely associated with particular plant communities. It uses desert scrub and thorny brush (ocotillo, cactus, cat-claw, mesquite), saltbush, greasewood, canotia, creosote bush, sagebrush, antelope brush, rabbitbrush, and arid shrublands with juniper. In Idaho, it uses open shrublands of tall sagebrush, spiny hopsage, and horsebrush, and areas where shrub height exceeds 50 cm (20 in). Wiens and Rotenberry (1981) found black-throated sparrows in sites with greater shrub cover, maximum vegetation height, shrub species diversity, and bird species diversity compared to other sites. The species was also positively correlated with the presence of dead woody vegetation. In northeastern Washington, the black-throated sparrow is closely associated with steep, sandy/rock slopes with hopsage/buckwheat/sage and some grasses (M. Denny pers. comm.). The black-throated sparrow is usually found below 1500 m (5000 ft) elevation in the northern part of its range and up to 2100 m (7000 ft) farther south (Rising 1996).

Nest - The black-throated sparrow builds an open cup nest on the ground at the base of a cactus, shrub, or grass tuft, or occasionally in a low shrub, 15 to 45 cm (6 to 18 in) above the ground. It is sometimes parasitized by cowbirds.

Wintering - The black-throated sparrow winters from the Mojave desert southward through Baja and into northwestern and central Mexico. Apart from desert scrub, it may also frequent riparian areas, grasslands, and weedy fields (Rising 1996).

Feeding - In the dry season, the black-throated

mountain slopes and in ravines. It may be harmed by sagebrush control or heavy grazing that removes the grass and forb groundcover that provides a food base. Cowbird parasitism is also a concern in areas with fragmentation and cattle.

sparrow feeds chiefly on seeds, adding insects and new shoots of grass and forbs in wetter months. Young are fed insects. This sparrow will visit water holes in the dry season, but once rains begin, gets its water from green vegetation and insects.

Status - DeSante and George (1994) indicate that populations in Nevada have declined by more than 50%. Long-term BBS trends, from 1968 to 1995, show a significant decline survey-wide and a slight decline in the West overall; however, trends appear more stable since 1980. The species is poorly sampled in many parts of its range. From 1968 to 1995, trend estimates show significant increases in Nevada and New Mexico, an increase in the Basin and Range region, and declines in Arizona, California, and Utah. Centers of abundance are in Nevada, Utah, southern California, and the desert Southwest. The black-throated sparrow is of management concern due to local declines and uncertainty of its status in many areas.

Conservation - The details of the black-throated sparrow's biology and ecology are largely unknown. The species responded positively to moderate grazing in a semi-desert habitat in Arizona (Bock et al. 1984), and a Utah study in shadscale showed a mixed response to heavy grazing (Medin 1986). Elsewhere, quantitative studies of the species' response to management activities are lacking. Their ground nests may be vulnerable to trampling. The black-throated sparrow would benefit from good perennial grass cover to conceal its nest. Cowbird parasitism is also a concern where there are cattle.

Lark Sparrow (*Chondestes grammacus*)

Breeding Habitat - The lark sparrow is found in lower-elevation shrublands and savannah of valleys and foothills; in open, dry woodlands and woodland margins (cottonwood riparian, oak savannah, pinyon-juniper, and ponderosa pine with bunchgrasses); and in grasslands or farmlands with scattered shrubs. It uses shrubs, small trees, and fence posts as song perches and as lookouts. In Montana, it is associated with grassland and sagebrush habitats, and less frequently with cottonwood and aspen

(Hutto 1995).

Nest - The lark sparrow builds an open cup nest, usually on the ground in a slight depression or low in a shrub, sometimes in a rocky crevice. It often places its nest at the base of vegetation (bunchgrass, cactus, thistle, sagebrush, or rabbitbrush) or up to 3 m (10 ft) high in a shrub or tree (sagebrush, cottonwood, sycamore, mesquite, or live oak). The lark sparrow will reuse the nests of other species, and territoriality disappears with the onset of

incubation. It is a frequent cowbird host.

Wintering - This sparrow winters from southern California and southern Arizona through Baja to central Mexico. In migration and winter, it is usually seen in flocks and frequents agricultural fields, suburban gardens, oak woodlands, chaparral, and mesquite and acacia interspersed with grassland.

Feeding - The lark sparrow forages on the ground for insects (especially grasshoppers) and the seeds of grasses and forbs. It often forages in flocks even in the breeding season.

Status - Long- and short-term BBS trend estimates show significant declines across the West and survey-wide from 1968 to 1995 and from 1980 to 1995. In the 1980 to 1995 period, estimates show significant declines in Colorado and the Intermountain Grasslands and Columbia Plateau physiographic regions, and possible declines in California, New Mexico, and Wyoming. Sample sizes are

too low for reliable estimates for Arizona, Washington, and Idaho. Centers of abundance are well-distributed throughout the Great Plains, Great Basin, Colorado Plateau, and western California. Widespread declines make us concerned about this species.

Conservation - In semidesert habitats of Arizona, Bock et al. (1984) found that moderate grazing can have a positive effect on populations depending on the overall habitat condition. Elsewhere, quantitative information on the lark sparrow's sensitivity to management activities is lacking. The lark sparrow would benefit from good perennial grass cover to conceal its nest. Reducing or eliminating pesticide spraying and grasshopper control may increase its prey base.

SHRUBLAND AND GRASSLAND SPECIES

Swainson's Hawk (*Buteo swainsoni*)

Breeding Habitat - The Swainson's hawk is found in sagebrush shrublands, prairies, and cultivated land (e.g., hay, alfalfa, and grain fields) with scattered trees. Open sagebrush/bunchgrass, juniper/sagebrush/bunchgrass, aspen/grassland, and aspen/sagebrush/bunchgrass communities are important as breeding and feeding habitat in the northern Great Basin (Maser et al. 1984). Tall trees (riparian, juniper, aspen, and shelterbelts) next to open fields are used for nest and roost sites. However, the increase in perch sites in most shrublands (telephone poles, fence posts, and trees) favors the red-tailed hawk over the Swainson's hawk (Houston and Bechard 1983). Nesting density varies from 0.1 to 1.6 nests per 10 km² (0.3 to 4 per mi²) throughout their range.

Nest - The Swainson's hawk constructs its nest of large twigs in isolated trees or in riparian zones adjacent to open country. The nest is often in a deciduous tree, sometimes in a conifer or shrub. In the Great Basin, nests are often in juniper and not necessarily associated with riparian zones. In a treeless area, the nest may be placed on a cliff ledge or on the ground.

Wintering - During migration, Swainson's hawks will roost in large fields. Highly migratory, the species mostly winters from south of the United States to South America. Swainson's hawks from throughout North America winter in concentrations of hundreds to thousands in the Pampas of Argentina, where they forage on locust and grasshopper outbreaks and roost in woodlands and shelterbelts.

Feeding - Swainson's hawks feed in low vegetation in openings of low sagebrush, other shrubs, woodlands, and wet meadows (Maser et al. 1984). Bechard (1982)

found that they used cultivated fields after and during harvesting, taking advantage of reduced plant cover. Locusts, grasshoppers, and crickets are favorite prey, but the Swainson's hawk also takes small mammals (rabbits, prairie dogs, ground squirrels, mice, voles), birds, amphibians, snakes, and beetles. Early observers reported the Swainson's hawk feeding heavily on grasshoppers, and also taking other insects and small vertebrates (see May 1935). Woodbridge (pers. comm.) suggests the species evolved to follow outbreaks of locusts and grasshoppers; however, eradication of North American locusts and widespread grasshopper control have shifted the hawk's diet to small mammals in many areas.

Status - According to historical accounts, the Swainson's hawk was once the most common hawk in suitable habitat. In the West, it has been in decline since the early part of the century and is now a rare breeder in the Great Basin (Ryser 1985; Harlow and Bloom 1989). A long-term decrease in productivity has also been documented in Saskatchewan (Houston 1993). Although BBS data show stable to increasing trends across the West from 1968 to 1995, and across the United States since 1980, these estimates seem to be driven by increases in Montana and Texas. BBS trends for many other areas are less certain due to small sample sizes. Populations in Colorado and Wyoming have declined steadily since 1968, and the central Great Plains show sharp declines since 1980. Relative abundances are low throughout the hawk's breeding range. Declines may be associated with loss of native bunchgrass prairies and perennial grasslands for breeding, foraging, and wintering habitat; widespread pesticide application on wintering grounds; and habitat changes that favor red-tailed hawks (Harlow and Bloom

1989). Organophosphate pesticide applications on wintering grounds have inadvertently killed thousands of roosting hawks in recent years (Woodbridge et al. 1995; England et al. 1997).

Conservation - This hawk is tolerant of agricultural lands interspersed with grasslands and sagebrush shrublands. Foraging habitat may be limiting, and the hawk should benefit from maintenance of native grass and forb habitats for rodent and insect prey. In sagebrush

shrublands, provide foraging habitat by managing for native, perennial bunchgrasses in openings or intermixed with open sagebrush and preventing dominance by sagebrush or non-native annual grasses (Harlow and Bloom 1989). Maintain scattered trees and woodlands for nesting.

Ferruginous Hawk (*Buteo regalis*)

Breeding Habitat - The ferruginous hawk is found in flat or rolling landscapes in sagebrush shrublands and other arid shrublands, dry open prairie grasslands, and badlands of western North America. Its optimal habitat is extensive ungrazed or lightly grazed prairie or sagebrush shrublands with nesting sites that command a view (Gilmer and Stewart 1983).

Nest - The ferruginous hawk prefers to nest in a tree (deciduous or conifer, often juniper) or on rimrock or a cliff ledge with a view. It will also nest on an outcrop, shrub, hillside, haystack, or elevated ground. In Wyoming, nests were observed in junipers, but were most often found in sagebrush shrublands on spires and outcrops (S. Ritter unpub. data). In western Colorado, ferruginous hawks nest in lone or small clumps of junipers at the desert edge or on rock outcrops on hillsides (R. Lambeth, pers. comm.). This hawk builds a large nest of heavy sticks and debris and will reuse a nest site and nest from year to year. It will also use artificial nest platforms.

Wintering - This species winters from the southwestern United States to Baja California and central Mexico, although a few winter on the breeding grounds.

Feeding - Small mammals (chiefly ground squirrels and pocket gophers east of the Continental Divide, and jackrabbits or cottontails west of the Divide) are the mainstay of this hawk's diet (Bechard and Schmutz 1995). It will also feed on songbirds, ducks, grouse, snakes, lizards, and large insects. The ferruginous hawk's breeding density and productivity apparently track the

abundance of its major prey (Bechard and Schmutz 1995).

Status - Ferruginous hawk populations suffered large declines in this century due to severe persecution, loss of native prairie habitats, and reduced prey availability, including elimination of prairie dog towns and ground squirrel colonies (Harlow and Bloom 1989). Breeding Bird Survey data show overall stable to increasing population trends across the West since 1968 and especially since 1980. However these estimates are driven by apparent increases in Montana and Colorado, and estimates for other states are less certain due to small sample sizes. The species remains rare throughout its range, and relative abundances on BBS routes are low.

Conservation - Breeding productivity apparently varies with prey availability, and especially with jackrabbit abundance in the Great Basin. Maintaining habitats for prey base, especially rodents (e.g., prairie dogs) and lagomorphs, and protection of elevated nest sites (trees and rock outcrops) should benefit the ferruginous hawk. Nest abandonment has been linked to mining developments (Bechard and Schmutz 1995). For recommendations on protecting ferruginous hawk nest sites from disturbance, see White and Thurow (1985) and Olendorff (1993). Recreational facilities such as trails should be routed away from and screened from view of known nest sites.

Prairie Falcon (*Falco mexicanus*)

Breeding Habitat - Most associated with prairie grasslands and sagebrush shrublands, the prairie falcon can be found in many open habitats from prairies and arid valleys to dry alpine tundra. Availability of cliff nest sites and a prey base of small mammals and birds are important factors. The highest known nesting density in North America is in southwest Idaho, where average home range size is 49 to 73 km² (20 to 29 mi²).

Nest - The prairie falcon nests in a shallow scrape on protected ledges of cliffs and outcrops. Nest sites are usually in crevices or cavities beneath protective overhangs on sheer cliffs. Most eyries face south or east and

overlook open habitats. This falcon will re-use old nest sites as well as find new sites within a territory. It will also use man-made holes on otherwise unsuitable cliffs.

Wintering - The species mostly winters from southern Canada to Baja California and northern Mexico, often at lower elevations than during breeding season. In fall and winter, prairie falcons wander and may congregate locally, possibly following the occurrence of horned larks, a principle prey species.

Feeding - This falcon preys on small birds (especially horned larks, western meadowlarks, and mourning doves) and small mammals, including ground squirrels

and rabbits. Reptiles and insects make up a small portion of its diet. It will flush prey by flying low over the ground, will stoop on flying birds from above, or hunt from a tall perch.

Status - BBS data are slim because the prairie falcon is not well sampled by the survey. Overall, BBS data show a significant decline across the West since 1968; the declining trend has been somewhat less steep since 1980. Sample sizes are too small for reliable state or physiographic region trend estimates and the falcon's abundance across the West is low. A 1987 assessment of status based on state wildlife agency listings and Audubon Christmas Bird Counts indicated that prairie falcon populations were stable (Platt and Enderson 1989). Although widespread, the prairie falcon is of concern primarily due to a high concern ranking in Idaho, where the species reaches its greatest recorded breeding density.

Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*)

Breeding Habitat - Columbian sharp-tailed grouse are associated with prairie grasslands and sagebrush-grasslands. In Idaho, Saab and Marks (1992) found that sharp-tails selected big sage habitat types during summer. They use areas dominated by perennial bunchgrasses like bluebunch wheatgrass or Idaho fescue (having a high percentage of leaves to stems) and where the shrub layer, if present, is dominated by big sagebrush and/or antelope bitterbrush (Ulliman et al. 1998). They use grasslands having few shrubs to sagebrush/grass areas having shrub cover up to 40%. The common denominator appears to be the amount of cover provided by the vegetation, whether herbaceous, shrub, or a combination. Brood sites are similar to nest sites, but they are usually close to broad-leaved brush patches or shrubby riparian zones. Sharp-tails will also nest and raise broods in cultivated fields (e.g., irrigated pasture, alfalfa hay, grain stubble, dryland seedings; Ulliman et al. 1998). They need habitat with moderate vegetative cover, high plant diversity, and high structural diversity. They are predominately associated with flat to rolling terrain during the breeding season. A self-sustaining population of sharp-tailed grouse needs thousands of hectares (acres).

Males display on leks, usually in open areas such as a small knoll, bench, or ridge top. Their mating displays, or dancing, occur from March through June, peaking in April. Leks contain as few as two males to as many as 30 or more, but average about 12 males (Ulliman et al. 1998). The females come to the lek to mate, then return to the surrounding grassland or shrubland to nest. Most nest and brood locations are within 2 km (1.2 mi) of the lek where the hen mated (Ulliman et al. 1998).

Nest - Sharp-tailed grouse nest on the ground in shallow depressions lined with grass, leaves, and other vegetative materials. They nest in sites with an overhead canopy of vegetation, provided either by grasses or shrubs.

Conservation - In Montana, Leedy (1972) found that eggshell thinning from organochloride pesticide poisoning was associated with expanding alfalfa production. In Idaho, the species showed a negative response to moderate grazing in big sagebrush/bluebunch wheatgrass (Reynolds and Trost 1981). Prairie falcons should benefit from protection of cliff nest sites and maintaining habitat for grassland and sagebrush shrubland birds and small mammals. Activities on the cliff tops above eyries are much more disturbing to nesting falcons than below the eyries at cliff bottoms (R. Lambeth pers. comm.). For drilling and construction activities, a buffer zone of 1 km (0.6 mi) around active nest sites is recommended to avoid nest abandonment (Suter and Jones 1981).

Wintering - Tall, broad-leaved mountain shrub and riparian cover types are critical components of winter habitat for sharp-tailed grouse (Saab and Marks 1992). They often move to higher elevations to get into moister sites that support greater amounts of these types of shrubs (Ulliman et al. 1998). However, in mild winters, they often stay in the open grasslands and shrubland communities that they used for nesting and brood-rearing. Suitable winter sites need to be no more than 6.4 km (4 mi) from leks to be useful to sharp-tails (Ulliman et al. 1998). They form mixed-sex winter flocks of 10 to 35 birds, occasionally up to 100.

Feeding - Sharp-tailed grouse feed on leaves, buds, flowers, seeds, and fruit. The young in their first two to three weeks eat mostly insects. In the winter, they eat the buds of broad-leaved trees and shrubs. In Idaho, the fruits of hawthorn and snowberry are favored, as are the buds of chokecherry and serviceberry (Ulliman et al. 1998). Alfalfa, wheat, and barley fields can provide important food resources, but they must be located near permanent cover that provides nesting, brood-rearing, and winter habitat (Ulliman et al. 1998).

Status - The subspecies Columbian sharp-tailed grouse has undergone a significant rangewide decline; it currently occupies less than 10% of its former range (Ulliman et al. 1998). Historically, Columbian sharp-tailed grouse ranged in suitable habitats from British Columbia south through eastern Washington and Oregon; Idaho; western Montana, Wyoming, and Colorado; and northern Utah, Nevada, and California (Fig. 1 in Ulliman et al. 1998). Many remaining populations are small and widely separated from other populations. Idaho has the best remaining populations, with 75% of the remaining birds; the subspecies has been extirpated from Oregon, California, and Nevada and is nearly gone in Montana (Ulliman et al. 1998). The conversion of native grassland and shrub-

grass communities to unsuitable land uses has been primarily responsible for the reduction in Columbian sharp-tailed grouse populations (Ulliman et al. 1998). Much of the remaining historical habitat that has not been converted to other uses has been degraded by fire (too much in some areas, not enough in other areas), invasion of non-native annual vegetation, and excessive grazing by livestock (Ulliman et al. 1998).

Conservation - The federal Conservation Reserve Program (CRP) has restored many thousands of hectares of nesting and brood-rearing habitat for Columbian sharp-tailed grouse and has resulted in a large increase in the abundance of this species in Idaho (Ulliman et al. 1998). The CRP, however, sets aside lands for only 10-15 years, with option for an extension, so these lands are likely to either be placed back into crop production or used for livestock grazing in the future. Maintaining or restoring grasslands and sagebrush-grasslands to good to excellent ecological condition (i.e., late seral condition) will benefit

Loggerhead Shrike (*Lanius ludovicianus*)

Breeding Habitat - The loggerhead shrike is found in open country wherever there is low vegetation for foraging and scattered shrubs and trees for nesting and roosting, often around ecotones between open cover types. Hunting perches are an important component of the habitat. The loggerhead shrike occurs in sagebrush shrublands, arid scrub, prairies, mountain meadows, desert shrublands, juniper and pinyon-juniper, mountain mahogany, riparian areas, and shelterbelts (Yosef 1996). In the northern Great Basin, greasewood/grass, tall sagebrush/bunchgrass, mountain mahogany/shrub, juniper/sagebrush/bunchgrass, and riparian communities are primary habitats (Maser et al. 1984). Wiens and Rotenberry (1981) found loggerhead shrikes uncommon in sagebrush shrublands and associated with areas of broken topography.

Nest - The loggerhead shrike builds an open cup nest in a shrub or tree with dense foliage for protective cover, often preferring thorny vegetation, and sometimes in a brush pile or vine tangle. It sometimes uses the same nest, and often the same shrub or tree, from past years (Yosef 1996). In a study in southwestern Idaho, nests were constructed deep within shrubs 1 to 2 m tall (3 to 6 ft) and were found in sagebrush (65%), antelope bitterbrush (20%), and greasewood (12%). The study found that nests in this sagebrush shrubland were invariably placed low to the ground, averaging 79 cm (31 in; range 33 to 160 cm, 13 to 63 in) regardless of shrub height, and the authors suggest this may be representative of nest heights in arid western shrublands (Woods and Cade 1996).

Wintering - Northern populations retreat from the breeding grounds, and the species winters throughout the southern tier of North America, including the Great Basin and Colorado Plateau, California, the Southwestern states, and south through Mexico (Yosef 1996).

sharp-tailed grouse. Retaining a residual cover of perennial grasses and forbs of at least 20 cm (8 in) in nesting habitat will provide sufficient nesting cover. Grazing of key winter shrubs should be no more than 35% use (Ulliman et al. 1998). Sharp-tailed grouse require thousands of hectares (acres) to support a self-sustaining population; large blocks of agriculture are not conducive to sharp-tail occupancy (Ulliman et al. 1998).

Protection of dancing grounds or leks from disturbance during the mating season is important for successful reproduction. Ulliman et al. (1998) recommend no developments within 365 m (400 yd) of a lek and avoiding physical, mechanical, and loud noise disturbances within 800 m (0.5 mi) of a lek during the breeding season (March through June) from one hour before sunrise to three hours after sunrise.

Feeding - The shrike hunts where vegetation is scattered and bare ground is exposed, hunting from perches within 2 m (6 ft) of the ground. It feeds chiefly on insects (beetles and grasshoppers) but also small birds, small mammals (ground squirrels, mice, and voles), and lizards (Yosef 1996). Shrikes adjust their diet to the availability of prey, taking more vertebrates in winter, migratory birds during spring migration, rodents in mid-summer, and grasshoppers once the larger instars become abundant. Shrikes prefer to forage where substrate vegetation is low (1 to 25 cm; 0.4 to 9 in) and hunt on patchy, open ground or swoop on prey in shrubs. Young, inexperienced shrikes prefer to hunt on bare ground where their success in capturing prey is higher (Leu 1995).

Status - Once abundant, the loggerhead shrike has declined sharply since the mid-20th century in much of the East and Midwest. Shrikes were often shot in the past, but sharp declines coincide with the use of organochloride pesticides (e.g., DDE and dieldrin) from the 1940s through the 1970s. BBS data show nearly universal declines across the continent, and populations in the West have declined significantly since 1968. Data show significant declines in the Great Basin, Columbia Basin, and Colorado Plateau from 1968 to 1995. Western centers of abundance are in the Southwest and California. Declines are thought to be linked to pesticide contamination, habitat loss, and winter survival problems, but are not well understood.

Conservation - Agricultural conversion of sagebrush shrublands and prairies, urbanization, strip-mining, and hedgerow destruction have reduced suitable habitat. In the Canadian prairies, steep declines in shrike numbers coincided with grasshopper control using dieldrin, and declines may be connected more to reduction in prey base than to direct effects of chemicals on reproduction, but the full effects of pesticide contamina-

tion are not known (Yosef 1996). In a Nevada study, loggerhead shrikes responded positively to grazing in shadscale and low sage habitats (Page et al. 1978). They showed no response to grazing in big sage/bluebunch wheatgrass in Idaho (Reynolds and Trost 1980) or in shadscale in Utah (Medin 1986). The shrike would benefit from elimination of pesticides and maintenance of a diverse vegetative structure. Long-term heavy grazing

may ultimately reduce prey habitat and degrade the vegetation structure for nesting and roosting. Light to moderate grazing may provide open foraging habitat.

GRASSLAND SPECIES

Long-billed Curlew (*Numenius americanus*)

Breeding Habitat - Although a shorebird, the long-billed curlew is not associated with water during the breeding season. It breeds in shortgrass uplands, grazed mixed-grass prairie, meadows, arid scrub prairies, and short, open sagebrush. For nesting, curlews prefer open areas with a wide view. They will nest in recently-grazed areas of short vegetation, desert, dry prairies, sagebrush shrublands, grasslands, and moist meadows.

Nest - The curlew nests in an open scrape on the ground, usually on a well-drained site with gravelly soils, in a grassy hollow, or on a small slope. It often places the nest near a rock, manure pile, or other object, and lines the scrape with grass, weeds, and bits of cow chips. An Idaho study in grazed cheatgrass found that curlews preferred to nest in areas with short vegetation (10 to 20 cm; 4 to 8 in) and wide visibility, and required a 300- to 500-m (327 to 5445 yd) buffer zone around a territory that is unoccupied by other curlews. Territories averaged 14 ha (35 ac; Bicak et al. 1982). In Wyoming, nests in sagebrush shrublands were in areas where the sagebrush was short (<0.3 m or 1 ft) and open (S. Ritter unpub. data). In Utah, nests were in vegetation from 4.5 to 6 cm tall (1.8 to 2.5 in) in small clumps of live and dead vegetation near patches of barren ground (Paton and Dalton 1994). Nest predators include magpies, gulls, raptors, and many medium-sized mammals. The precocial chicks feed themselves from hatching, and remain in dry grasslands until they are able to fly, feeding on items picked from the ground.

Wintering - Long-billed curlews use beaches and mudflats during migration. They migrate to coastal and grassland habitats in California, Mexico, and Central America, and winter in flocks on tidal flats, inland grassland, and agricultural fields.

Feeding - Adults pick items from the soil or probe into wet sand and mud, feeding on insects (grasshoppers, beetles, caterpillars, larvae) and other invertebrates, especially worms, crustaceans, mollusks, small amphibians, and the eggs and nestlings of small birds. The long-billed curlew will also consume berries before fall migration.

Status - Long-billed curlew populations were decimated by uncontrolled hunting in the 19th and early 20th centuries. Protected populations in the arctic recovered, but pesticide poisoning and widespread agricultural conversion of grassland habitats in the central and western states have not permitted the same population recovery. The species is not well sampled on the BBS, so sample sizes are small, but trend estimates show a long-term significant decline across the continent, particularly in the western Great Plains. West of the Rockies, the species was stable to increasing over the 1968 to 1995 survey period, with a significant increase in the Columbia Basin. Because curlews can be inconspicuous during breeding, relative abundances along survey routes are low. Centers of abundance are in western Montana and the Snake River Plain, the Columbia Basin, western Utah and eastern Nevada, the Staked Plains of New Mexico and Texas, and High Plains of Colorado and Wyoming.

Conservation - Long-billed curlews generally respond positively to grazing prior to the onset of nesting to create short-grass habitat (Ryder 1980; Bicak et al. 1982; Medin and Clary 1990). A study in the northern plains, however, showed no response to heavy or moderate grazing in mixed-grass habitats (Kantrud and Kologiski 1982), and Reynolds and Trost (1981) found a negative response to moderate grazing in big sage/bluebunch wheatgrass. During the breeding season, nests and nestlings are vulnerable to livestock trampling. Curlews may respond positively to burning that creates openings of short grass (A. Bammann pers. comm.). The species should benefit from wetland protection, protection from trampling during nesting, and maintenance of open areas of short to mixed-grass uplands. In Washington, curlews nested on Conservation Reserve Program lands that had been in the program for 5 years (M. Denny pers. comm.).

Burrowing Owl (*Athene cunicularia*)

Breeding Habitat - The burrowing owl is found in open, treeless country, including dry prairies, grasslands, meadows, open sagebrush shrublands, and agricultural lands, but not in mountain meadows. Where free from direct harassment, it will also use outlying areas of airports, golf courses, road rights-of-way, and vacant lots. The presence of abandoned small mammal burrows in grazed, level grasslands for nest and roost sites is of primary importance (Haug et al. 1993), and this owl is frequently associated with prairie dog and ground squirrel colonies.

Nest - The burrowing owl nests in abandoned burrows of small mammals, especially prairie dogs, ground squirrels, marmots, and badgers. Burrowing owls in the West do not excavate their own burrows although owls in Florida have been known to do so. The owls prefer areas with a high density of burrows that may provide escape for young owls, and often nest in loose colonies. Owls maintain burrows throughout the nesting season and will return to the same burrow the following year. Badgers are a major nest predator. Other predators are domestic cats and dogs, opossums, weasels, and skunks (Haug et al. 1993). Burrowing owls will also use human-made structures such as culverts, overflow pipes, and artificial nest burrows.

Wintering - The burrowing owl migrates from the northernmost areas of its breeding range in the Great Plains and Great Basin to winter in the Southwest, Mexico, and Central America.

Feeding - Active both night and day, the burrowing owl hunts mostly at dawn, dusk, and at night. It is an opportunistic predator and feeds on insects, small mammals (kangaroo rats and voles), small birds, and other small vertebrates. It hunts from a perch, from low flight, or by stalking prey on the ground, and forages in short grass, including mowed or grazed pastures.

Status - Prairie dog and ground squirrel control efforts and agricultural conversion reduced the prey base

and nesting habitat for the burrowing owl in many parts of its range. The species is listed as endangered in Minnesota and Iowa and threatened in Canada, and is of concern throughout much of the West. Populations in Canada are in sharp decline (Haug et al. 1993). Populations are down by more than 50% in California, Nevada, Colorado, and New Mexico and have also declined in Idaho, Montana, and Arizona (DeSante and George 1994). The BBS does not adequately sample burrowing owls for state-level trend estimates. Estimates for the West as a whole show a significant increase from 1968 to 1995, with a steeper increase since 1980, probably driven by an apparent increase in California in recent years. The overall estimate for the Rocky Mountain and Great Plains states shows a decline since 1968, but a more stable trend since 1980. Trends in the Southwest show a steep and significant decline since 1980.

Conservation - Protection of burrowing mammal populations is of primary importance to maintaining the burrowing owl's nest habitat. Agricultural conversion of grasslands and pastures and the control of small mammal populations eliminate the owl's breeding habitat. Predators, pesticides, shooting, and vehicle collisions also take a heavy toll on the birds. A summary of grazing studies shows mixed responses to grazing in sagebrush and grassland habitats (Saab et al. 1995). Owls will use well-grazed, early successional grasslands that emulate prairie dog towns (MacCracken et al. 1985). Burrowing owls will benefit from management that maintains zones free of herbicides and pesticides within a 600-m (655-yd) radius of burrows and that provides uncultivated plots of dense grasses and forbs within owl home ranges to support rodent and insect prey (Rich 1986; Haug and Oliphant 1990).

Short-eared Owl (*Asio flammeus*)

Breeding Habitat - Widely distributed across North America, the short-eared owl uses prairies, grasslands, meadows, marshes, and open sagebrush shrublands. It nests most often in grassland, but also in stubble fields, hay fields, and Conservation Reserve Program fields. It is strongly associated with ungrazed and undisturbed native grasslands and wetlands that support dense small mammal populations (Duebbert and Lokemoen 1977; Kantrud and Higgins 1992). This owl roosts singly or communally on the ground, in a low shrub, or in a conifer.

Nest - The short-eared owl nests in a depression on the ground in concealing cover, typically on a dry site such as a slight ridge, knoll, or mound. In Montana, of 28 recorded nests, 85% were surrounded by grasses and 90%

were in vegetation less than 0.5 m (1.6 ft) high (Holt and Leasure 1993).

Wintering - Northern populations are migratory, wintering from southern Canada to southern Baja, and south through Mexico. Short-eared owls use grain stubble-fields, hay meadows, and pastures and will roost in dense conifers to escape heavy snow cover. Roosts within the northern breeding range are often communal.

Feeding - This owl hunts day or night, though in winter usually at dawn and dusk, and probably in synchrony with prey activity. Voles are the owl's primary prey throughout North America, but it will also take other rodents, grassland birds (killdeer, western meadowlark, and horned lark), and large insects. It seeks out areas with

high rodent densities, causing local irruptions in short-eared owl numbers during the breeding season, migration, and winter.

Status - Wetland destruction, grassland conversion, and overgrazing of grasslands and shrubsteppe are believed to have caused significant declines across the West. Agricultural harvesting destroys nests laid in croplands. Populations have declined by more than 50% in California and New Mexico (DeSante and George 1994). Because the short-eared owl is an irruptive and nomadic bird, the BBS population trend data are scarce. The 30-year trend estimate for the West as a whole shows a steep decline, chiefly in the period from 1968 to 1979. There is also a significant overall decline survey-wide, but sample sizes are too low for accurate trend estimates for states and physiographic regions. Relative abundances are low

Vesper Sparrow (*Pooecetes gramineus*)

Breeding Habitat - A bird of short grasslands, the vesper sparrow breeds throughout North America. In the Great Basin, it is found in sagebrush-grass habitats of higher valleys and mountains, where shrubs are low and scattered and grass-cover is thin. It also occurs in mountain meadows, pinyon-juniper, prairie edges, abandoned fields, Conservation Reserve Program fields, and shelterbelt margins—wherever there is sparse grassland with song perches. In Montana, the vesper sparrow is associated with sagebrush, grassland, and agricultural habitats (Hutto 1995). It can be found in the early seral stages of woodlands (Hejl and Woods 1991) or in pinyon-juniper openings with small, dense shrubs (Sedgwick 1987). Populations will increase after prescribed burns in ponderosa pine and pine-grassland savannah (Bock and Bock 1983). Male vesper sparrows frequently use sagebrush and juniper as song perches (Castrale 1983).

Nest - This sparrow builds an open cup nest on the ground, well-hidden in an excavated depression at the base of vegetation. It is a common host to cowbirds.

Wintering - The vesper sparrow winters in the southern United States, from California, central Nevada and Arizona, south through Baja and into central Mexico. It uses grassy or weedy pastures and fields, prairies, old burns, brushy borders of fields, desert scrub, and woodland openings.

Feeding - The vesper sparrow forages on the ground, and both insects and the seeds of grasses and forbs are important in its diet. A study in western North Dakota found that grasshoppers composed 67% of its diet, yet its nest success was not affected where grasshoppers were experimentally reduced, as nesting birds compensated by foraging farther from the nest. In this study, predation of nestlings played a large role in nest failure (Adams et al. 1994).

Status - In the 19th century, the vesper sparrow

throughout the species' range.

Conservation - Highly dependent on vole populations, the short-eared owl irrupts locally when vole densities are high. In general, it responds negatively to moderate and heavy grazing in mixed grass and big sagebrush habitats (Saab et al. 1995). Maintaining large, continuous grasslands and wetlands with dense vegetation to support a prey base, and grasses 0.5 m (1.6 ft) high or less, provides breeding and foraging habitat. Short-eared owls benefit from habitat management for waterfowl, particularly nest cover protection, and the burning and management of grasslands for nesting and prey habitat (Holt and Leasure 1993).

expanded its range in the Northeast following the clearing of forests for agriculture, then decreased again in this century as farmlands disappeared. A Montana study found vesper sparrows and Brewer's sparrows to be the two most abundant species in a sagebrush-steppe study site (Feist 1968). Although Brewer's sparrows are common in grassland habitats, the BBS trend estimates for 1968 to 1995 show long-term declines in the West and survey-wide. Declines are significant in the Basin and Range, Dissected Rockies, and Columbia Plateau physiographic regions, particularly since 1980. Washington, California, and Colorado are the only western states that show stable to increasing trends, and in Arizona and Nevada sample sizes are too low for statewide estimates. DeSante and George (1994) list Washington and Oregon as states where vesper sparrow populations have notably declined. Centers of abundance in the West are scattered throughout the Columbia Basin, northern and eastern Great Basin, Snake River Plain, Colorado Plateau, and western Great Plains. The species' association with native grasslands and its widespread population declines make it a species of management concern.

Conservation - In an overview of several studies, the vesper sparrow shows inconsistent responses to grazing in several grassland types; a negative response to heavy grazing in sagebrush/grasslands; and a positive response to heavy grazing in greasewood/wild rye and shadscale/Indian ricegrass habitats (Saab et al. 1995). In the sagebrush shrublands, it benefits from maintenance of open habitats with scattered shrubs and good bunchgrass cover for nest concealment. Widespread use of pesticides and grasshopper control may be detrimental to the vesper sparrow's prey base.

PRIMARILY DRY WOODLAND SPECIES

Gray Flycatcher (*Empidonax wrightii*)

Breeding Habitat - Restricted to the arid west, the gray flycatcher is a common breeding migrant of the Great Basin, principally associated with juniper woodlands (Ryser 1985). In the Great Basin's western reaches, the species nests in mature big sagebrush where the sagebrush is luxuriant and reaches small tree size. Arid open woodlands (such as juniper, pinyon-juniper, and oak-pine), aspen, tall sagebrush/bunchgrass, and mountain mahogany communities are important breeding and feeding habitat. Riparian woodlands are also important for feeding (Maser et al. 1984).

Nest - The gray flycatcher constructs a cup nest in a juniper or other low tree or sagebrush, usually within 1 to 4 m (3 to 12 ft) of the ground. Ryser (1985) notes that it may place its nest in or under the same tree as a Swainson's hawk nest in a passive nesting association, taking advantage of the hawk's defense of its own nest site from snakes, crows, and ravens.

Wintering - Arid scrub, riparian woodlands, and mesquite are important to the gray flycatcher during migration. The species winters from the Southwestern United States to southern Baja and central Mexico in desert sagebrush shrublands, savannahs, and gallery forests (Rappole et al. 1983).

Feeding - An insectivore, the gray flycatcher feeds on beetles, grasshoppers, moths, and other small insects. It "fly-catches" close to the ground, sallying out from

perches on tops of shrubs and trees. It also catches and gleans insects from the ground and low plants.

Status - The BBS data show a significant positive trend in the West overall from 1968 to 1995, particularly since 1980. The species is poorly sampled by the BBS, however, and sample sizes are too low for accurate state or physiographic region trend estimates, although relative abundances are high on survey routes reporting gray flycatchers. Centers of abundance are in eastern Oregon, the Snake River Plain, and Columbia Basin. The species' association with old-growth juniper and mature big sagebrush stands, plus trend uncertainties for local populations, make the gray flycatcher a species of management concern.

Conservation - A summary of grazing studies indicates mixed responses to grazing in sagebrush habitats—a positive response in shadscale/Indian ricegrass and Nevada bluegrass/sedge, but a negative response in big sagebrush/bluebunch wheatgrass (Saab et al. 1995). The gray flycatcher will probably benefit from maintenance of tall, mature big sagebrush/bunchgrass communities and of mature juniper and pinyon-juniper stands as primary nesting and feeding habitats. Reducing or eliminating pesticides may increase its prey base.

APPENDIX II.

SCIENTIFIC NAMES OF OTHER SPECIES

The major woody sagebrush taxa (genus *Artemisia*) found in the sagebrush-shrubland region and other plant and animal species mentioned in the main text (*Artemisia* taxa after Kartesz 1994; some subspecies not represented).

Scientific Name	English Name	Scientific Name	English Name
LOW SAGEBRUSHES		GRASSES	
<i>Artemisia arbuscula</i>	low sagebrush	continued	
<i>spp. longiloba</i>	alkali sagebrush	<i>Elymus elymoides</i>	bottlebrush squirreltail
<i>A. bigelovii</i>	Bigelow sagebrush	(<i>Sitanion hystrix</i>)	
<i>A. cana</i>	silver sagebrush	<i>Stipa thurberiana</i>	Thurber needlegrass
<i>A. frigida</i>	fringed sage	<i>S. comata</i>	needle-and-thread
<i>A. nova</i>	black sagebrush	<i>Nassella viridula</i>	
<i>A. pygmaea</i>	pygmy sagebrush	(<i>Stipa viridula</i>)	green needlegrass
<i>A. rigida</i>	stiff sagebrush	<i>Taeniatherum caput-medusae</i>	
<i>A. spinescens</i>	budsage	<i>spp. asperum</i>	Medusahead (wildrye)
TALL SAGEBRUSHES		FORBS	
<i>A. filifolia</i>	sand sagebrush	<i>Achillea millefolium</i>	common yarrow
<i>A. rothrockii</i>	Rothrock sagewort	<i>Agoseris</i> spp.	mountain-dandelion
<i>A. tridentata</i>	big sagebrush	<i>Astragalus</i> spp.	milk-vetch
<i>spp. tridentata</i>	basin big sagebrush	<i>Balsamorhiza sagittata</i>	balsamroot
<i>spp. wyomingensis</i>	Wyoming big sagebrush	<i>Crepis alnifolia</i>	hawksbeard
<i>spp. vaseyana</i>	mountain big sagebrush	<i>Eriogonum</i> spp.	fleabane or buckwheat
<i>spp. xericencis</i>	xeric sagebrush	<i>Gutierrezia sarothrae</i>	snakeweed
<i>spp. spiciformis</i>	subalpine big sagebrush	<i>Lactuca serriola</i>	prickly lettuce
<i>A. tripartita</i>	threetip sagebrush	<i>Melilotus</i> spp.	sweet-clover
OTHER SHRUBS		<i>Phlox</i> spp.	phlox
<i>Chrysothamnus</i> spp.	rabbitbrush	<i>Taraxacum officinale</i>	common dandelion
<i>Purshia tridentata</i>	antelope bitterbrush, antelope brush	<i>Tragopogon dubius</i>	yellow salsify
<i>Sarcobatus vermiculatus</i>	greasewood	<i>Trifolium</i> spp.	clover
<i>Atriplex confertifolia</i>	shadscale	BIRDS	
<i>Ephedra viridis</i>	Mormon tea	<i>Molothrus ater</i>	brown-headed cowbird
<i>Eurotia lanata</i>	winter fat	<i>See also Appendix I.</i>	
<i>Grayia spinosa</i>		MAMMALS	
(<i>Atriplex spinosa</i>)	spiny hopsage	<i>Bison bison</i>	bison
<i>Amelanchier</i> spp.	serviceberry	<i>Antilocapra americana</i>	pronghorn
<i>Cercocarpus ledifolius</i>	curlleaf mountain- mahogany	<i>Odocoileus hemionus</i>	mule deer
<i>Prunus</i> spp.	wild cherry, chokecherry	<i>Cervus elaphus</i>	elk
<i>Symphoricarpos</i> spp.	snowberry	<i>Sylvilagus idahoensis</i>	pygmy rabbit
<i>Tetradymia spinosa</i>	cottonthorn, horsebrush	<i>S. audubonii</i>	desert cottontail
<i>Crataegus</i> spp.	hawthorn	<i>S. nuttallii</i>	Nuttall's cottontail
GRASSES		<i>Lepus californicus</i>	black-tailed jackrabbit
<i>Pseudoroegneria spicata</i>	bluebunch wheatgrass	<i>L. townsendii</i>	white-tailed jackrabbit
(<i>Agropyron spicatum</i>)	crested wheatgrass	<i>Lagurus curtatus</i>	sagebrush vole
<i>Agropyron cristatum</i>		<i>Cynomys ludovicianus</i>	blacktail prairie dog
<i>Pascopyrum smithii</i>		<i>C. gunnisoni</i>	whitetail prairie dog
(<i>Agropyron smithii</i>)	western wheatgrass	<i>Ammospermophilus leucurus</i>	white-tailed antelope ground squirrel
<i>Bromus tectorum</i>	cheatgrass	<i>Spermophilus lateralis</i>	golden-mantled ground squirrel
<i>Festuca idahoensis</i>	Idaho fescue	<i>Taxidea taxus</i>	badger
<i>Oryzopsis hymenoides</i>	Indian ricegrass	REPTILES	
<i>Poa secunda</i>		<i>Sceloporus graciosus</i>	sagebrush lizard
(<i>Poa sandbergii</i>)	Sandberg's bluegrass		

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is part of an international coalition called Partners in Flight. This coalition includes government agencies, conservation groups, academic institutions, private businesses, and other citizens who share a common vision: to keep bird populations and their habitats healthy. These individuals and groups are dedicated to voluntary actions that will help preserve the magnificent diversity of birds throughout the Western Hemisphere.

