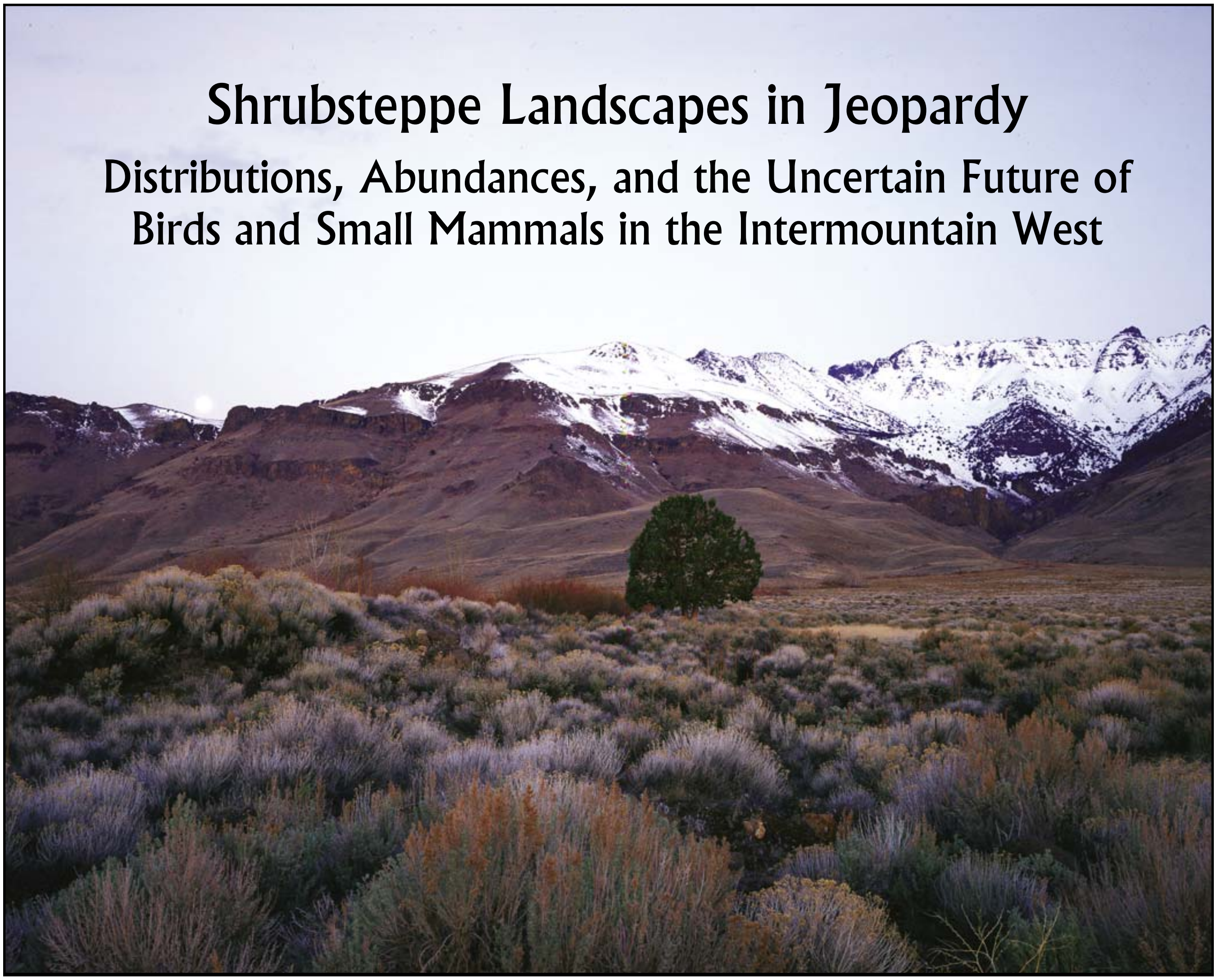
Shrubsteppe Landscapes in Jeopardy

Distributions, Abundances, and the Uncertain Future of Birds and Small Mammals in the Intermountain West



David S. Dobkin and Joel D. Sauder

High Desert
Ecological
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COVER: Moonrise over shrubsteppe on Steens Mountain in southeast Oregon's Great Basin. Photograph by Greg Burke.

The High Desert Ecological Research Institute, under the direction of Dr. David S. Dobkin, was established in 1993 to serve as a regional center for ecological research and policy analysis with a primary focus on natural resource issues related to the Intermountain West and the Pacific Northwest. The Institute conducts cooperative, multidisciplinary, long-term research on a wide range of problems in natural resource management and conservation in western North America. The High Desert Ecological Research Institute is an independent, nonprofit, research and educational organization.

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EXECUTIVE SUMMARY

Landscapes dominated by sagebrush (*Artemisia* spp.) extend across large portions of 11 states in the Intermountain West, but very little of the sagebrush biome remains undisturbed or unaltered from its condition prior to Euro-American settlement. Sagebrush shrubsteppe is now one of North America's most imperiled and neglected ecosystems due to the profound, ecologically transformative influences of numerous human-caused impacts that have fragmented and degraded sagebrush habitats across their widespread distribution.

We considered the entire suite of bird and small-mammal species that occur in shrubsteppe landscapes, and distilled a list of 61 species that are completely or extensively dependent on shrubsteppe ecosystems in the Intermountain West. We conducted a broad-scale analysis of distributions, abundances, and sensitivity to habitat disturbance in order to assess the current state of knowledge and the conservation needs of these species in the 11 western states. We further focused our analyses on the three ecoregions (Columbia Basin, Great Basin, and Wyoming Basin) with the greatest percentages of sagebrush land cover.

In our assessment of shrubsteppe-dependent birds, we analyzed regional and subregional population trends using Breeding Bird Survey (BBS) data for 25 upland species and 12 riparian species, and mapped the geographic patterns of avian population change in these ecoregions. We examined population trends of birds for the Western BBS Region as a whole, and for each of the four physiographic provinces that comprise the Columbia Plateau, Great Basin, and Wyoming Basin ecoregions for the periods 1968–1983, 1984–2001, and 1968–2001.

Remarkably little is known about the actual distributions or population trend patterns of small mammals because there is no standardized survey comparable to the BBS. We compiled an extensive database from the published literature for 18 upland and 6 riparian small-mammal species. We incorporated the database into a geographic information system (GIS) to map presence and absence of each species in relation to presumed historical distributions, and determined the actual proportion of studies that documented presence of each species in suitable habitats across the Intermountain West.

We mapped geographic patterns of species richness for birds and mammals across the Intermountain West based on BBS presence/absence data and historical distributions.

Avian Population Trends and Responses to Habitat Alteration

We found significant declining population trends for 16 of the 25 upland bird species (64%) in one or more of the regions considered over at least one of the three periods examined. Only three of the 25 species (12%) exhibited significant long-term increases across the Western BBS Region, but none of these showed significant increasing population trends in any of the constituent physiographic provinces. Five of the 12 riparian species (42%) declined significantly over both the long term and short term across the Western BBS Region. Only one riparian species showed any significant increase in any region or time period at all. No significant trends were found for 14 of the 37 species (38%), but for 13 of these the lack of trends appeared to be a consequence of undersampling by the BBS rather than evidence of stability.

Birds that depend on native vegetation for their nests clearly are jeopardized by the loss or degradation of native vegetation. We examined each species' dependence on ground and shrub vegetation for nesting and foraging and found that nearly all of the 25 upland species (88%) are obligate ground/shrub nesters or foragers. Eighteen of the 25 species (72%) are obligately dependent on native ground and shrub vegetation both for nesting and foraging. Nine of the 12 riparian species (75%) are obligate ground or shrub nesters in riparian habitats of the three focal ecoregions.

The Columbia Plateau, Great Basin, and Wyoming Basin are among the least consistently sampled of all physiographic provinces covered by the BBS. The BBS routes that do exist in this region underrepresent sagebrush habitats, and some of the species we considered are poorly detected by BBS methodology. Given these limitations, it is both remarkable and alarming to find that nearly two-thirds of the upland bird species and nearly half of the riparian species we considered have declining population trends, especially given our strongly conservative filtering of BBS data. The most striking pattern seen in the significant trends at the ecoregion level was the overwhelmingly negative picture across the long-term period for the Columbia Basin.

Mammal Distributions and Abundances

Eleven of the 24 mammals we considered are endemic to the Intermountain West shrubsteppe: five ground squirrels, pygmy rabbit, four heteromyid rodents (Great Basin pocket mouse, dark kangaroo mouse, pale kangaroo mouse, chisel-toothed kangaroo rat), and the Townsend's pocket gopher.

Of the 19 species for which adequate trapping data were available, only one species (Great Basin pocket mouse) was found in more than 62% of potentially suitable localities. Based on a combination of field studies and known ecological requirements, 21 of 24 (88%) small-mammal species respond negatively to the effects of livestock grazing. Eleven of 18 (61%) upland mammals responded negatively to the presence of exotic plant species, but most riparian species exhibited essentially neutral responses to the presence of exotic vegetation if it supplied dense cover.

Our analysis of field studies that used appropriate trapping methods in suitable habitats is the first comprehensive attempt to quantify actual presence and absence of species across the region. We were surprised by the high frequency with which species were found to be missing in studies that had focused exclusively on suitable locations. The high percentages of studies that failed to find species where expected should raise concern regarding the actual current extent of populations relative to standard range maps of these species.

Geographic Patterns of Species Richness and Community Stability

Species richness for upland birds was concentrated in the three primary shrubsteppe ecoregions, indicating an extraordinary degree of dependence by this suite of species on shrubsteppe landscapes of the Columbia Plateau, Great Basin, and Wyoming Basin. Areas of highest species richness included the breadth of the Columbia Plateau extending from southeastern Oregon to easternmost Idaho, the eastern two-thirds of the Great Basin, and the southwestern portion of the

Wyoming Basin. Virtually no areas within these three ecoregions exhibited high species richness for riparian birds.

Species composition of upland shrubsteppe bird communities compared between the 1968–1983 and 1984-2001 periods varied little across most of the three primary shrubsteppe ecoregions. In sharp contrast to upland birds, community composition of riparian birds varied substantially between the two periods. Given the relative rarity and ecological importance of riparian habitats within shrubsteppe landscapes, the high degree of instability in community structure of riparian birds should raise great concern as a reflection of the poor ecological condition of riparian habitats across much of the Columbia Plateau, Great Basin, and Wyoming Basin ecoregions.

Species richness for small mammals was far more concentrated within the three primary shrubsteppe ecoregions compared to the results for birds. For the 18 upland mammals, highest species richness occurred in southeastern Oregon and northwestern Nevada in the Columbia Plateau, and across all but the southeasternmost portion of the Great Basin. Species richness for mammals was markedly lower in the Wyoming Basin, partly as a consequence of the restricted geographic ranges for many of the endemic species. The high degree of endemism among small mammals of the shrubsteppe is likely even greater than species-level ranges indicate. We believe that genetic analyses of upland and riparian small mammals would provide further examples of such “cryptic” species as the narrowly distributed, endemic ground squirrels.

In addition to the much lower species richness found for upland mammals in the Wyoming Basin, north-central Oregon and eastern Washington were relatively depauperate in both shrubsteppe bird and mammal species. We interpret this pattern as a reflection of the high proportion of these landscapes that has been converted to agricultural production.

Our maps of species richness for birds and for small mammals can be integrated with the recent detailed vegetation-mapping results of Knick et al. (2003) to guide future conservation efforts from the standpoint of overall biodiversity of species most closely tied to shrubsteppe landscapes.

Conclusions

Range maps created by connecting the dots among sites where a species has been captured do not paint a realistic picture, especially in the highly altered and fragmented shrubsteppe landscapes of today. For small terrestrial mammals in particular, our results support the view that many of these species now exist only as small, disconnected populations isolated from each other by unsuitable habitats across which they cannot disperse. Many of the bird and mammal species we examined have broad geographic ranges, but our spatially explicit analyses of actual trapping and BBS data, along with previous work on shrubsteppe bird population dynamics emphatically demonstrate this point: It is completely untenable to assume species’ presence based simply on presence of appropriate habitat in shrubsteppe landscapes of the Intermountain West.

Some of the species included in our analyses were already known to be declining or rare. Nevertheless, given the number of species analyzed and the breadth of ecological roles encompassed, we expected to find that conservation concern would prove unwarranted for a significant number of the species we examined. Based on the information presented in this report, we find no basis for optimism about the prospects in the Intermountain West of any of the 61 species we examined. The results of our analyses present an overall picture of an ecosystem teetering on the edge of collapse (Knick et al. 2003). It is clear that the bird and small mammal species dependent upon Intermountain West shrubsteppe landscapes are providing the signals that they are at risk.

INTRODUCTION

Landscapes dominated by sagebrush (*Artemisia* spp.) extend across large portions of 11 states in the Intermountain West and comprise one of the most extensive habitat types in the entire United States. These cold-desert ecosystems, the so-called western rangelands, appear relatively simple in their ecological structure and function. Less than 150 years ago, however, sagebrush ecosystems were considerably more complex and biologically rich. Today, sagebrush shrubsteppe constitutes one of North America's most imperiled and neglected ecosystems (Noss and Peters 1995, Mac et al. 1998) due to the profound, ecologically transformative influences of livestock grazing, followed by alteration of natural fire regimes and consequent invasion by exotic plant species (Bock et al. 1993, Fleischner 1994, Saab et al. 1995, Rotenberry 1998, Young and Sparks 2002).

The sagebrush biome previously covered 63 million hectares (156 million acres) of western North America, but very little remains undisturbed or unaltered from its condition prior to Euro-American settlement (West 1996). The inherent resilience of these ecosystems has been lost and the ability to resist invasion and respond to disturbance has been compromised. More than 60% of remaining sagebrush steppe now has either exotic annual grasses in the understory or has been converted completely to non-native annual grasslands (West 2000). Enormous areas have been transformed into monocultures of introduced, noxious plant species useful to neither native animals nor livestock (Mack 1981, West 1996, Brooks and Pyke 2001). More than 90% of the region's flowing waters and their associated riparian habitats, the critical lifeblood of these arid and semiarid landscapes, have been compromised by domestic livestock and agricultural development (Chaney et al. 1990, Ohmart 1994). Many streams that once flowed year-round now flow only intermittently; many others have disappeared in their entirety.

The extensive geographic distribution of sagebrush depicted in vegetation maps (Fig. 1) conveys a sense of optimism for the conservation health of this plant community and its animal inhabitants. That presumption, however, is misplaced. Numerous human-caused impacts have contributed to the extraordinary fragmentation (Fig. 2) and degradation of sagebrush habitats across their widespread distribution, resulting in severe ecological and economic challenges (Knick et al. 2003). Land managers have used prescribed fires, mechanical treatments, biological agents, and herbicides to remove sagebrush from large areas for reseeding with non-native grasses, principally to provide forage for livestock (Pechanec et al. 1965, Vale 1974, Bureau of Land Management 1991). Ag-

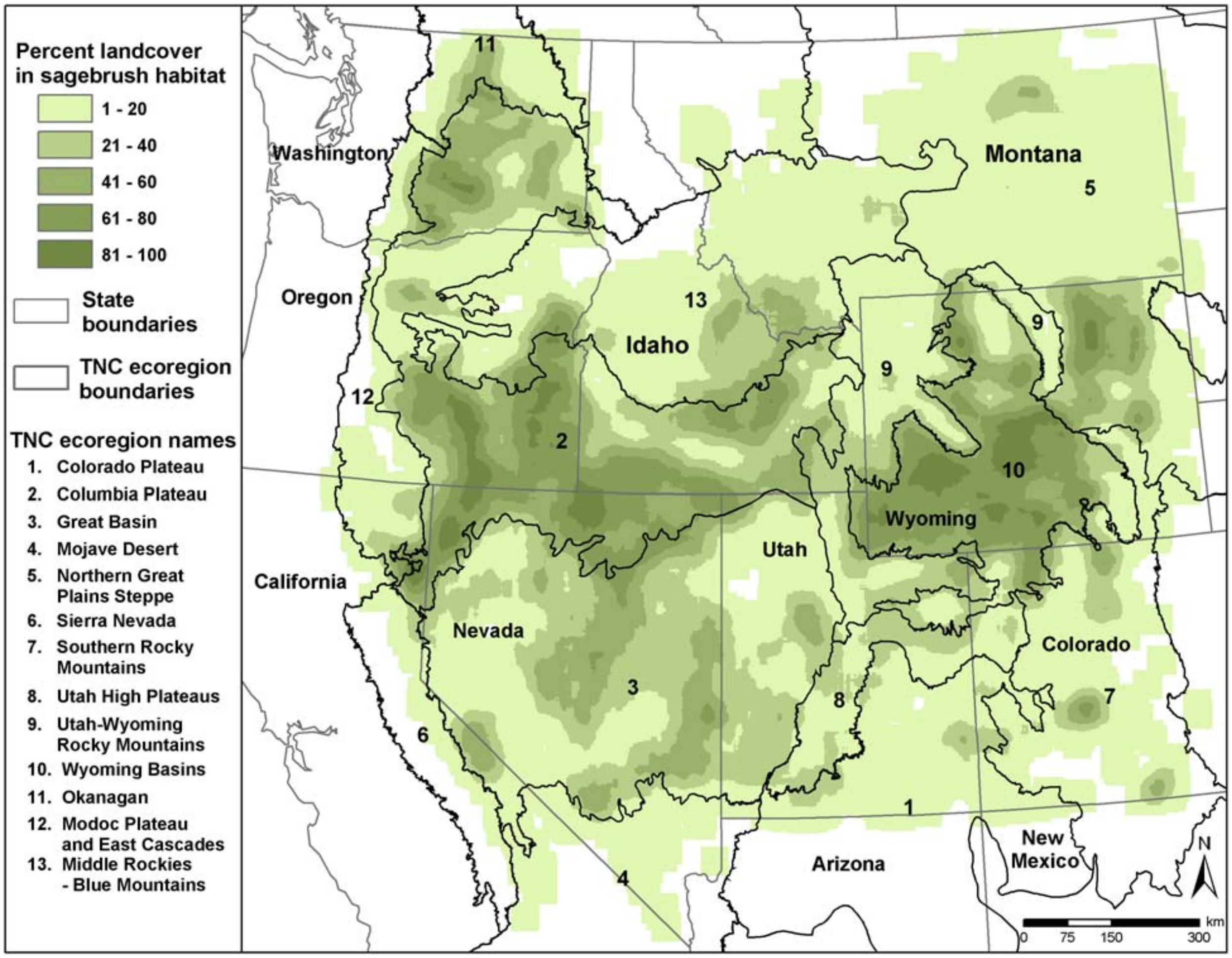

Figure 1. Distribution of sagebrush (from Knick et al. 2003). Map depicts percent of land cover within 25-km radii of each map cell dominated by tall sagebrush, produced by resampling the base map to a 2.5 km resolution. Reprinted by permission of the Cooper Ornithological Society.

riculture, mining, energy development (oil, gas, and coal-bed methane), powerline and natural-gas corridors, urbanization, and expansion of road networks have fragmented landscapes or completely eliminated sagebrush from extensive areas (Noss et al. 1995, Hann et al. 1997). These changes have pushed many sagebrush systems beyond ecological thresholds for potential recovery (Laycock 1991, West and Young 2000). The cumulative effects of land use and habitat degradation are moving sagebrush ecosystems toward ecological collapse and dysfunction.

Widespread concern for sagebrush-dependent wildlife due to loss of sagebrush habitats is a relatively recent phenomenon, and has focused primarily on sage-grouse (*Centrocercus* spp.), the flagship gamebird of these landscapes (Dobkin 1995, Connelly and Braun 1997, Braun 1998, Connelly et al. 2000). The federal government presently is in the midst of an assessment of Greater Sage-Grouse (*C. urophasianus*) in response to a petition filed to list the species as Endangered across its entire range (see Connelly et al. 2004). A listing of the Greater Sage-Grouse or any of the other widespread species dependent on sagebrush ecosystems would have major ramifications

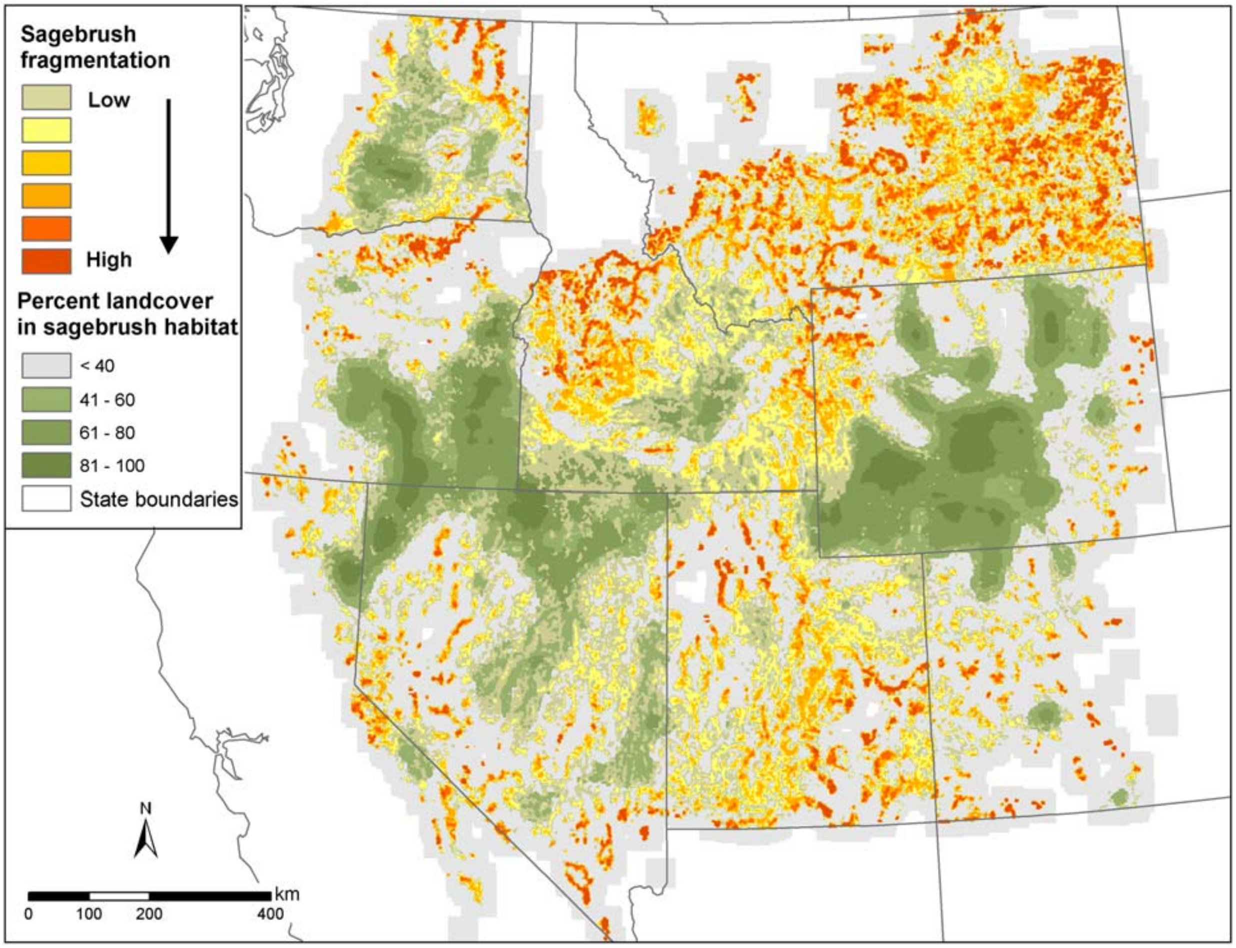

Figure 2. Sagebrush distribution is highly fragmented and much less extensive than large-scale maps suggest. The map depicts the ratio of the percent of land cover containing sagebrush (Fig. 1) to the amount of perimeter with other habitats. Dark-green areas indicate extensive distribution of sagebrush as the dominant feature in the landscape (area is much larger than perimeter), grading into gray areas (small area, small perimeter), and crossing a threshold at which fragmentation of sagebrush patches (low area, high perimeter) becomes the dominant landscape feature. Small-scale measures of perimeter were estimated by resampling the base map to a 500-m resolution and measuring the proportion of total edge between sagebrush and other habitat patches within 2.5 km of each map cell. Reprinted from Knick et al. (2003) by permission of the Cooper Ornithological Society.

for use and management of large areas of the western United States. Approximately two-thirds of the total area occupied by sagebrush in the western United States (Fig. 1) is managed by federal government agencies, primarily the U.S. Bureau of Land Management (Knick et al. 2003).

When an entire ecosystem is in trouble, it is not just the flagship species that face risks. Just as the Spotted Owl (*Strix occidentalis*) became a surrogate for numerous species of animals and plants that depend upon old-growth coniferous forests, there are many other wildlife and plant species besides sage-grouse that are largely or entirely dependent upon sagebrush shrub-steppe.

Among birds, shrubland and grassland species are declining faster than any other group of species in North America (Dobkin 1994, Saab and Rich 1997, Paige and Ritter 1999). These species represent an important component of the biodiversity of the western United States. Species that are most dependent on sagebrush ecosystems, such as Brewer's Sparrow (*Spizella breweri*), Sage Sparrow (*Amphispiza belli*), and Sage Thrasher (*Oreoscoptes montanus*), may be important predictors of impending collapse in sagebrush ecosystems because of their sensitivity to multiscale habitat changes (Rotenberry and Knick 1999, Knick and Rotenberry 2000, 2002).

Aside from the pygmy rabbit (*Brachylagus idahoensis*), whose Columbia Basin populations were listed recently as Endangered (U.S. Fish and Wildlife Service 2003), little attention has been paid to the conservation status or needs of small mammal species or of other taxa (e.g., insects, amphibians, reptiles) tied to shrubsteppe ecosystems in the Intermountain West (Wisdom et al. 2002). Concern for a few scattered populations of some species (e.g., Preble's shrew [*Sorex preblei*], little pocket mouse [*Perognathus longimembris*], kit fox [*Vulpes macrotis*]) has occurred at the level of individual states, but the larger picture of regionwide conservation status or ecological condition has not been assessed. Indeed, in spite of being endemic to shrubsteppe landscapes of the region, some small mammal species have received no attention from any state or federal agencies (e.g., Townsend's pocket gopher [*Thomomys townsendii*], sagebrush vole [*Lemmiscus curtatus*]).

Based on our consideration of the entire suite of bird and small mammal species that occur in shrubsteppe landscapes of the region, we distilled a list of 61 species that are characterized by complete or extensive dependence on shrubsteppe ecosystems in the Intermountain West. We undertook a broad-scale analysis to determine what is presently known about distributions, abundances, and sensitivity to habitat disturbance in order to assess the current state of knowledge and the conservation status of these species. We compiled and analyzed information for each of these species from the 11 western states that provide significant sagebrush habitat, and summarized this information in individual species accounts that form much of this report. The individual accounts detail what is known about current and historical distributions, habitat requirements and associations, population sizes and trends, susceptibility to habitat changes and impacts, and current state or federal status or listing. Guided by the results of Knick et al. (2003), we further focused our analyses on the three ecoregions (Columbia Basin, Great Basin, and Wyoming Basin) with the greatest percentages of sagebrush land cover (hereafter referred to as the three primary shrubsteppe ecoregions). We analyzed regional and subregional population trends for birds, mapped patterns of species richness for birds and mammals, and provided the first maps to depict geographic patterns of avian population change in these ecoregions.

METHODS

Species Selection: Birds

We selected species for inclusion in our analyses based on a hierarchy of criteria. For upland bird species, the primary criterion was predominant or complete association with shrubsteppe landscapes in the 11 western states. Our second criterion was the extent to which a species' total geographic range was confined to the geographic area of interest, or the extent to which important population segments of a species occurred within shrubsteppe landscapes of the 11 western states. Some species that are now much reduced in the region, such as Sharp-tailed Grouse, were included based on their more extensive distributions and greater abundances during historical times. The preceding criteria were assessed based on the relative abundance maps produced by the North American Breeding Bird Survey (BBS; Sauer et al. 2003), and the comprehensive individual species accounts of the *Birds of North America* project (American Ornithologists' Union 1992–2003).

Most riparian bird species of these landscapes are widely distributed beyond the geographic region of interest, but within shrubsteppe landscapes they occur primarily or exclusively in riparian habitats. Thus, riparian species were selected based on a combination of the preceding criteria and the species' predominant dependence on riparian habitats within the region, as determined by previous regional conservation assessments (e.g., Saab and Rich 1997, Paige and Ritter 1999) and by scientific studies of riparian birds in the region (e.g., Dobkin and Wilcox 1986, Tewksbury et al. 2002, Earnst et al. 2004).

Based on the foregoing criteria, 25 species of upland birds and 12 species of riparian birds are included in our analyses (Table 1).

TABLE 1. Upland and riparian bird species closely associated with shrubsteppe landscapes in the Intermountain West.

Common name	Scientific name
Upland species	
Greater Sage-Grouse	*Centrocercus urophasianus*
Sharp-tailed Grouse	*Tympanuchus phasianellus*
Ferruginous Hawk	*Buteo regalis*
Prairie Falcon	*Falco mexicanus*
Long-billed Curlew	*Numenius americanus*
Burrowing Owl	*Athene cunicularia*
Gray Flycatcher	*Empidonax wrightii*
Loggerhead Shrike	*Lanius ludovicianus*
Gray Vireo	*Vireo vicinior*
Horned Lark	*Eremophila alpestris*
Sage Thrasher	*Oreoscoptes montanus*
Virginia's Warbler	*Vermivora virginiae*
Green-tailed Towhee	*Pipilo chlorurus*
Chipping Sparrow	*Spizella passerina*
Brewer's Sparrow	*Spizella breweri*
Vesper Sparrow	*Pooecetes gramineus*
Lark Sparrow	*Chondestes grammacus*
Black-throated Sparrow	*Amphispiza bilineata*
Sage Sparrow	*Amphispiza belli*
Savannah Sparrow	*Passerculus sandwichensis*
Grasshopper Sparrow	*Ammodramus savannarum*
White-crowned Sparrow	*Zonotrichia leucophrys*
Western Meadowlark	*Sturnella neglecta*
Brewer's Blackbird	*Euphagus cyanocephalus*
Scott's Oriole	*Icterus parisorum*
Riparian species	
Yellow-billed Cuckoo	*Coccyzus americanus*
Belted Kingfisher	*Ceryle alcyon*
Willow Flycatcher	*Empidonax traillii*
Veery	*Catharus fuscescens*
Swainson's Thrush	*Catharus ustulatus*
Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapilla*
Yellow Warbler	*Dendroica petechia*
MacGillivray's Warbler	*Oporornis tolmiei*
Wilson's Warbler	*Wilsonia pusilla*
Song Sparrow	*Melospiza melodia*
Bullock's Oriole	*Icterus bullockii*

SPECIES SELECTION: MAMMALS

Large mammals such as ungulates and carnivores generally have been well studied and typically are central to much of wildlife management, especially in the western United States. We focused our efforts on the far less well-known spectrum of small mammals, defined as species with body mass of less than ~1 kg.

In addition to small size, we used two additional criteria for inclusion of species in the analyses. First, within the 11 western states the species must be associated predominantly or completely with shrubsteppe landscapes. Second, a majority of the species' total geographic range must fall within the geographic area of interest. Geographic distributions for each species were determined from the mammal distribution maps of Hall (1981) and from the *Mammalian Species* accounts (which generally were reproduced from Hall with little alteration) published by the American Society of Mammalogists (1974–2002). Hall (1981) created his maps for each species simply by circumscribing the most peripheral distribution records. Between sparse

TABLE 2. Upland and riparian mammal species closely associated with shrubsteppe landscapes in the Intermountain West.

Common name	Scientific name
Upland species	
Merriam's shrew	*Sorex merriami*
Preble's shrew	*Sorex preblei*
Spotted bat	*Euderma maculatum*
Pallid bat	*Antrozous pallidus*
Pygmy rabbit	*Brachylagus idahoensis*
Idaho ground squirrel	*Spermophilus brunneus*
Merriam's ground squirrel	*Spermophilus mollis*
Piute ground squirrel	*Spermophilus canus*
Townsend's ground squirrel	*Spermophilus townsendii*
Washington ground squirrel	*Spermophilus washingtoni*
Little pocket mouse	*Perognathus longimembris*
Great Basin pocket mouse	*Perognathus parvus*
Dark kangaroo mouse	*Microdipodops megacephalus*
Pale kangaroo mouse	*Microdipodops pallidus*
Chisel-toothed kangaroo rat	*Dipodomys microps*
Desert woodrat	*Neotoma lepida*
Sagebrush vole	*Lemmiscus curtatus*
Kit fox	*Vulpes macrotis*
Riparian species	
Water shrew	*Sorex palustris*
Townsend's pocket gopher	*Thomomys townsendii*
Western harvest mouse	*Reithrodontomys megalotis*
Long-tailed vole	*Microtus longicaudus*
Montane vole	*Microtus montanus*
Western jumping mouse	*Zapus princeps*

distribution records, Hall made informed guesses to fill out distributions. Detailed geographic distributions are nonexistent for virtually all small mammals of the western United States. Habitat affinities were assessed from individual species accounts of the *Mammalian Species* series, regional handbooks devoted to mammals (e.g., Verts and Carraway 1998), and recent studies from the primary scientific literature.

Based on the foregoing criteria, 18 species of upland mammals and 6 species of riparian mammals are included in our analysis (Table 2).

Population Trends and Spatial Analyses: Birds

For birds, we report significant ($P \leq 0$ .05) regional BBS trends developed using a linear route regression methodology (hereafter called standard BBS analysis; Sauer et al. 2003). We recognize that low sample sizes confound the ability to accurately discern population trends. This problem is especially common in the Intermountain West, which is the region most undersampled by the BBS in the conterminous 48 states (Lawler and O'Connor 2004). We adopted a conservative approach to population trend assessments by using a minimum sample size criterion of $n > 10$ BBS routes for presence of a species within a physiographic province for each time period analyzed. Statistically significant (but biologically questionable) trends with marginal sample sizes are identified as such. For species with $n \leq 10$ BBS routes in a physiographic province, we did not attempt to estimate population trends, as such trends are so unreliable statistically as to be meaningless.

BBS trend analyses can only be calculated by physiographic provinces, which roughly follow the same geographic boundaries as Nature Conservancy ecoregions (Fig. 3). The only exception in our area is division of the Great Basin ecoregion into two physiographic provinces (Great Basin Desert, Basin and Range). Because of the general pattern of very small sample sizes in these two physiographic provinces, we frequently present combined results from both provinces and simply refer to them collectively as "Great Basin."

For the avian literature review, we relied heavily on the *Birds of North America* species accounts to provide the requisite information. Where further information was needed, recent primary literature was reviewed for additional information about habitat affinities and for specific factors known to influence populations. To depict the distribution of bird species across the region, we modified the relative abundance

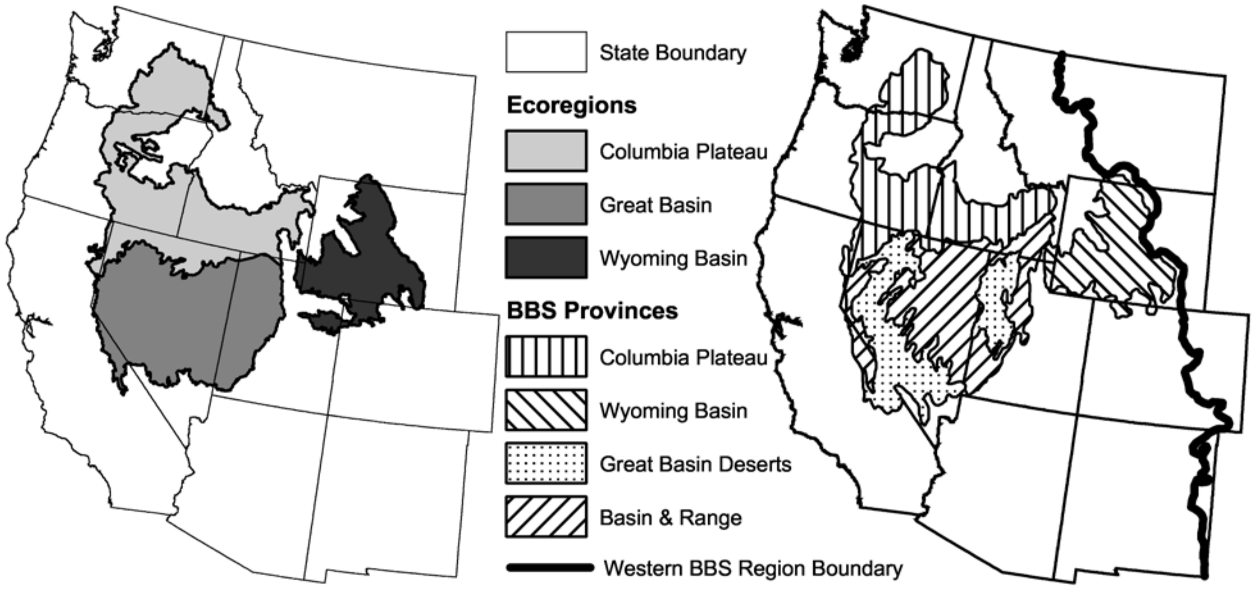

Figure 3. Overlap between the three primary shrubsteppe ecoregions (left) and four Breeding Bird Survey (BBS) physiographic provinces (right). Together, the BBS provinces Great Basin Deserts (stippled) and Basin and Range (right hatch) correspond closely to the Great Basin ecoregion. The Western BBS Region encompasses the entire area west of the indicated boundary (bold line).

maps produced from BBS data by Sauer et al. (2003).

For each species, we acquired BBS data for the years 1968–2001 from the 11 western states. Bird abundance and weather data were synthesized by plot and year to create a single database for each species that described where a species was and was not detected. Data collected under adverse weather conditions were excluded from our analyses. We created new maps from these databases using inverse distance weighting in conjunction with a smoothing function (ESRI 2003). Because many survey routes have been abandoned over the years and inconsistent data are well known to skew analyses, we filtered the data conservatively to include only routes that had been surveyed at least four times in each of the time periods we evaluated (1968–1983, 1984–2001). These criteria were met by 349 routes. Mean abundances over each period were used in the natural neighbor function of ArcGIS (ESRI 2003) to interpolate potential abundances at locations between routes. The product grids were reclassified into discrete categories and converted into shapefiles. These shapefiles depicted the distribution of locations with potentially higher bird abundances for each species and showed changes in abundances between the two analysis periods. Additionally, the differences in mean abundances between the two periods were processed, using similar methodology, so that spatial patterns of declines and increases in abundances could be examined.

Population and Spatial Analyses: Mammals

In contrast to the BBS for birds, no long-term, standardized surveys exist to monitor small-mammal populations. As a result, no index to relative abundances exists across the geographic distribution of species. Thus, the only available data was what could be mined from literature sources. We focused on retrieving data concerning habitat associations, preferred habitat characteristics, population density estimates, and factors that influence population numbers. We reviewed the scientific literature for the selected mammal species by using three database search engines widely available in university libraries and elsewhere: BIOSIS Previews (1990–Summer 2003), Biological Abstracts (1991–Summer 2003), and Wildlife & Ecology Studies Worldwide (1935–2003). We specifically selected and reviewed studies that were conducted in the Intermountain West, and reviewed the literature cited in each paper for additional studies that were older or otherwise absent from the search engines. This continued as an iterative process until no new papers could be located that addressed applicable topics or contained useful data.

We used the authors' study area descriptions for all field studies going back to 1938 to incorporate all localities into a geographic information system (GIS) that mapped sampling methodology, habitats sampled, and species occurrence onto study locations. Some papers reported data from multiple study sites, and we incorporated each site separately into the GIS if the study area descriptions provided sufficient information. Using the compiled database, we mapped presence and absence of each species based on the trapping results in relation to presumed historical distributions, and determined the actual proportion of studies that documented presence of each species in suitable habitats across the Intermountain West.

Geographic Patterns of Species Richness and Community Stability

To evaluate broad-scale patterns of species richness, we created maps of total species richness by using presence-absence data derived from BBS data for birds, and by overlaying the maps derived from Hall (1981) for mammals. To evaluate the temporal stability of community structure for birds, we compared Jaccard's index values (Magurran 1988) for riparian and for upland bird species compared between the 1968–1983 and 1984–2001 periods. For each BBS route, the Jaccard index is a simple binary measure of species presence and absence that ranges from 0 if the two time periods have no species in common to 1 if both sets of species are identical.

We recognize that the presumed distributions for birds (Sauer et al. 2003) and mammals (Hall 1981) are not without errors, particularly as a result of ecologically unsuitable habitats embedded in matrices of suitable habitat (or the converse). These distributions, however, are the best science-based maps available and they adequately achieve their intended purpose, which is to depict the general distribution of the species and to demonstrate the species' association with Intermountain West landscapes.

RESULTS

Avian Population Trends

Population trends calculated by standard BBS analysis for each species are shown in Table 1 of each individual species account (see accounts for animal scientific names and Appendix A for plant scientific names). We examined trends for the Western BBS Region as a whole (Fig. 3), and for each of the four physiographic provinces that comprise the focal region (Columbia Plateau, Great Basin Desert, Basin and Range, and the Wyoming Basin), for the 1968–1983, 1984–2001, and 1968–2001 periods.

Upland species. Significant declining population trends were found for 16 of the 25 upland bird species in one or more of the regions considered over at least one of the three periods examined (Table 3). Long-term declines (1968–2001) were found for 10 species across the Western Region as a whole, and for eight species within one or more of the four physiographic provinces. Among the latter eight species, all but one (Sage Thrasher) also exhibited long-term declines across the Western Region. Significant short-term declines (1968–1983 or 1984–2001) occurred for 13 species across the

TABLE 3. Population trends for birds based on Breeding Bird Survey (BBS) data for the Western Region and for the Columbia Plateau, Great Basin Desert, Basin and Range, and Wyoming Basin physiographic provinces. Only statistically significant long-term (1968–2001) and short-term (1968–1983 or 1984–2001) trends are shown. For each analysis, a species must have been present on more than 10 BBS routes within a province or region.

	Western BBS Region				Individual provinces			
	Long-term decline	Long-term increase	Short-term decline	Short-term increase	Long-term decline	Long-term increase	Short-term decline	Short-term increase
Upland species								
Greater Sage-Grouse								
Sharp-tailed Grouse	×		×					
Ferruginous Hawk		×						
Prairie Falcon			×					
Long-billed Curlew						×		
Burrowing Owl		×						
Gray Flycatcher		×						
Loggerhead Shrike	×		×		×		×	
Gray Vireo								
Horned Lark	×		×		×		×	
Sage Thrasher					×		×	
Virginia's Warbler								
Green-tailed Towhee			×				×	
Chipping Sparrow	×		×		×			
Brewer's Sparrow	×				×			×
Vesper Sparrow							×	×
Lark Sparrow			×					
Black-throated Sparrow	×		×		×		×	
Sage Sparrow			×	×				×
Savannah Sparrow				×				×
Grasshopper Sparrow	×		×		×		×	
White-crowned Sparrow	×		×					
Western Meadowlark	×		×				×	×
Brewer's Blackbird	×		×		×			
Scott's Oriole								
Total (of 25 upland species)	10	3	13	2	8	1	8	5
Riparian species								
Yellow-billed Cuckoo								
Belted Kingfisher								
Willow Flycatcher	×		×				×	
Veery								
Swainson's Thrush								
Orange-crowned Warbler	×		×					
Nashville Warbler								
Yellow Warbler								
MacGillivray's Warbler								
Wilson Warbler	×		×					
Song Sparrow	×		×			×		
Bullock's Oriole	×		×					
Total (of 12 riparian species)	5	0	5	0	0	1	1	0
Total (of 37 species)	15	3	18	2	8	2	9	5

Western Region, and for eight species in one or more physiographic provinces. Among the latter eight species, all but two (Sage Thrasher and Vesper Sparrow), also exhibited short-term declines across the Western Region.

Only three of the 25 species exhibited significant long-term increases across the Western Region (Table 3), but none of the three exhibited significant increasing trends in any of the four physiographic provinces across any time period. Two species (Sage Sparrow and Savannah Sparrow) showed significant short-term increases across the Western Region, and both exhibited short-term increases at the physiographic province level as well. Sage Sparrows did not exhibit any significant long-term population trends, but declined significantly across the Western Region during 1968–1983, followed by significant increasing trends in 1984–2001 in the Western Region as a whole and in the Great Basin. Similarly, Savannah Sparrows showed no significant long-term trends in any region, but increased significantly across the 1968–1983 period in the Western Region and in 1984–2001 in the Wyoming Basin. Three additional species (Brewer's Sparrow, Vesper Sparrow, and Western Meadowlark) exhibited short-term increases in some physiographic provinces, but Brewer's Sparrow also showed long-term declining trends across the Western Region and Columbia Plateau, and the other two species both had significant long-term (Western Meadowlark) and short-term (Vesper Sparrow and Western Meadowlark) declining trends in other physiographic provinces.

Riparian species. Five of the 12 riparian species exhibited significant long-term and short-term declines across the Western Region (Table 3). Only the Willow Flycatcher showed significant declines in at least one physiographic province as well. No riparian species showed any significant increases for any region or time period considered, with the sole exception of a long-term increasing trend by the Song Sparrow in the Basin and Range province.

For the majority of species considered, BBS sample sizes were inadequate to detect statistically reliable trends at the physiographic province level. The few significant trends found for species at these smaller scales (Table 4) generally mirrored significant trends for the BBS Western Region as a whole (Table 3). Of the 11 species with significant declining trends at the ecoregion level, eight had significant declines in a single ecoregion, two had significant declines in two of the three ecoregions (Sage Thrasher and Grasshopper Sparrow), and only the Loggerhead Shrike had significant declines in all three ecoregions. Six of the seven species with significant declines in the Columbia Basin and all three species with significant declines in the Great Basin were declining across the entire 1968–2001 period (Table 4). The five species with significant declines in the Wyoming Basin showed a more mixed temporal picture of decline (two long term and three in 1968–1983). The most striking pattern seen in the significant trends at the ecoregion level was the overwhelmingly negative picture across the long-term period for the Columbia Basin (Table 4).

Based on our analyses of the selected BBS routes and their spatial distribution of per route abundances, we categorically ranked species by relative abundances across the region as a whole (Table 5). In spite of substantial differences in relative abundance among species, relative rarity did not completely preclude finding a statistically significant population trend in the Western BBS Region for some of these species (e.g., Sharp-tailed Grouse, Ferruginous Hawk, Prairie Falcon). The four upland bird species for which no significant population trends were detected (Greater Sage-Grouse, Gray Vireo, Virginia's Warbler, Scott's Oriole), however, comprised 50% of all species in the lowest relative abundance category (Table 5). For riparian birds, the most abundant species were comparable in relative abundances to upland species in the

TABLE 4 Avian population trends derived from Breeding Bird Survey data for the three primary shrubsteppe ecoregions of the Intermountain West (Columbia Plateau, Great Basin[a], Wyoming Basin). Survey data were analyzed over a long-term period (1968–2001) and two short-term periods (1968–1983 and 1984–2001). Only statistically significant increases (+) or decreases (–) are shown; the relevant periods are indicated.

	Columbia Plateau		Great Basin		Wyoming Basin	
	Trend	Period	Trend	Period	Trend	Period
Upland species						
Long-billed Curlew	+	1968–2001				
Loggerhead Shrike	–	1968–2001	–	1968–2001	–	1968–1983
Horned Lark	–	1968–2001				
	–	1984–2001				
Sage Thrasher	–	1968–2001	–	1968–2001		
			–	1968–1983		
Green-tailed Towhee					–	1968–1983
Chipping Sparrow					–	1968–2001
Brewer's Sparrow	–	1968–2001			+	1984–2001
Vesper Sparrow			+	1968–1983	–	1968–2003
					+	1984–2001
Black-throated Sparrow	–	1968–2001				
	–	1984–2001				
Sage Sparrow			+	1984–2001		
Savannah Sparrow					+	1984–2001
Grasshopper Sparrow	–	1968–2001			–	1968–2001
	–	1984–2001				
Western Meadowlark	+	1968–1983				
	–	1984–2001				
Brewer's Blackbird			–	1968–2001		
			–	1984–2001		
Riparian species						
Willow Flycatcher	–	1984–2001				
Song Sparrow			+	1968–2001		

[a]Great Basin ecoregion includes data from two BBS physiographic provinces: Great Basin Desert, Basin and Range.

intermediate range of abundances. For all birds, most of the least abundant species appeared too infrequently or too inconsistently in the BBS data set at the level of individual shrubsteppe ecoregions to detect any statistically significant population trends.

Avian Spatial Analyses

Mapping based on temporal changes in BBS data generally corroborated our BBS population trend analyses. Our spatial analyses illustrated the geographic pattern of change in relative abundances for each species (Figure 2 in each of the species accounts that follow), and the spatial pattern of changes in absolute abundances over time (Figure 3 in the species accounts). For each species, we can now see the actual geographic pattern of declines and increases within each ecoregion.

For example, our spatial analyses suggested that Loggerhead Shrike population declines were widespread in the Western BBS Region, and especially severe in the three primary shrubsteppe ecoregions. Comparison of shrike distributions between the 1968–1983 and 1984–2001 periods indicated population losses from

TABLE 5. Relative abundances of bird species based on analyses of 349 Breeding Bird Survey (BBS) routes surveyed at least four times in each of two periods, 1968–1983 and 1984–2001, in the Western BBS Region. Symbols indicate significant declining (–) or increasing (+) trends found for at least one of three time periods in at least one region or physiographic province. Five species had both positive and negative trends.

TABLE 5A. Upland Species

Relative abundance: Less abundant → More abundant

Less abundant				More abundant
Sharp-tailed Grouse (–)	Loggerhead Shrike (–)	Sage Thrasher (–)	Horned Lark (–)	Brewer's Blackbird (–)
Prairie Falcon (–)	Green-tailed Towhee (–)	Chipping Sparrow (–)		
	Grasshopper Sparrow (–)	Lark Sparrow (–)	Brewer's Sparrow (–, +)	Western Meadowlark (–, +)
Greater Sage-Grouse		Black-throated Sparrow (–)		
Gray Vireo	Long-billed Curlew (+)	White-crowned Sparrow (–)		
Virginia's Warbler	Gray Flycatcher (+)			
Scott's Oriole		Vesper Sparrow (–, +)		
		Sage Sparrow (–, +)		
Ferruginous Hawk (+)				
Burrowing Owl (+)		Savannah Sparrow (+)		

TABLE 5B. Riparian Species

Relative abundance: Less abundant → More abundant

Less abundant			More abundant
Yellow-billed Cuckoo	Orange-crowned Warbler (–)	Willow Flycatcher (–)	Song Sparrow (–, +)
	Wilson's Warbler (–)	Bullock's Oriole (–)	
			Yellow Warbler
	Belted Kingfisher		
	Veery		
	Swainson's Thrush		
	Nashville Warbler		
	MacGillivray's Warbler		

large portions of the Columbia Plateau, from the western two-thirds of the Great Basin, and from the western portion of the Wyoming Basin (Fig. 8.2 and 8.3, p. 48).

As an example of an apparently increasing species, Ferruginous Hawk population increases appeared confined to several relatively small and disjunct areas of the West. Most of the areas showing increasing population trends were in various parts of Montana and in southeastern Colorado/northeastern New Mexico, areas that lie completely outside of the primary shrubsteppe ecoregions (Fig. 3.3, p. 37).

Only five of the 37 species (Sharp-tailed Grouse, Yellow-billed Cuckoo, Gray Vireo, Virginia's Warbler, and Scott's Oriole) were detected so infrequently on BBS routes within the three primary shrubsteppe ecoregions that no meaningful spatial analyses could be conducted.

The changes in relative abundances depicted on the maps in the individual species accounts accurately show the direction of relative numerical change and the regions in which the changes occurred. The actual percentage change in area (from 1968–1983 to 1984–2001) over which each species was predicted to have higher or lower abundances, however, was strongly influenced by the spatial pattern of BBS routes included in the analyses. The problem of undersampling (too few BBS routes relative to the very large geographic area considered) across all three shrubsteppe ecoregions clearly affected the accuracy of our numerical estimates of these areas. A substantially larger number of consistently sampled BBS routes is needed in all three ecoregions to refine these estimates.

Avian Susceptibility to Habitat Alteration

Birds that depend on native vegetation for the supporting structure and protective cover of their nests clearly are jeopardized by the complete loss of native vegetation (e.g., from agricultural conversion). The effects of livestock grazing, invasion by exotic plant species, and alteration of natural fire regimes can be much less obvious and sometimes synergistic.

As an index to their dependence on intact native plant communities, we examined each species' degree of dependence on ground and shrub vegetation for nesting and foraging. Not surprisingly given their close association with shrubsteppe plant communities, virtually all upland species are obligate ground/shrub nesters or foragers (Table 6). Eighteen of the 25 species are obligately dependent on native ground and shrub vegetation both for nesting and foraging. Only Ferruginous Hawk and Prairie Falcon are not directly dependent on ground and shrub vegetation for nesting or foraging, although clearly much of their prey is wholly dependent on ground and shrub vegetation for food or cover.

Nine of the 12 riparian species are obligate ground or shrub nesters in riparian habitats of the three focal ecoregions (Table 6). Only six species obligately forage on ground and shrub vegetation, although three additional species (Orange-crowned, Nashville, and Yellow Warblers) forage extensively in the shrub layer in addition to foraging in trees.

Mammal Distributions and Abundances

Eleven of the 24 mammals we considered are endemic to the Intermountain West shrubsteppe: five ground squirrels, pygmy rabbit, four heteromyid rodents (Great Basin pocket mouse, dark kangaroo mouse, pale kangaroo mouse, chisel-toothed kangaroo rat), and the Townsend's pocket gopher. All but the gopher are upland species.

Quantitative details of trapping results (catch per unit effort, estimated densities, etc.) are provided in the Population Data section of each species account for all studies conducted in the three primary shrubsteppe ecoregions. Presence and absence of each species based on

TABLE 6. Susceptibility of upland and riparian shrubsteppe birds to livestock grazing, exotic plant invasion, and unnaturally frequent fires, as indicated by nesting and foraging dependence on native ground and shrub vegetation.

Species	Obligate ground or shrub nester	Obligate ground or shrub forager
Upland species		
Greater Sage-Grouse	×	×
Sharp-tailed Grouse	×	×
Ferruginous Hawk		
Prairie Falcon		
Long-billed Curlew	×[a]	×
Burrowing Owl		×
Gray Flycatcher	×	
Loggerhead Shrike	×	×
Gray Vireo	×	
Horned Lark	×	×
Sage Thrasher	×	×
Virginia's Warbler	×	×
Green-tailed Towhee	×	×
Chipping Sparrow		×
Brewer's Sparrow	×	×
Vesper Sparrow	×	×
Lark Sparrow	×	×
Black-throated Sparrow	×	×
Sage Sparrow	×	×
Savannah Sparrow	×	×
Grasshopper Sparrow	×	×
White-crowned Sparrow	×	×
Western Meadowlark	×	×
Brewer's Blackbird	×	×
Scott's Oriole		
Upland species total	20 of 25	20 of 25
Riparian species		
Yellow-billed Cuckoo		
Belted Kingfisher		
Willow Flycatcher	×	×
Veery	×	×
Swainson's Thrush	×	×
Orange-crowned Warbler	×	
Nashville Warbler	×	
Yellow Warbler	×	
MacGillivray's Warbler	×	×
Wilson's Warbler	×	×
Song Sparrow	×	×
Bullock's Oriole		
Riparian species total	9 of 12	6 of 12
Overall total	29 of 37	26 of 37

[a] The only obligate ground-nesting species known to fare well in exotic annual grasslands.

the trapping results are shown in the Figure 1 maps of each species account in relation to presumed historical distributions. Only five species were found in locations significantly beyond the boundaries of their presumed distributions: Preble's shrew, spotted bat, pallid bat, pygmy rabbit, and pale kangaroo mouse.

We summarized the results of all field studies that used suitable traps in appropriate habitats to determine the actual proportion of studies that documented presence of each species across the Intermountain West (Table 7). The potential for finding each species at each of these localities should be close to 100%. Numbers lower than 100% would indicate that the species had not been found consistently in appropriate habitat, despite appropriate trapping methods. As a conservative approach, we adopted a threshold of 70% as a criterion for reasonable predictability of a species' presence, given appropriate habitat within its presumed geographic range and adequate sampling effort with appropriate equipment. Of the 19 species for which suitable trapping data were available, only one species was found in more than 70% of sampled localities (Great Basin pocket mouse [80%]). No other species was found in more than 62% of potentially suitable localities (Table 7). Aside from the three species with extremely limited geographic ranges (Idaho, Townsend's, and Washington ground squirrels) and the two species devoid of suitable trapping data (Townsend's pocket gopher and kit fox), the least common species (i.e., present in ≤33% of potentially suitable sites) appeared to be Merriam's shrew, Preble's shrew, water shrew, spotted bat, pygmy rabbit, and long-tailed vole. Given the relatively large geographic ranges presumed for all but the three restricted ground squirrels, we found remarkably few field studies in the Intermountain West over the past 65 years that could be evaluated for presence of water shrew, pallid bat, and western jumping mouse (Table 7).

Mammalian Susceptibility to Habitat Alteration

Responses to loss or degradation of native plant communities due to livestock grazing or other disturbances, and responses to presence of exotic vegetation (principally cheatgrass) are provided in each species account. Comparative studies of small-mammal response to livestock grazing were found for 11 of the 24 species examined. These field studies compared small-mammal communities of moderately to heavily grazed upland or riparian habitats with those of lightly grazed or rested habitats (i.e., areas that had been withdrawn from livestock grazing, generally for one to several years). We classified each species' response as positive or negative only when the difference in mean trapping results between grazing treatments was ≥20%; we classified differences of <20% as neutral. Of the 62 comparisons, 46 were negative, nine were neutral, and seven were positive (Appendix B). Of the seven positive responses, however, five were from upland species that showed increased abundances in grazed riparian or mesic areas compared with ungrazed riparian or mesic areas, indicating that the effects of livestock grazing in moist habitats had converted them into habitats suitable for upland species.

A summary of small-mammal responses to livestock grazing based on field studies using adequate trapping methodology demonstrated overwhelmingly negative responses to the effects of livestock grazing for 12 species (Table 8). Based on the ecological requirements and known responses of ecologically similar species, an additional nine species have extremely high likelihood for negative responses to livestock grazing effects (Table 8). The likely effects of livestock grazing were not clearly negative only for the two bat species and the kit fox.

Negative responses to presence of exotic plant species have been demonstrated clearly for eight upland species, and can be inferred with high likelihood for three additional upland

TABLE 7. Presence or absence of upland and riparian small mammal species across the Intermountain West, based on field studies using suitable traps in appropriate habitats. Numbers of sites trapped are shown. Trapping success at these sites (final column), given that the species is actually present, should be close to 100%. Therefore, scores markedly lower than 100% (e.g., below 70%) suggest that the species is encountered substantially less often than expected.

	No. of sites		% of sites with species present
	Species present	Species absent	
Upland species			
Merriam's shrew	8	39	17
Preble's shrew	12	36	25
Spotted bat	17	70	20
Pallid bat	8	5	62
Pygmy rabbit[a]	19	192	9
Idaho ground squirrel[a]	54	126	30
Merriam's ground squirrel[a]	3[b]		
Piute ground squirrel[a]	22[b]		
Townsend's ground squirrel[a]	6[b]		
Washington ground squirrel[a]	46	133	26
Little pocket mouse	28	18	61
Great Basin pocket mouse[a]	51	13	80
Dark kangaroo mouse[a]	19	16	54
Pale kangaroo mouse[a]	12	11	52
Chisel-toothed kangaroo rat[a]	25	20	56
Desert woodrat	18	20	47
Sagebrush vole	31	21	60
Kit fox[c]			
Riparian species			
Water shrew	3	6	33
Townsend's pocket gopher[a,c]			
Western harvest mouse	34	38	47
Long-tailed vole	13	40	24
Montane vole	30	23	57
Western jumping mouse	8	5	62

[a]Endemic to the region.

[b]Studies conducted only at known active colonies.

[c]No site-specific trapping studies reported.

TABLE 8. Response to livestock grazing and response to dominance by cheatgrass (and other exotic plant species) by upland and riparian small mammal species across the Intermountain West, based on field studies using appropriate trapping methodology. Negative or positive responses, respectively, indicate decreased or increased abundances or productivity. Zeroes indicate no appreciable change in abundance or productivity. Parenthetical responses signify high likelihood of response based on ecological requirements and known response of ecologically similar species.

	Response to grazing	Response to exotic vegetation
Upland species		
Merriam's shrew	(–)	–
Preble's shrew	(–)	(–)
Spotted bat	unknown	unknown
Pallid bat	unknown	unknown
Pygmy rabbit[a]	(–)	–
Idaho ground squirrel[a]	(–)	–
Merriam's ground squirrel[a]	(–)	(–)
Piute ground squirrel[a]	–	–
Townsend's ground squirrel[a]	(–)	–
Washington ground squirrel[a]	–	(–)
Little pocket mouse	–	–
Great Basin pocket mouse[a]	–	0
Dark kangaroo mouse[a]	(–)	unknown
Pale kangaroo mouse[a]	(–)	unknown
Chisel-toothed kangaroo rat[a]	–	–
Desert woodrat	–	unknown
Sagebrush vole	–	–
Kit fox	unknown	unknown
Riparian species		
Water shrew	–	0
Townsend's pocket gopher[a]	(–)	(–)
Western harvest mouse	–	–/0
Long-tailed vole	–	–
Montane vole	–	–/0
Western jumping mouse	–	–/0

[a]Endemic to the region.

species (Table 8). Six upland species cannot be characterized with confidence concerning their responses to non-native vegetation. Riparian species, in contrast to most upland species, showed mixed responses to the presence of exotic vegetation. In general, if sufficient density of vegetation was present to provide the requisite amount of cover, most of the riparian small mammals exhibited essentially neutral responses (Table 8). Where exotic dominance translated into reduced cover, responses were distinctly negative. Among riparian species, only Townsend's pocket gopher is presumed to always respond negatively to dominance by exotic species, because of its complete dependence on native broad-leaved flowering plants for food.

Geographic Patterns of Species Richness and Community Stability

Birds. Based on the presence-absence data we derived from BBS survey results, we mapped species richness patterns that included 21 of the 25 upland species and 11 of the 12 riparian species. BBS data were insufficient to include Sharp-tailed Grouse, Gray Vireo, Virginia's Warbler, Scott's Oriole, and Yellow-billed Cuckoo.

The broad-scale patterns of species richness for upland and riparian birds across the 11 western states were virtual mirror images of each other (Fig. 4A). Species richness for the suite of upland bird species we examined was concentrated in the three primary shrubsteppe ecoregions, indicating an extraordinary degree of dependence by this suite of bird species on shrubsteppe landscapes of the Columbia Plateau, Great Basin, and Wyoming Basin. All 21 upland species mapped were found to co-occur, indicated by the darkest red shading in Figure 4A. Areas of highest species richness included the breadth of the Columbia Plateau ecoregion extending from southeastern Oregon to easternmost Idaho, the eastern two-thirds of the Great Basin ecoregion, and the southwestern portion of the Wyoming Basin ecoregion.

In contrast, riparian species richness was greatest in the mountains and coastal lowlands outside of the three primary shrubsteppe ecoregions. Although all 11 mapped riparian

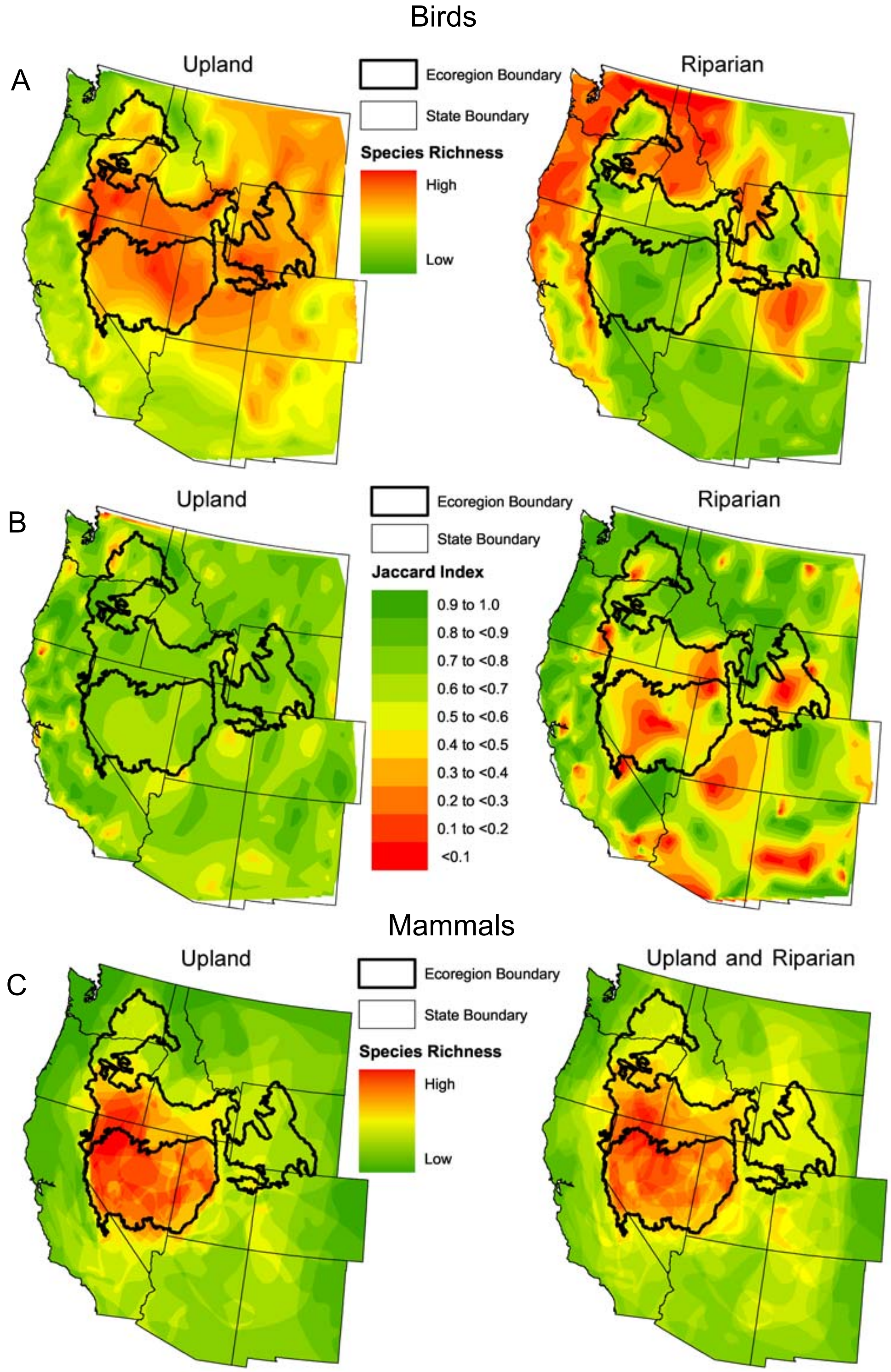

Figure 4. *Geographic patterns in bird and small-mammal communities of the western shrubsteppe.* (*A*) *Species richness for 21 upland and 11 riparian shrubsteppe bird species, based on presence-absence data from the Breeding Bird Survey. Maximum species richness on these maps is 21 species for upland birds and 11 species for riparian birds.* (*B*) *Community stability measured by Jaccard's index for upland and riparian shrubsteppe bird species. Index values compare species composition between the 1968–1983 and 1984–2001 periods based on data from the Breeding Bird Survey. Jaccard's index ranges from 1.0* (*maximum similarity*) *to 0* (*minimum similarity*). (*C*) *Species richness for small mammals based on historical range maps for 18 upland species only, and for 24 upland and riparian species combined. Maximum species richness on these maps is 13 species for upland mammals alone, and 18 species for upland and riparian mammals combined. Small sample size prevented meaningful separate analysis of riparian mammals.*

species were found to co-occur, virtually no areas within the three shrubsteppe ecoregions exhibited high species richness for the suite of riparian species.

Jaccard's index for upland bird species compared between the 1968–1983 and 1984–2001 periods suggested that community structure in appropriate habitat remained largely unchanged (Fig. 4B). Within the three primary shrubsteppe ecoregions, areas with slightly lower levels of community stability included much of the central Great Basin ecoregion, eastern Washington in the Columbia Plateau ecoregion, and the southeastern portion of the Wyoming Basin.

For riparian birds, areas of highest species richness also were areas of highest community stability, as indicated by the distribution of the highest Jaccard index values (Fig. 4B). Aside from a few relatively small areas, across most of the three primary shrubsteppe ecoregions we found relatively low to very low Jaccard Index values, indicating substantial variation in avian community structure compared between the 1968–1983 and 1984–2001 periods. The high degree of instability in riparian community structure indicates considerable fluctuation in species composition among years.

Mammals. We mapped total species richness for the 24 upland and riparian mammal species combined, and for the 18 upland species alone (Fig. 4C). Sample size was too small to provide any meaningful pattern of species richness for the six riparian species considered alone.

Patterns of high species richness were far more concentrated within the three primary shrubsteppe ecoregions compared to the results for birds, and were largely similar for both the combined and upland-only maps. For all 24 species considered together, a maximum of 18 species were found to co-occur (indicated by the darkest red shading in Fig. 4C). Areas of highest species richness occurred from southeastern Oregon to easternmost Idaho in the Columbia Plateau ecoregion, and in much of the Great Basin ecoregion. Species richness was markedly lower in the Wyoming Basin ecoregion.

Species richness for the suite of 18 upland mammal species we considered was significantly more concentrated than for all 24 species considered together. A maximum co-occurrence of 13 species was found, with areas of highest species richness occurring in southeastern Oregon and northwestern Nevada in the Columbia Plateau ecoregion, and across all but the southeasternmost portion of the Great Basin ecoregion. Distinctly fewer species of upland small mammals were supported in the Wyoming Basin and in the Columbia Plateau regions of north-central Oregon, eastern Washington, and eastern Idaho (Fig. 4C). Mammalian species richness in the Wyoming Basin was distinctly lower in the upland species map compared with the map that included riparian species.

DISCUSSION

Population Trends: Birds

The Great Basin and the Wyoming Basin are among the least consistently sampled of all physiographic provinces covered by the BBS, and sampling consistency in the Columbia Plateau is only marginally better (Lawler and O'Connor 2004). The BBS routes that do exist in this region underrepresent sagebrush habitats (Table 2 in Knick et al. 2003), and some species such as upland gamebirds are poorly detected by the BBS's method of roadside counts (Saab and Rich 1997). Given these limitations, it is both remarkable and alarming to find that nearly two-thirds (16 of 25) of the upland bird species we considered have declining population trends, especially given our strongly conservative filtering of BBS data.

BBS methodology is well known to undersample habitats that are relatively uncommon, such as the woody riparian habitats of the arid and semiarid West. Thus it is similarly surprising and worrisome that 42% (5 of 12) of the riparian species we evaluated showed significant declining population trends. To these five must be added the now rare Yellow-billed Cuckoo, (Laymon and Halterman 1987), resulting in six of the 12 considered species demonstrably in decline in the region.

Three upland species besides Greater Sage-Grouse, and seven riparian species in addition to Yellow-billed Cuckoo, exhibited no significant population trends. The absence of statistically significant trends for these species, however, cannot be taken as an indication of population stability. The Greater Sage-Grouse, which is only conspicuous when males congregate on widely scattered display grounds, is difficult to detect on BBS routes but nevertheless is clearly in decline (Connelly et al. 2004, Schroeder et al. 2004). The three other upland species without trends (Gray Vireo, Virginia's Warbler, Scott's Oriole) and six of the seven riparian species without trends (Belted Kingfisher, Veery, Swainson's Thrush, Nashville Warbler, MacGillivray's Warbler) appeared infrequently in the BBS database and virtually not at all on the BBS routes analyzed for the three primary shrubsteppe ecoregions. The lack of trends found for these species is likely a consequence of undersampling by the present BBS route coverage. Of the 14 species for which no significant trends were found, only Yellow Warbler was sampled sufficiently to conclude that populations likely were stable.

In contrast to the high percentage of significant population declines among the 37 bird species we considered, only three species exhibited increasing population trends without also showing conflicting declining trends in some areas or for some time periods.

The results of our population trend analyses present an overall picture of an ecosystem in trouble, especially across the three primary shrubsteppe ecoregions. For the great majority of bird species considered, the general pattern of decline or rarity is sounding a clear warning.

Population Trends: Mammals

Remarkably little is known about the actual distribution or conservation status of most small-mammal species that are tied to shrubsteppe landscapes of the Intermountain West. The reason is simple: there is no standardized survey comparable to the BBS to provide data for small-mammal populations. As a result, there is no general understanding of population trend patterns for small mammals across the United States.

Our analysis of field studies that used appropriate trapping methods in suitable habitats is the first comprehensive attempt to quantify actual presence and absence of species across the region. We were surprised by the high frequency with which species were found to be missing in studies that focused on suitable locations. Of 22 species, only Great Basin pocket mouse was found consistently enough to indicate a reasonable likelihood of being relatively common in suitable habitat. The distribution of study sites was surprisingly broad for most species, with the notable exceptions of water shrew, pallid bat, and western jumping mouse, which were substantially undersampled relative to the extent of their geographic range in the Intermountain West. For a few additional species, such as sagebrush vole and long-tailed vole, study sites were scattered across much of their historical range, but with some significant geographic gaps. For nearly all of the species covered, however, understanding of actual distributions clearly can be improved by additional field studies to systematically sample small-mammal communities across the three primary shrubsteppe ecoregions. As indicated by our maps in the species accounts, the small-mammal communities of the Wyoming Basin in particular have received little attention.

Additional locality information for small mammals could be compiled from specimens contained in museum collections, which would supplement our understanding of recent distributions relative to presumed historical ranges.

Lacking in such collections, however, is the even more important information of where trapping *failed* to find the species in appropriate habitat within the presumed historical range. Absent such information, our analyses remain the best quantitative sampling of presence and absence for the species evaluated.

The high percentages of studies that failed to find species where expected should raise concern regarding the actual current extent of populations relative to standard range maps. The appropriate context in which to view these results is to understand the high degree of habitat fragmentation and altered disturbance regimes across shrubsteppe landscapes (Knick et al. 2003), the overwhelmingly negative response to livestock grazing shown by nearly all of the species considered, and the very limited dispersal abilities of terrestrial small mammals. Our results support the view that many of these species now exist only as small, disconnected populations isolated from each other by unsuitable habitats across which they cannot disperse (Yensen and Sherman 2003).

The recent catastrophic decline and assured extinction of the largest known population of northern Idaho ground squirrels (Sherman and Runge 2002) well illustrates the challenges posed by the highly disrupted landscapes that now characterize much of the Intermountain West. The combined effects of loss of fire, livestock grazing, and introduction of exotic plant species eliminated suitable habitat and the native plant species on which the squirrel depended. Alarmingly, this scenario is neither unique to this one population, nor to this one species; it is the reality faced by many small-mammal species in today's shrubsteppe landscapes.

Restricted Distributions and Endemic Birds

In general, birds associated with shrubsteppe landscapes have larger geographic ranges than most of the small terrestrial mammals we evaluated. The far greater dispersal capabilities of birds and the associated high potential for gene flow among populations are reflected by the lack of endemic species among shrubsteppe birds. Nevertheless, the absence of endemic species with small geographic ranges does not preclude an extraordinary degree of dependence on shrubsteppe habitats by some avian species.

We can identify a continuum of ecological dependence on shrubsteppe habitats for upland birds based on the species' extent of habitat specificity and overall concordance of their total geographic range with the distribution of shrubsteppe landscapes. The most closely associated species, which are in essence entirely dependent on shrubsteppe, are Greater Sage-Grouse, Sage Thrasher, Brewer's Sparrow, and Sage Sparrow. A second group that is nearly as dependent includes Gray Flycatcher, Gray Vireo, Green-tailed Towhee, Black-throated Sparrow, and perhaps Scott's Oriole. The other 14 upland species comprise a third group with ranges that extend beyond the region, but which are nevertheless closely or exclusively associated with shrubsteppe habitats in the Intermountain West portion of their distribution. Some of the species in this third group have distributions that extend well east of the Rocky Mountains (e.g., Loggerhead Shrike, Horned Lark, Vesper Sparrow, Lark Sparrow, Grasshopper Sparrow), with the core of their distribution on the Great Plains. Populations that occur west of the Rockies on shrubsteppe landscapes of public lands, however, are of great importance for these species, as all are experiencing significant population declines in the eastern United States (Sauer et al. 2003), especially east of the Great Plains where grasslands continue to disappear as farmlands transition into woodland and suburban sprawl.

In comparison to upland birds, none of the riparian birds are as narrowly dependent at the species level on riparian habitats of the Intermountain West, and all have geographic ranges that extend well beyond the region. For all of these species, however, populations within the area of interest constitute important population segments that are highly to entirely dependent on riparian habitats across the vast Intermountain West. Some of these riparian species are narrowly distributed at the subspecific level (e.g., Willow Flycatcher), but the precise geographic distributions and habitat specificity for subspecies is poorly known or completely unknown in the Intermountain West for the great majority of species considered in our analyses.

Restricted Distributions and Endemic Mammals

Ten of the 18 upland mammals we evaluated are endemic to the Intermountain West shrubsteppe. An additional six species (Merriam's shrew, Preble's shrew, little pocket mouse, desert woodrat, sagebrush vole, kit fox) have geographic ranges that extend beyond the Intermountain West, but the populations in our region are nevertheless dependent on shrubsteppe habitats. Thus, aside from the two bat species evaluated, all of the upland mammals depend completely upon native shrubsteppe habitats.

In parallel with riparian birds, riparian mammals (with the exception of the endemic Townsend's pocket gopher) have distributions that extend well beyond the Intermountain West. Although within the Intermountain West all five of the riparian small mammals are highly dependent on riparian habitats, three species (western harvest mouse, long-tailed vole, montane vole) will occupy nonriparian areas in those rare instances where suitably dense grass cover is available (see species accounts).

The high degree of endemism among small mammals of the shrubsteppe is likely even greater than species-level ranges indicate. Many of these species consist of two or more described subspecies within the Intermountain West (e.g., dark kangaroo mouse, chisel-toothed kangaroo rat) or have described subspecies that occur just beyond the Intermountain West in California or the Southwest (e.g., little pocket mouse, desert woodrat, kit fox). Much of the described subspecific variation in western small mammals is based on morphological variation; relatively few species have been analyzed for the extent of genetic variation. Where thorough genetic analyses have been conducted, sufficient genetic separation has been found to warrant elevation to full species among some populations previously viewed as subspecies. The best example is the group of five *Spermophilus* ground squirrel species (Hoffman et al. 1993), all of which have relatively small to highly restricted geographic ranges. Three of the five ground squirrels (Idaho ground squirrel, Piute ground squirrel, and Merriam's ground squirrel) each consist of two genetically distinct subspecies. We believe that genetic analyses of upland small mammals would provide further examples of such "cryptic" species. Great Basin pocket mouse, for example, exhibits sufficient karyotypic variability and divergent mitochondrial DNA to indicate the existence of at least two genetically distinct, but still formally unrecognized, species in the Intermountain West (Verts and Carraway 1998).

The general lack of endemism among riparian mammals partly reflects greater extent and greater connectedness of the region's riparian habitats in the past. Beginning with the close of the Pleistocene some 12,000 years ago, riparian habitats across the arid and semiarid West became increasingly isolated as climates warmed (Grayson 1993). Many populations of water shrew, long-tailed vole, montane vole, and western jumping mouse likely have been isolated from conspecific populations for centuries or millennia. Several isolated subspecies of the montane vole occur along the southernmost portion of the species' range, but no systematic studies have examined the extent of genetic isolation shown by this or other species in riparian fragments across the Intermountain West. Vole populations restricted to the naturally fragmented riparian habitats among isolated mountain ranges of the Great Basin (Dobkin, unpubl. data) are likely candidates for genetic studies. We would not be surprised if comparisons among riparian mammal populations in such settings found genetic divergence sufficient to warrant separate species status.

Biodiversity Hotspots and Coolspots: Geographic Patterns of Species Richness

Patterns of avian species richness indicated similar species composition across substantial portions of the three primary shrubsteppe ecoregions for the 21 upland species that we mapped (Fig. 4A). The relatively uniform distribution of upland shrubsteppe species coincided quite well with mapped areas of highest sagebrush landcover (Fig. 1). Areas of highest species richness also coincided reasonably well with areas of lowest shrubsteppe fragmentation across the region (Fig. 2), although the relatively sparse coverage of BBS routes across southern Idaho failed to reflect the extensive shrubsteppe fragmentation of some areas.

Three of the four upland species omitted from the species richness maps (Gray Vireo, Virginia's Warbler, Scott's Oriole) all appear to have centers of abundance southeast of the Great Basin, and can be considered as more closely associated with the Colorado Plateau ecoregion. Virginia's Warbler may be in the process of expanding or shifting its range northward, especially into the Great Basin ecoregion (Dobkin and Fleishman, unpubl. data). If such a shift is a response to global warming, we might expect to see similar shifts by Gray Vireo and Scott's Oriole, as well. At present, there is a dearth of adequate BBS sampling effort in the southern portion of the Great Basin to detect such an expansion for any of these three species.

In stark contrast to upland birds, community composition of riparian birds varied substantially between the 1968–1983 and 1984–2001 periods. Given the relative rarity and ecological importance of riparian habitats within shrubsteppe landscapes, the high degree of instability in riparian community structure should raise great concern as a reflection of the poor ecological condition of riparian habitats across much of the Columbia Plateau, Great Basin, and Wyoming Basin ecoregions—in essence, the areas mapped as bright red to yellow in Figure 4B. In focusing that concern, the adverse effects of livestock grazing (Saab et al. 1995, Dobkin et al. 1998, Tewksbury et al. 2002, Krueper et al. 2003, Earnst et al 2004) and dewatering of riparian zones (Rood et al. 2003) can no longer be ignored for the damage exacted on riparian avifaunas and habitats.

The pattern of high species richness for upland species is much more geographically concentrated for the suite of small mammals compared to upland birds. This is perhaps not surprising given the much more limited powers of dispersal for small terrestrial mammals, and their generally narrower habitat affinities. Greater habitat specificity may also be reflected by the relatively high degree of endemism seen in the mammals. This specificity was further reflected by the absence of complete co-occurrence of species on the species richness maps for small mammals, in contrast to both the upland and the riparian bird maps. For upland mammals, compared with birds, we found much less similarity in species composition between the southern Columbia Plateau/Great Basin ecoregions and the Wyoming Basin ecoregion. Eleven of the 18 upland small mammals do not occur in the Wyoming Basin: five species of *Spermophilus* ground squirrels, four heteromyids (little pocket mouse, dark kangaroo mouse, pale kangaroo mouse, chisel-toothed kangaroo rat), desert woodrat, and kit fox.

In addition to the much lower species richness found for upland mammals in the Wyoming Basin, north-central Oregon and eastern Washington were relatively depauperate in both shrubsteppe bird and mammal species. We interpret this pattern as a reflection of the high proportion of these landscapes that has been converted to agricultural (primarily wheat) production.

The areas of highest species richness found for birds and for small mammals can be integrated with the mapping results of Knick et al. (2003) to guide future conservation efforts from the standpoint of overall biodiversity of species most closely tied to shrubsteppe landscapes.

Concluding Remarks

The species included in our analyses were selected based primarily on their dependence upon shrubsteppe landscapes in the Intermountain West, and not on demonstrated conservation jeopardy. Although there is growing concern for many of the bird species that are closely tied to native shrubsteppe and grasslands of the Intermountain West (Knick et al. 2003), there is little general understanding of the conservation needs for most of these species across the region as a whole. With few exceptions, even less attention has been paid to the conservation needs of small mammals across the region.

The multiple sources of human-caused impacts to shrubsteppe landscapes are well known (Knick et al. 2003). Less well appreciated is the importance of fire as the dominant ecological process that controlled the shifting temporal and spatial mosaic of grasslands and shrublands in these landscapes, and thus provided suitable habitats for the full suite of species from grassland dependent to shrubland dependent. Although there is some disagreement on the frequency and spatial scale of fires prior to Euro-American settlement, there is uniform agreement that fire frequencies in the Intermountain West have been altered greatly over the past 150 years. In some areas, characteristic fire-return intervals are now much longer as a result of fire suppression and the loss of fine fuels to livestock grazing; in other places, fire-return intervals are dramatically shorter due to the spread and dominance of fire-promoting exotic species, such as cheatgrass.

Across the Intermountain West, altered fire frequencies in combination with the ubiquity of livestock grazing continue to drive the loss of native plant community structure and composition on which shrubsteppe birds and small mammals depend. Exotic annual grasses flourish in the absence of competition with the eliminated native grasses and broad-leaved flowering plants, and increase fires to unnatural frequencies of only a few years. Each successive fire promotes expansion of the invaders, resulting in self-perpetuating monocultures of exotic plant species characterized by very short fire-return intervals (d'Antonio and Vitousek 1992). The difference between a sagebrush-dominated landscape with a diverse understory of native bunchgrasses and broad-leaved flowering plants versus a landscape composed of cheatgrass grasslands is as biologically unmistakable as the difference between a mature forest and agricultural cropland. The exotic-plant-dominated landscapes that replace native vegetation on which wildlife depend are uninhabitable for nearly all of the bird and small-mammal species considered in this report.

We know that shrubsteppe habitat has diminished greatly over the past 200 years. The recent detailed analysis for Greater Sage-Grouse found that at least 44% of potential habitat has disappeared (Schroeder et al. 2004), and no attempt was made to evaluate the suitability of remaining habitat in terms of fragmentation and degradation. The current pace of oil, gas, and coal development, particularly in the Wyoming Basin, promises an accelerated trajectory of landscape-scale fragmentation and soil disturbance that will promote invasion by cheatgrass and other exotic plant species, with clear negative consequences for shrubsteppe birds, mammals, and the region's hydrology. Unquestionably, range maps created by connecting the dots among sites where a species has been captured do not paint a realistic picture, especially in the highly altered and fragmented shrubsteppe landscapes of today (Knick et al. 2003). For small terrestrial mammals in particular, many species now exist not in broad ranges, but as scattered, disconnected populations isolated from each other by unsuitable habitats that preclude successful dispersal. Our analyses of trapping data for terrestrial small mammals, geographic patterns of species richness for riparian birds, and previous work on upland shrubsteppe birds (Knick and Rotenberry 2002) emphatically demonstrate that it is completely untenable to assume species' presence based simply on presence of appropriate habitat in shrubsteppe landscapes of the Intermountain West.

When we first began this assessment, some of the species included in our analyses already were known to be declining or rare (Greater Sage-Grouse, Sharp-tailed Grouse, Yellow-billed Cuckoo, pygmy rabbit, Idaho ground squirrel, Washington ground squirrel, kit fox). We expected to find, however, that conservation concern would prove unwarranted for a significant number of the species we examined. Based on the information presented in this report, we find no basis for optimism about the future prospects in the Intermountain West of any of the 61 species we examined. At best, we can conclude that the data are mixed or unclear, and not necessarily promising, for a few species (Long-billed Curlew, Gray Vireo, Virginia's Warbler, Yellow Warbler, Scott's Oriole, Great Basin pocket mouse). It is clear that the ecological integrity of Intermountain West shrubsteppe landscapes largely has been compromised, and that the bird and small mammal species dependent upon these habitats are providing the signals that they are at risk.

Acknowledgments

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SPECIES ACCOUNTS

BIRDS OF SHRUBSTEPPE LANDSCAPES

Greater Sage-Grouse (*Centrocercus urophasianus*)

Regional Taxonomic Equivalents:

Centrocercus urophasianus urophasianus, *Centrocercus urophasianus phaios*

Current and Historical Distribution:

Prior to widespread Euro-American settlement of the West 150 years ago, the Greater Sage-Grouse occurred in 16 U.S. states and three Canadian provinces. The species has been extirpated from five states and one province. In states and provinces where populations remain, abundance and distribution have been reduced considerably (Fig. 1.1, 1.2).

Habitat Requirements and Associations:

The Greater Sage-Grouse is a shrubsteppe obligate of the western United States that uses a variety of habitats throughout the course of a year (Schroeder et al. 1999). Sage-grouse nest in areas of dense cover, primarily composed of big sagebrush and various native herbaceous plants. After hatching, broods commonly seek out riparian meadows and other moist areas where native broadleaved flowering plants and insects abound. During winter, Greater Sage-Grouse feed almost exclusively on sagebrush leaves, preferring areas with cover of sagebrush and plants of greater than average heights. Research suggests that breeding areas should have 15–25% shrub cover with shrub heights approximately 40–80 cm. Herbaceous plants should be a minimum of 18 cm tall and provide >15% cover. The structure of brooding and wintering habitats should be similar to nesting, but with increased densities of broadleaved flowering plants and shrubs, respectively (Connelly et al. 2000).

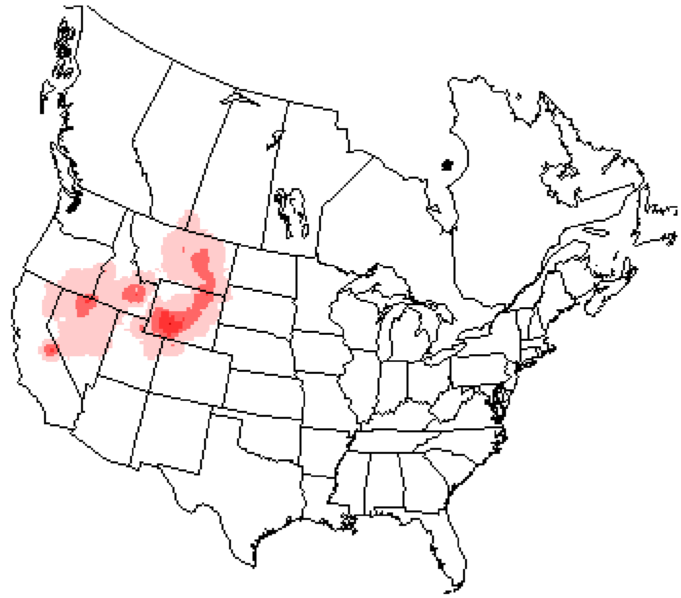

Figure 1.1. Greater Sage-Grouse distribution. Darker shading indicates greater abundance.

Table 1.1. Greater Sage-Grouse population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n[a])		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(23)*	ns *(32)*	ns *(47)*
Columbia Plateau	ns[b] *(4)*	ns[b] *(9)*	ns[b] *(10)*
Great Basin Desert	—	—	—
Basin and Range	ns[b] *(5)*	ns[b] *(5)*	ns[b] *(10)*
Wyoming Basin	ns *(14)*	ns *(17)*	ns *(25)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \le 0.05$; $^{**}P \le 0.01$; $^{***}P \le 0.001$; ns = not significant ($P > 0.10$); — = no data.

BBS Data Analysis:

Greater Sage-Grouse populations are poorly sampled by the BBS. Hence, although no long or short-term population trends are evident in any area (Table 1.1), the results are of questionable reliability.

Our spatial analyses suggest that Greater Sage-Grouse populations have declined (Fig. 1.3). The area predicted to have potentially high abundances (>0.5 birds detected per BBS route) declined by 7% in the western states and by 16% in shrubsteppe ecoregions. Areas of decline are widespread and extend across much of the current distribution of Greater Sage-Grouse (Fig. 1.4).

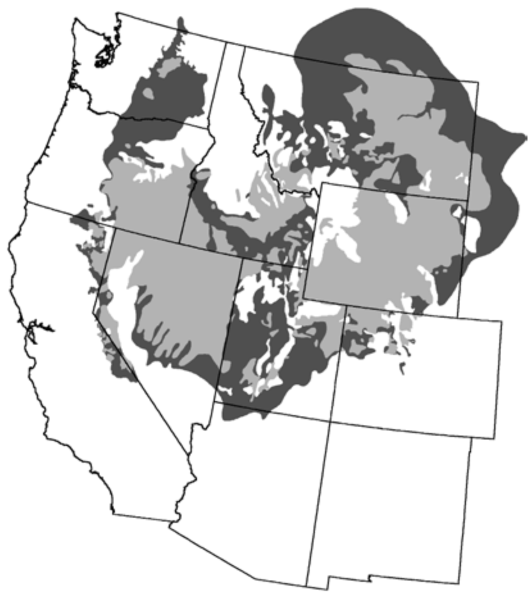

Figure 1.2. The current distribution of the Greater Sage-Grouse (light gray) is considerably reduced from the historical distribution (dark gray; from Schroeder et al. 2004, used with permission).

Population Impacts:

Declines in Greater Sage-Grouse populations are largely attributed to habitat destruction, degradation, and fragmentation (Dobkin 1995). Extensive areas of shrubsteppe have been converted to agricultural land. The combination of altered fire frequency (both lower and higher) and livestock grazing has converted large areas of shrubsteppe to monocultures of exotic annual grasses or to pure sagebrush stands that lack most native grasses and broad-leaved flowering plants. Range "improvement"

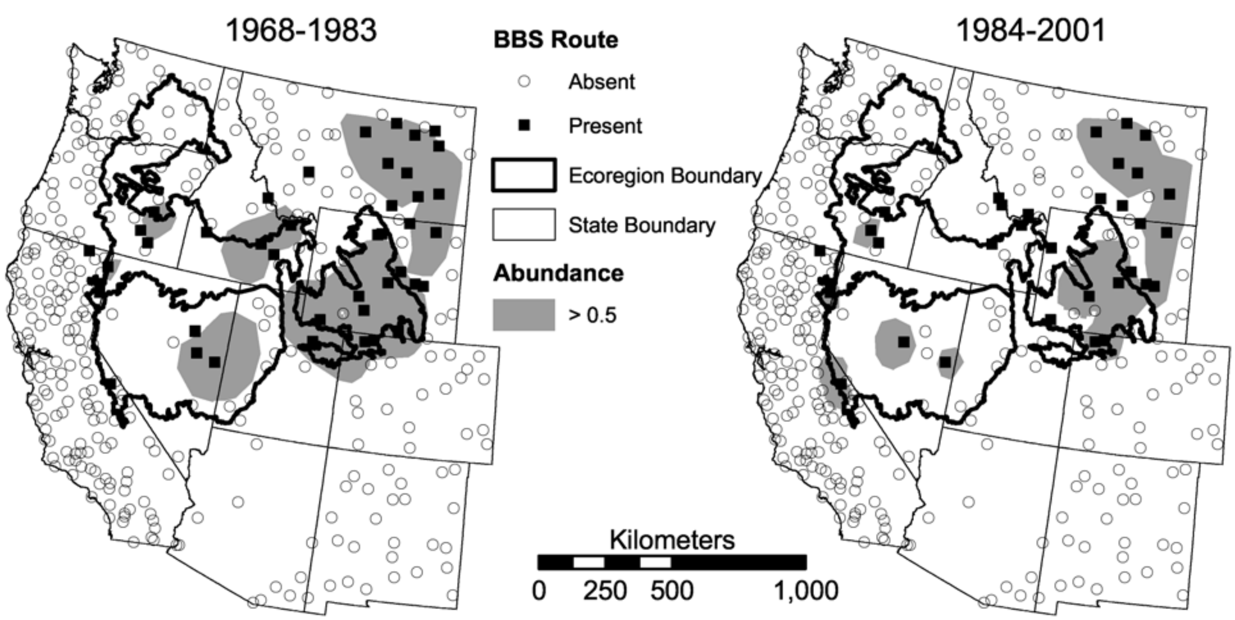

Figure 1.3. Greater Sage-Grouse distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>0.5 birds detected) based on natural neighbor analyses of BBS routes.

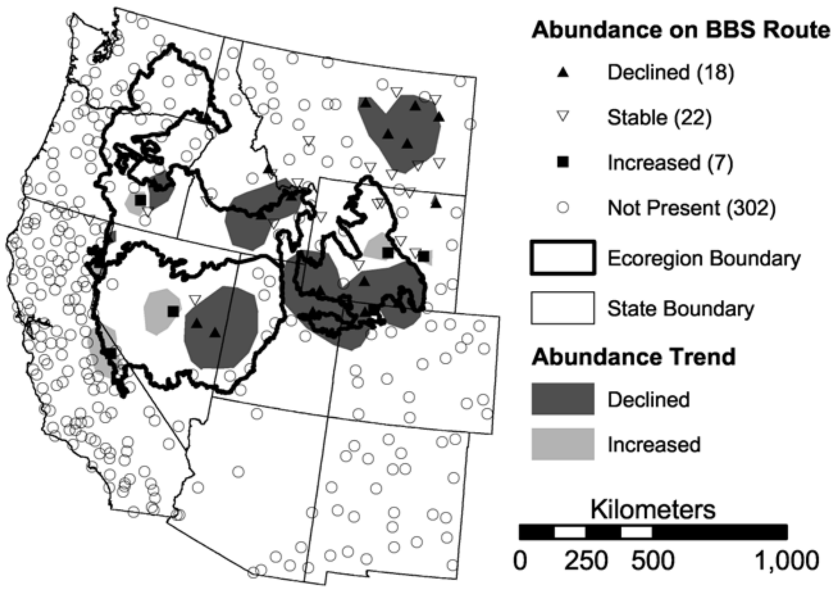

Figure 1.4. Direction of Greater Sage-Grouse detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

efforts, such as chaining, herbicidal spraying, and seeding of exotic grasses, have been conducted on large areas to alter native habitat for the benefit of livestock. Nest failure, increased predation, and reduced survival rates are consequences of reduced habitat quality for sage-grouse populations. Recent studies documented greatly reduced survival in Greater Sage-Grouse infected with West Nile virus, raising additional concerns for the species.

State or Federal Status/Listing:

Federal: proposed for listing as endangered/threatened

Nevada: species of concern

Oregon: species of concern

Utah: species of concern

Washington: threatened

References:

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Sharp-tailed Grouse
(*Tympanuchus phasianellus*)

Regional Taxonomic Equivalents:

Tympanuchus phasianellus columbianus

Current and Historical Distribution:

Prior to widespread Euro-American settlement of the West 150 years ago, Sharp-tailed Grouse were present in 21 U.S. states and eight Canadian provinces. The species has been extirpated from eight states, and many remaining populations in other areas are fragmented, severely reduced, or at risk of extinction. Sharp-tailed Grouse populations in the Pacific Northwest occupy as little as 10% of their former range (Fig. 2.1).

Habitat Requirements and Associations:

Across the species' range, occupied habitats vary significantly in composition and by season (Giesen and Connelly 1993). Sharp-tailed Grouse are found in grassland, shrubsteppe, and mixed-shrub habitats (Connelly at al. 1998). Physiognomic rather than floristic characteristics are thought to be key factors influencing presence and abundance. Leks occur on level areas, often with disturbed or reduced vegetation. Nests usually occur within 2 km of a lek, beneath dense shrubs. Habitat mosaics that include native broadleaved flowering plants and shrubs provide good nesting areas. After hatching, broods disperse to areas with abundant broadleaved flowering plants and insects. Wintering Sharp-tailed Grouse use riparian, deciduous, and open coniferous woodlands for shelter and foraging.

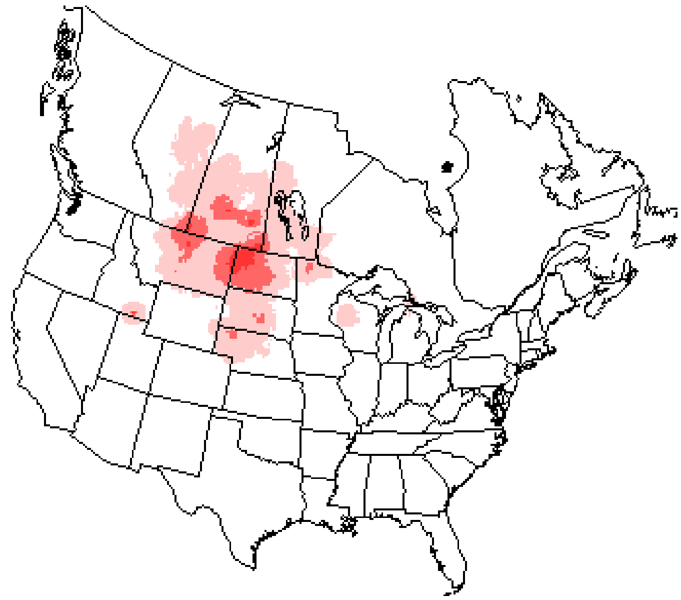

Figure 2.1. Sharp-tailed Grouse distribution. Darker shading indicates greater abundance.

Table 2.1. Sharp-tailed Grouse population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	–7.2*** *(42)*	ns *(20)*	–9.7** *(28)*
Columbia Plateau	ns[b]	ns[b]	ns[b]
Great Basin Desert	—	—	—
Basin and Range	—	—	—
Wyoming Basin	—	—	—

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \le 0$ .05; $^{**}P \le 0$ .01; $^{***}P \le 0$ .001; ns = not significant ($P > 0.10$); — = no data.

BBS Data Analysis:

Sharp-tailed Grouse populations are poorly documented by the BBS (Table 2.1). However, available data suggest that populations in the BBS Western region have declined significantly over both the long and short term. No data are available from the shrubsteppe physiographic provinces.

Sharp-tailed Grouse were detected on BBS surveys too infrequently to perform meaningful spatial analyses in shrubsteppe ecoregions.

Population Impacts:

Extensive areas of native habitat have been converted to agricultural lands, and although Sharp-tailed Grouse sometimes still nest in these areas, success is commonly much lower than in native habitat. Activities that reduce herbaceous cover (i.e., livestock grazing and haying) reduce nesting and brood-rearing success. Grazing and agriculture have destroyed or degraded many riparian areas that, previously, Sharp-tailed Grouse used for brood rearing and wintering.

Local populations have responded positively to habitat improvement efforts. Establishment and maintenance of grassland areas, such as Conservation Reserve Programs lands, have been beneficial, particularly if maintained by periodic fire instead of being subjected to haying or livestock grazing.

State or Federal Status/Listing:

Federal: proposed for listing as endangered/ threatened (*T. p. columbianus* only)

Idaho: species of concern

Utah: species of concern

Washington: threatened

References:

Connelly, J. W., M. Gratson, and K. P. Reese. 1998. Sharp-tailed Grouse (*Tympanuchus phasianellus*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 354. The Birds of North America, Inc., Philadelphia, PA.

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Ferruginous Hawk
(*Buteo regalis*)

Current and Historical Distribution:

The current distribution of Ferruginous Hawks in the U.S. (Fig. 3.1) is assumed to be generally similar to historical; no large-scale changes in distribution have been documented. Canadian populations have declined in range, primarily due to prairie habitat conversion (Johnsgard 1990).

Habitat Requirements and Associations:

The Ferruginous Hawk inhabits grassland and shrubsteppe regions across the central and western United States (Bechard and Schmutz 1995). Specific habitat characteristics that promote presence and abundance are poorly understood. This species avoids forests and narrow

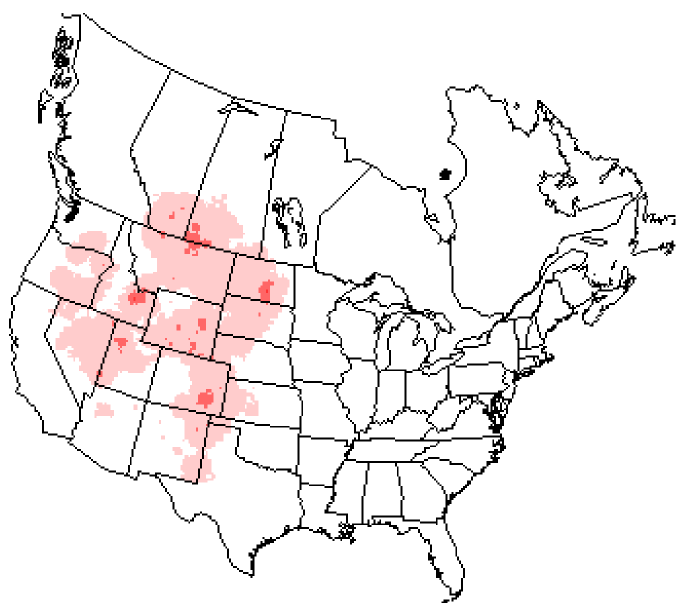

Figure 3.1. Ferruginous Hawk distribution. Darker shading indicates greater abundance.

canyons, preferring open plains and deserts. Rimrock, elevated knolls, isolated trees, utility structures, and edges of pinyon/juniper woodlands are used for hunting perches and nesting. Prey abundance, primarily jackrabbits and ground squirrels, is correlated significantly with the number of breeding pairs in an area and with reproductive success (Jasikoff 1982, Deschant et al. 2001b).

BBS Data Analysis:

In the Western BBS region as a whole, standard BBS analyses suggest that Ferruginous Hawk populations are experiencing significant long-term population growth (Table 3.1). Data from the shrubsteppe physiographic provinces, however, are sparse and statistically unreliable.

Our spatial analyses support a moderate increase in Ferruginous Hawk populations. The area predicted to have higher abundances (>0.5 birds detected per BBS route) increased by 5% for the Western BBS region, but remained stable for the shrubsteppe ecoregions (Fig. 3.2). For the majority of BBS routes, abundances of Ferruginous Hawks are stable or so low that a trend is not evident (Fig. 3.3).

Table 3.1. Ferruginous Hawk population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n[a])		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(15)*	ns *(99)*	4.0* *(112)*
Columbia Plateau	—	ns *(20)*	ns *(20)*
Great Basin Desert	—	ns[b] *(6)*	ns[b] *(6)*
Basin and Range	—	ns *(14)*	ns *(15)*
Wyoming Basin	20.2**[b] *(2)*	ns *(17)*	ns *(21)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Population Impacts:

Estimates of Ferruginous Hawk populations vary considerably, from <6,000 nationwide to >14,000 on the Great Plains alone (Olendorff

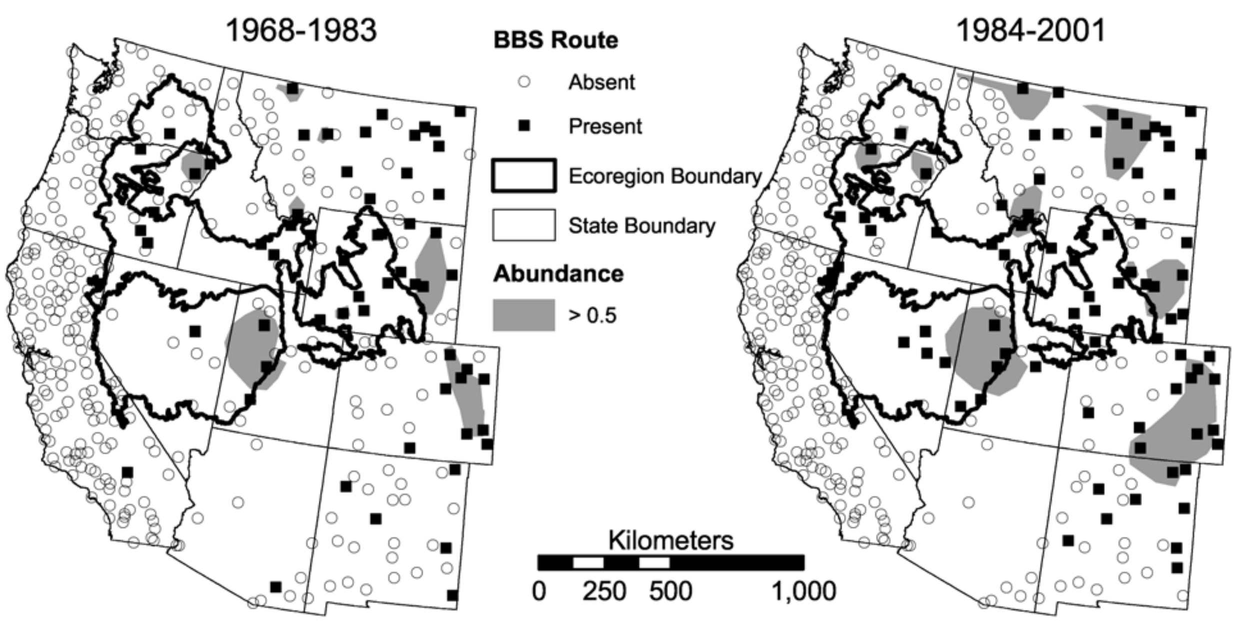

Figure 3.2. Ferruginous Hawk distribution on BBS routes, 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>0.5 birds detected) based on natural neighbor analyses of BBS routes.

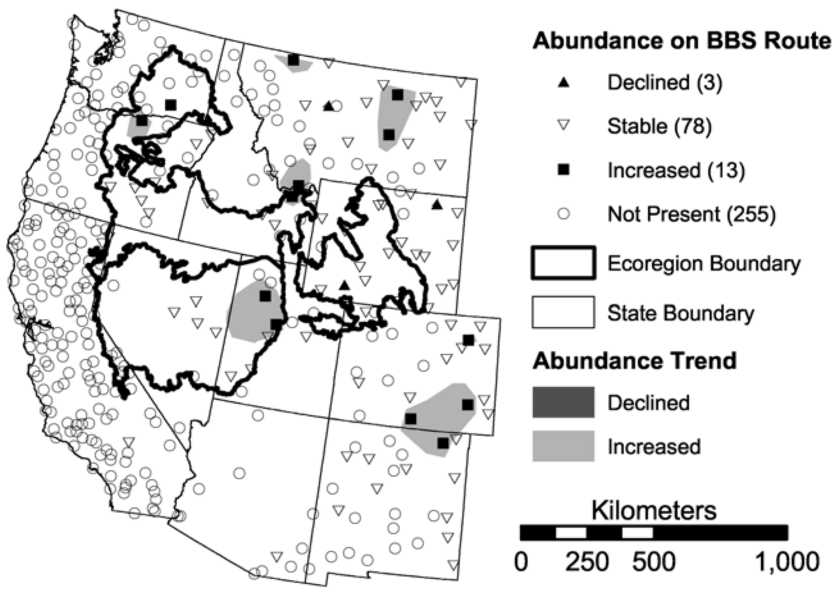

Figure 3.3. Direction of Ferruginous Hawk detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

1993). Although BBS data appear to indicate otherwise, populations are generally thought to be in decline, but patterns and causes are unclear. Habitat destruction and degradation are the greatest threats to Ferruginous Hawk populations. These issues directly influence prey abundance, an important factor in reproductive success. Compared with other *Buteo* species in the region, Ferruginous Hawks can be particularly sensitive to human activities and disturbances.

State or Federal Status/Listing:

Federal: species of concern (U.S. Fish and Wildlife Service; USDA Forest Service: Pacific and Rocky Mountain Regions; USDI Bureau of Land Management: Idaho, Nevada, Oregon, and Wyoming)

Oregon: species of concern

Utah: threatened species

Washington: threatened species

Wyoming: species of concern

References:

Bechard, M. J., and J. K. Schmutz. 1995. Ferruginous Hawk (*Buteo regalis*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 172. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 2001b. Effects of management practices on grassland birds: Ferruginous Hawk. (revised version). U.S. Geological Survey Northern Prairie Wildlife Research Center. Jamestown, ND.

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Olendorff, R. R. 1993. Status, biology and management of Ferruginous Hawks: a review. USDI Bureau of

Prairie Falcon
(*Falco mexicanus*)

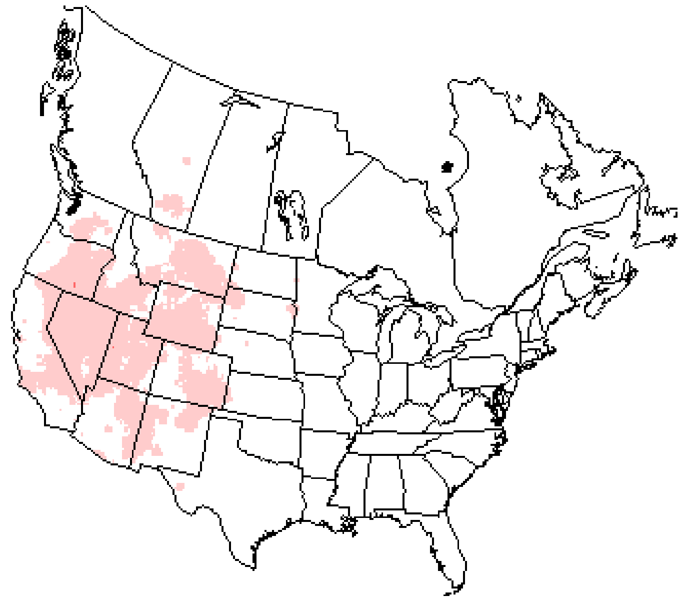

Figure 4.1. Prairie Falcon distribution.

Current and Historical Distribution:

The current distribution of Prairie Falcons (Fig. 4.1) is assumed to be generally similar to historical; no large-scale changes in distribution have been documented.

Habitat Requirements and Associations:

An inhabitant of arid western landscapes, the Prairie Falcon is found in shrubsteppe, grassland, and mixed-shrub areas where cliffs and rocky outcroppings are available for nesting (Steenhof 1998). Open habitats with moderate grass cover and low-growing sparse shrubs are preferred for foraging. Nest-site availability and ground squirrel populations, the primary prey, in many locations, are important factors in habitat selection by Prairie Falcons (Marzluff et al. 1997).

BBS Data Analysis:

Standard BBS analyses suggest that Prairie Falcon populations are stable (Table 4.1). In the Western BBS region and shrubsteppe physiographic provinces, no significant long-term trends are evident.

Our spatial analyses suggest that Prairie Falcon populations are stable. The area predicted to have higher abundances (>0.5 birds detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions (Fig. 4.2). Prairie Falcon densities are often low and changes in abundances slight; thus most routes show no change in abundance (Fig. 4.3).

Table 4.1. Prairie Falcon population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	–12.4* *(27)*	ns *(109)*	ns *(123)*
Columbia Plateau	ns[b] *(6)*	ns *(24)*	ns *(26)*
Great Basin Desert	ns[b] *(3)*	ns[b] *(11)*	ns *(14)*
Basin and Range	ns[b] *(2)*	ns *(17)*	ns *(18)*
Wyoming Basin	ns[b] *(6)*	23.0*[b] *(10)*	ns *(14)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^*P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$).

Population Impacts:

Prairie Falcon densities are generally low and poorly sampled by the BBS. Total population size has been estimated as 5,000-6,000 pairs (Johnsgard 1990). Due to their diet and preferred habitat, Prairie Falcons were less exposed than other North American falcons to

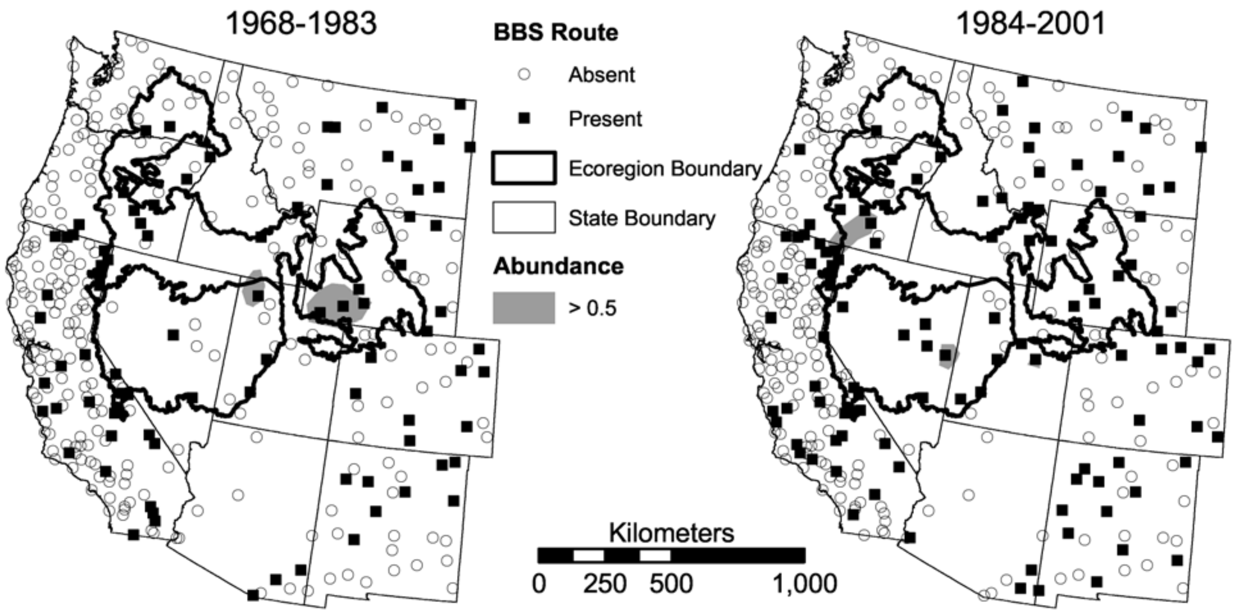

Figure 4.2. Prairie Falcon distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>0.5 birds detected) based on natural neighbor analyses of BBS routes.

pesticides of the 1960s and 1970s. Activities affecting ground squirrel abundance, such as agricultural conversion, livestock grazing, frequent wildfires, and poisoning may impact Prairie Falcon populations. Nest sites (i.e. cliffs) are a limited resource, and development or disturbance near these sites can reduce breeding success.

State or Federal Status/Listing:

Federal: species of concern (U.S. Fish and Wildlife Service; USDI Bureau of Land Management: Idaho and Nevada)

Washington: monitored species

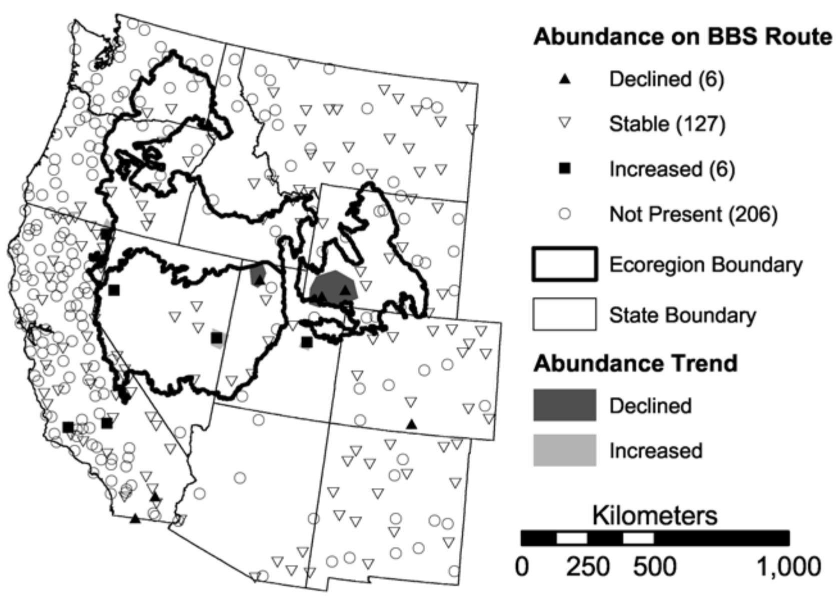

Figure 4.3. Direction of Prairie Falcon detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

References:

Johnsgard, P. A. 1990. Hawks, eagles & falcons of North America: biology and natural history. Smithsonian Institution Press, Washington, DC.

Marzluff, J. M., B. A. Kinsey, L. S. Schueck, M. E. McFadzen, M. S. Vekasy, and J. Bednarz. 1997. The influence of habitat, prey abundance, sex, and breeding success on the ranging behavior of Prairie Falcons. Condor 99:567–584.

Steenhof, K. 1998. Prairie Falcon (*Falco mexicanus*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 346. The Birds of North America, Inc., Philadelphia, PA.

Long-billed Curlew (*Numenius americanus*)

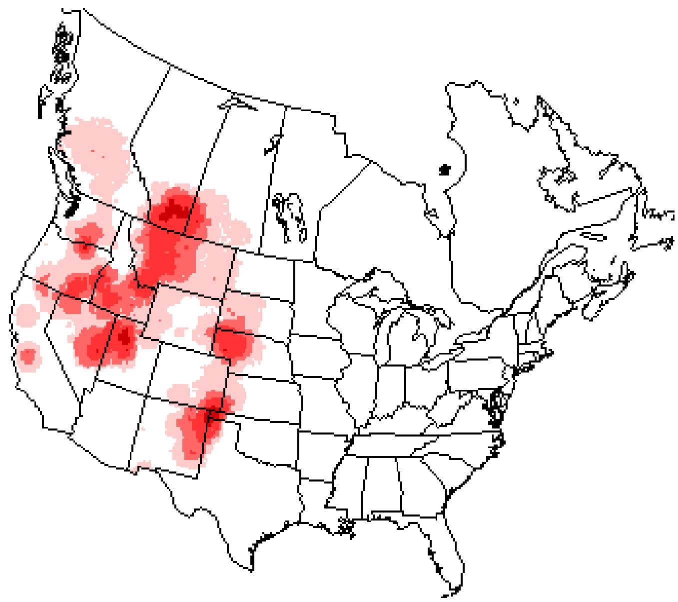

Figure 5.1. Long-billed Curlew distribution. Darker shading indicates greater abundance.

Regional Taxonomic Equivalents:

Numenius americanus americanus, Numenius americanus parvus

Current and Historical Distribution:

The current distribution of Long-billed Curlews (Fig. 5.1) has changed dramatically from the historical distribution. This species once bred across much of the midwestern and southwestern U.S., and large populations wintered along the Atlantic coast. In Canada, the species bred in large portions of Manitoba and Saskatchewan. Populations have been eliminated or severely reduced in many portions of the historical breeding range.

Habitat Requirements and Associations:

Long-billed Curlews breed in grassland and shrubsteppe. Curlews nest in open, short grasslands with rolling topography and few shrubs. Once the clutch has hatched, broods move to areas with increased herbaceous cover. Areas with dense shrubs, trees, or tall, dense grasses are generally avoided.

BBS Data Analysis:

Standard BBS analyses suggest that Long-billed Curlew populations are generally stable

Table 5.1. Long-billed Curlew population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(50)*	ns *(148)*	ns *(165)*
Columbia Plateau	ns[b] *(12)*	ns[c] *(42)*	3.8** *(45)*
Great Basin Desert	—	ns[b] *(7)*	ns[b] *(7)*
Basin and Range	ns[b] *(6)*	ns *(13)*	ns *(15)*
Wyoming Basin	—	ns[b] *(2)*	ns[b] *(5)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

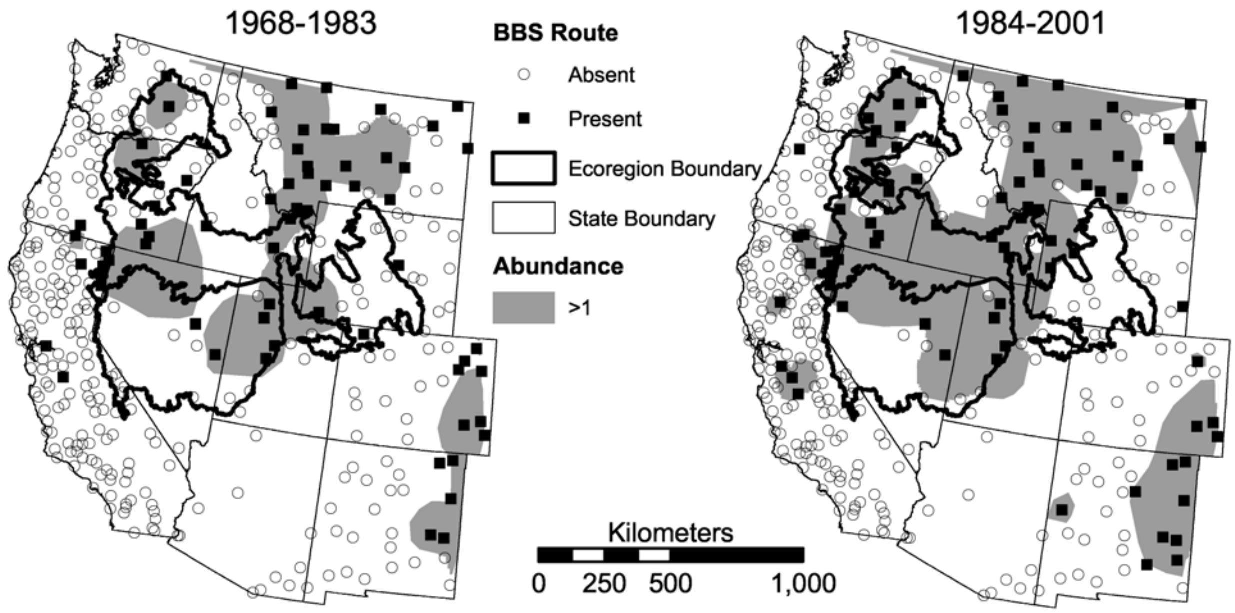

Figure 5.2. Long-billed Curlew distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>1 bird detected) based on natural neighbor analyses of BBS routes.

(Table 5.1). No significant long- or short-term population trends are evident in the Western BBS region. In the shrubsteppe physiographic provinces, only the Columbia Plateau shows a significant population trend, which is positive.

Our spatial analyses suggest that Long-billed Curlews are increasing in abundance across the western U.S. The area predicted to have higher abundances (>1 bird detected per BBS route) increased by 14% in the western states and by 20% in the shrubsteppe ecoregions (Fig. 5.2). Increased abundances are evident on many adjoining routes throughout the shrubsteppe and grasslands of the Intermountain West (Fig. 5.3).

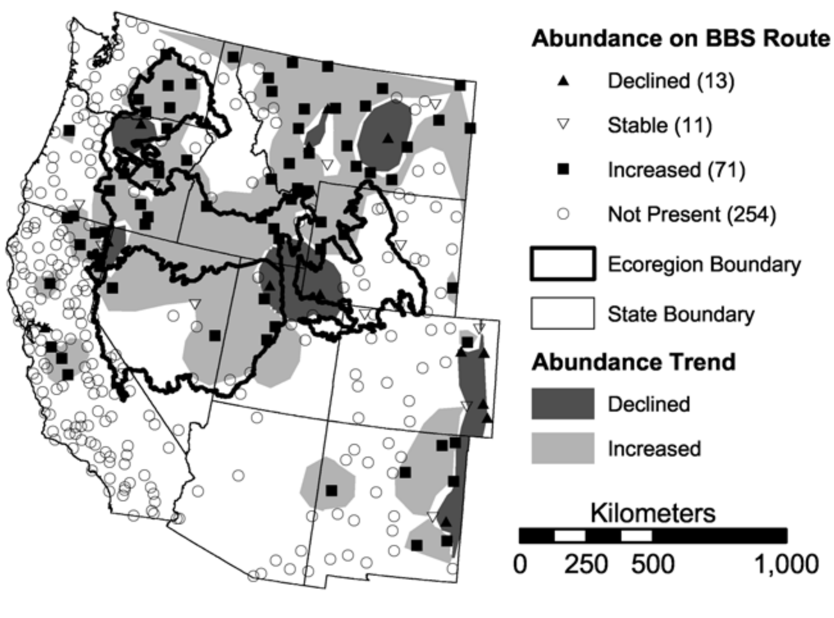

Figure 5.3. Direction of Long-Billed Curlew detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Population Impacts:

Hunting in the late nineteenth and early twentieth centuries decimated many curlew populations, but it is now illegal to hunt the species. Currently, the greatest threats to Long-billed Curlew populations are habitat destruction and degradation (Dechant et al. 2001f). The conversion of shrubsteppe and grasslands to agricultural areas has eliminated considerable amounts of habitat. Natural fire regimes, which rejuvenate grasslands and reduce shrub cover, have been altered. Livestock grazing is considered a positive factor for curlews if it breaks up denser mixedgrass prairie. At the same time, livestock grazing negatively influences populations if it promotes increased shrub cover, or if cows trample nests or disturb birds to the point of nest abandonment. Long-billed Curlews may select areas invaded by exotic annual grasses over native bunchgrasses, as a consequence of the sparse cover (Pampush and Anthony 1993).

State or Federal Status/Listing:

Federal: species of concern (U.S. Fish and Wildlife Service; USDA Forest Service: Rocky Mountain Region; USDI Bureau of Land Management: Nevada, Utah, and Wyoming)

Oregon: species of concern

Utah: species of concern

Wyoming: species of concern

References:

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, P. A. Rabie, and B. R. Euliss. 2001f. Effects of management practices on grassland birds: Long-billed Curlew (revised version). U.S. Geological Survey, Northern Prairie Wildlife Research Center. Jamestown, ND.

Dugger, B., and K. Dugger. 2002. Long-billed Curlew (*Numenius americanus*). *In* A. Poole and F. Gill [eds.], The birds of North American, No. 628. The Birds of North America, Inc., Philadelphia, PA.

Pampush, G., and R. Anthony. 1993. Nest success, habitat utilization and nest-site selection of Long-billed Curlews in the Columbia Basin, Oregon. Condor 95: 957–967.

Redmond, R., and D. Jenni. 1986. Population ecology of the Long-billed Curlew (*Numenius americanus*) in western Idaho. Auk 103:755–767.

Burrowing Owl
(*Athene cunicularia*)

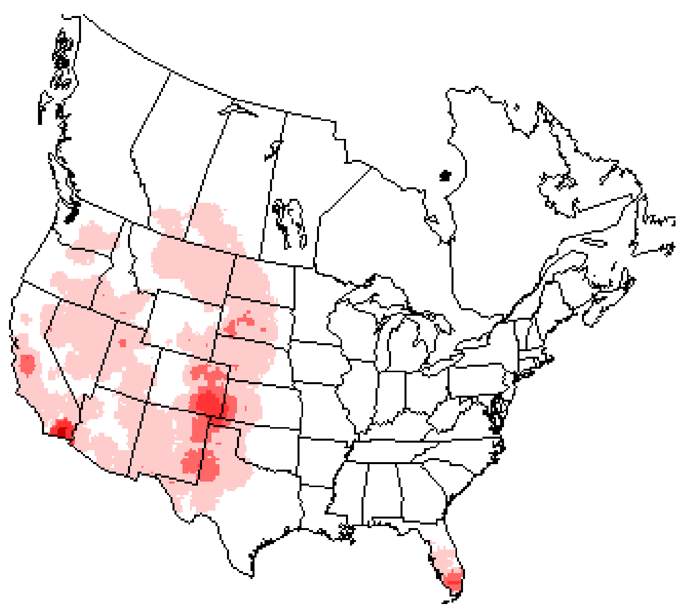

Figure 6.1. Burrowing Owl distribution. Darker shading indicates greater abundance.

Regional Taxonomic Equivalents:

Athene cunicularia hypugaea, *Speotyto cunicularia*

Current and Historical Distribution:

The current distribution of Burrowing Owls in the United States is generally assumed to be similar to historical; no large-scale changes in population have been documented (Fig. 6.1). However, Canadian populations have declined drastically and distribution has been reduced, primarily because of prairie habitat conversion (Johnsgard 1988).

Habitat Requirements and Associations:

Burrowing Owls inhabit grasslands, sparse shrublands, and deserts of the central and western U.S. This species has shown remarkable adaptation to human-altered environments and can successfully nest in vacant lots, golf courses, airfields, and roadway edges. Habitat characteristics influencing presence and abundance are poorly known. Low vegetation and a suitable nest burrow are critical requirements. Nest sites are commonly surrounded by bare ground or short grasses and do not occur in areas of dense, continuous shrubs. Burrowing Owls will expand existing burrow systems, and they rarely construct their own. Thus, burrowing mammals (principally ground squirrels, badgers, and marmots) are important sources of potential nest sites.

BBS Data Analysis:

Standard BBS analyses suggest that Burrowing Owl populations have increased (Table 6.1). In the Western BBS region, populations increased significantly over the long term. No trends are evident in the shrubsteppe physiographic provinces.

Table 6.1. Burrowing Owl population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(65)*	ns *(106)*	4.7* *(143)*
Columbia Plateau	ns *(12)*	ns *(22)*	ns *(27)*
Great Basin Desert	—	ns[b] *(7)*	ns[b] *(8)*
Basin and Range	ns[b] *(4)*	ns[b] *(10)*	ns *(13)*
Wyoming Basin	ns[b] *(2)*	ns[b] *(2)*	ns[b] *(4)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^*P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Our spatial analyses suggest that Burrowing Owl populations are stable. The area predicted

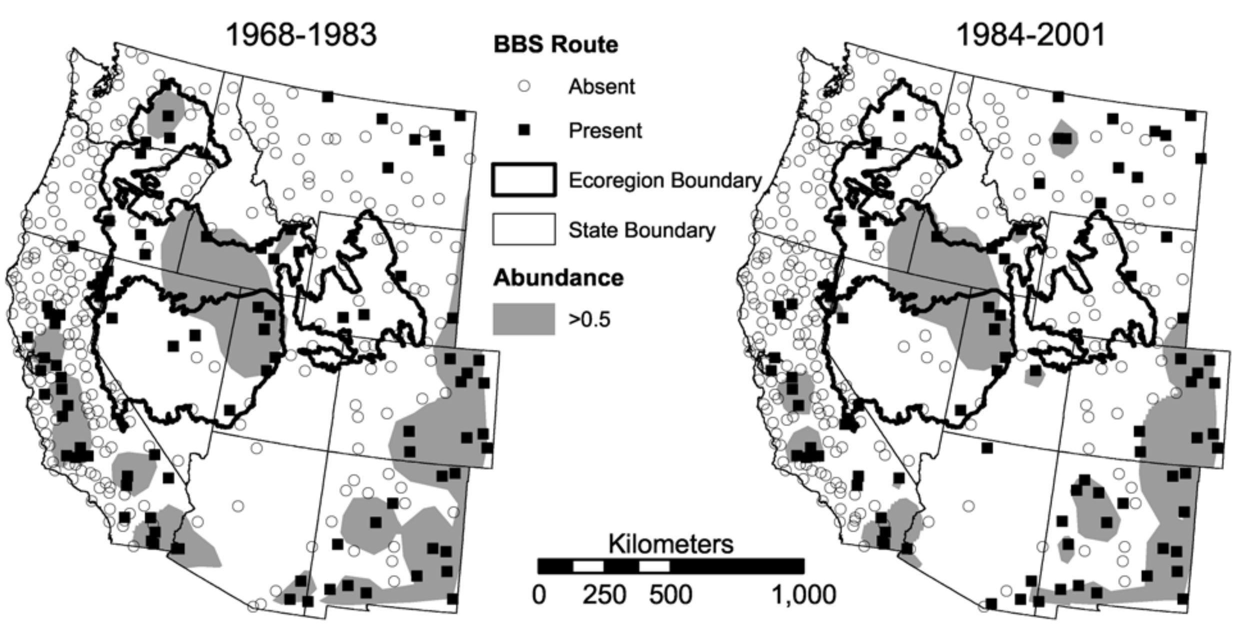

Figure 6.2. Burrowing Owl distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>0.5 birds detected) based on natural neighbor analyses of BBS routes.

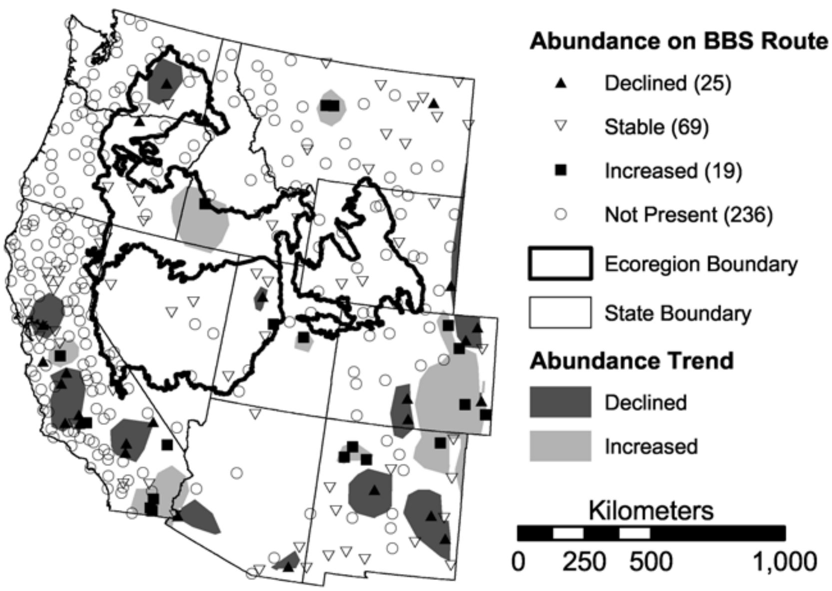

Figure 6.3. Direction of Burrowing Owl detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

to have higher abundances (>0.5 birds detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions (Fig. 6.2). Most routes showed no change in Burrowing Owl abundances (Fig. 6.3) and those that did are disjunct.

Population Impacts:

Native habitat degradation and destruction are the greatest factors influencing Burrowing Owl populations. Extensive areas of grassland and shrubsteppe have been degraded by livestock grazing or converted to agriculture. Pesticides can decrease populations, either directly via poisoning or indirectly by reducing populations of prey and fossorial mammals, which supply nest burrows. The role of predation in population trends is unclear, but badgers, coyotes, and birds of prey are all sources of mortality. Collisions with vehicles may be an important problem in some populations, particularly in agricultural and urban landscapes.

State or Federal Status/Listing:

Federal: species of concern (U.S. Fish and Wildlife Service; USDA Forest Service: Rocky Mountain Region; USDI Bureau of Land Management: Nevada, Oregon, Utah, and Wyoming)

Oregon: species of concern

Utah: species of concern

Washington: candidate for listing as endangered/threatened

Wyoming: species of concern

References:

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, P. A. Rabie, and B. R. Euliss. 2001a. Effects of management practices on grassland birds: Burrowing Owl (revised version). U.S. Geological Survey, Northern Prairie Wildlife Research Center. Jamestown, ND.

Haug, E. A., B. A. Millsap, and M. S. Martell. 1993. Burrowing Owl (*Speotyto cunicularia*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 61. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Johnsgard, P. A. 1988. North American Owls: biology and natural history. Smithsonian Institution Press, Washington, DC.

Paige, C., and S. Ritter. 1999. Birds in a sagebrush sea: Managing sagebrush habitats for bird communities. Partners in Flight, Western Working Group, Boise, ID.

Gray Flycatcher
(*Empidonax wrightii*)

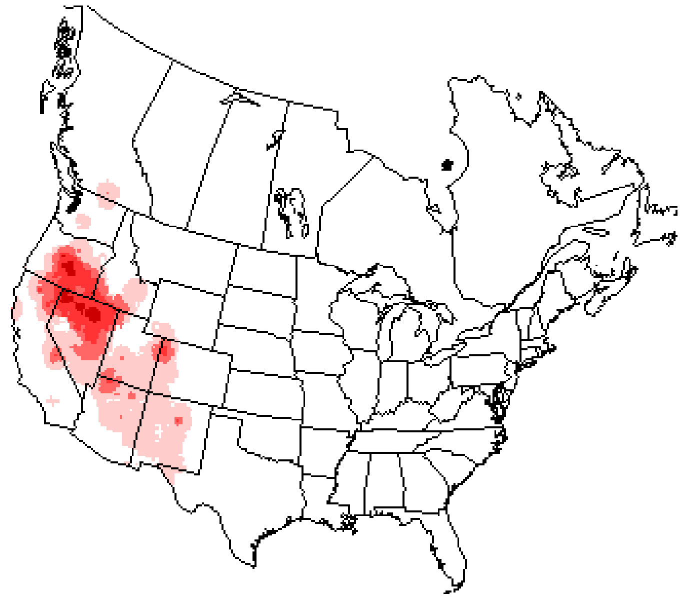

Figure 7.1. Gray Flycatcher distribution. Darker shading indicates greater abundance.

Current and Historical Distribution:

The historical distribution of Gray Flycatchers is thought to encompass primarily the Great Basin and southern Columbia Plateau ecoregions. Range expansions have been observed to the north into Washington and British Columbia, and to the southwest into California (Fig. 7.1).

Habitat Requirements and Associations:

Gray Flycatchers are associated with shrubsteppe, mountain mahogany, and pinyon/juniper woodlands. They may also be found in open oak or ponderosa pine forests with shrubby understories. Habitat characteristics that promote presence and abundance are poorly known. However, in shrubsteppe, Gray Flycatchers are associated with tall, dense sagebrush.

BBS Data Analysis:

Standard BBS analyses suggest that Gray Flycatcher populations have increased (Table 7.1). In the Western BBS region, populations increased significantly over the long term. In the shrubsteppe physiographic provinces, Gray Flycatcher population data are sparse or nonexistent.

Our spatial analyses support the conclusion that Gray Flycatcher populations are expanding. The area predicted to have higher abundances (>1 bird detected per BBS route) increased by 8% in the western states and by 15% in the shrubsteppe ecoregions (Fig. 7.2). However,

Table 7.1. Gray Flycatcher population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(27)*	ns *(113)*	5.1* *(121)*
Columbia Plateau	ns[b] *(5)*	ns *(22)*	ns *(23)*
Great Basin Desert	—	—	—
Basin and Range	ns[b] *(4)*	ns *(21)*	ns *(23)*
Wyoming Basin	—	—	—

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^*P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

BBS routes showing increased Gray Flycatcher abundances are patchy and sparsely distributed (Fig. 7.3).

Population Impacts:

Factors influencing Gray Flycatcher populations are poorly known. Habitat destruction and degradation have the greatest potential to influence populations. Chaining or burning of

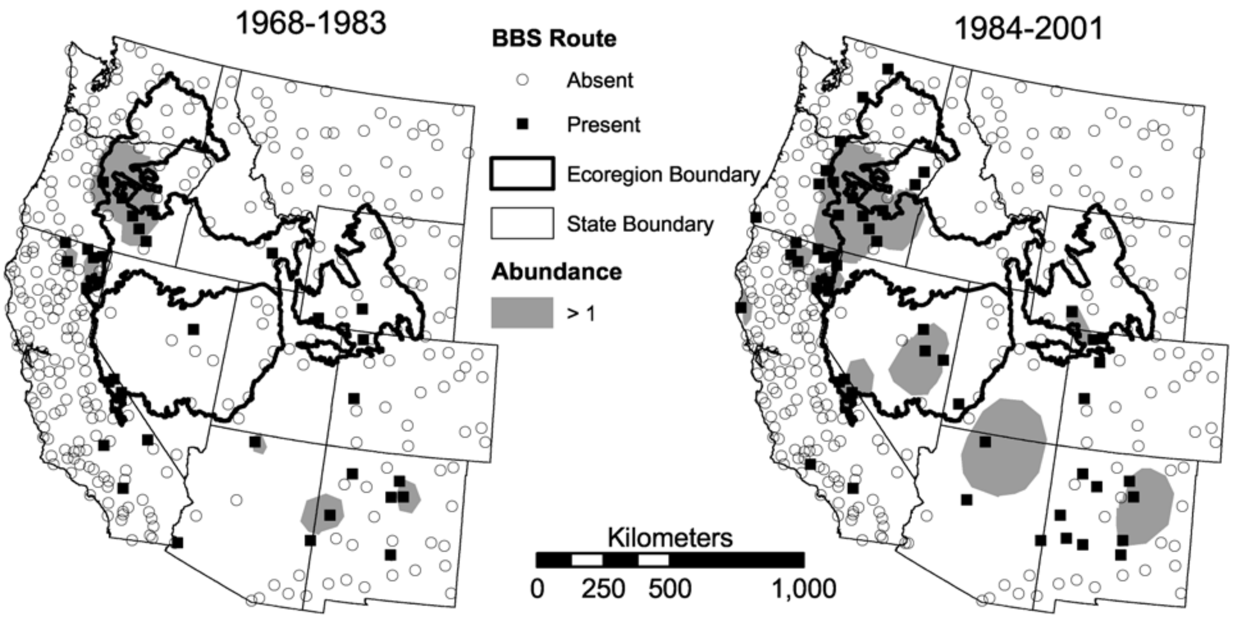

Figure 7.2. Gray Flycatcher distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>1 bird detected) based on natural neighbor analyses of BBS routes.

sagebrush and pinyon/juniper areas is known to eliminate Gray Flycatchers. This species is a cowbird host, but data reporting parasitism rates and impacts to nesting success are sparse. The effects of habitat fragmentation are poorly documented, but it likely increases nest parasitism and predation rates. The impacts of livestock grazing are poorly understood.

State or Federal Status/Listing:

Federal: species of concern (USDA Forest Service: Pacific Region)

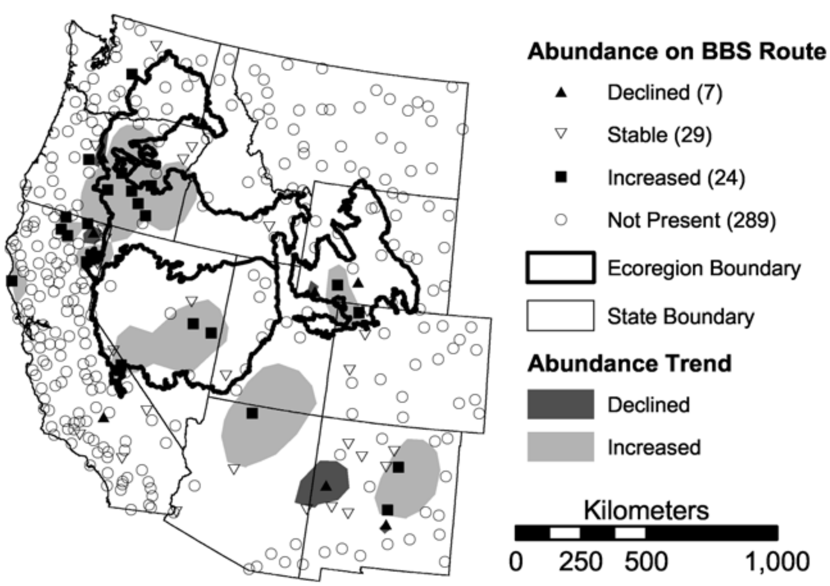

Figure 7.3. Direction of Gray Flycatcher detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

References:

Paige, C., and S. Ritter. 1999. Birds in a sagebrush sea: Managing sagebrush habitats for bird communities. Partners in Flight, Western Working Group. Boise, ID.

Sterling, J. C. 1999. Gray Flycatcher (*Empidonax wrightii*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 458. The Birds of North America, Inc., Philadelphia, PA.

Loggerhead Shrike
(*Lanius ludovicianus*)

Regional Taxonomic Equivalents:

Lanius ludovicianus excubitorides, *Lanius ludovicianus gambeli*

Current and Historical Distribution:

Loggerhead Shrikes are found across much of the United States (Fig. 8.1). Euro-American settlement facilitated range expansion in the northeastern U.S. through the creation of agricultural lands and fragmentation of previously unsuitable forest. Beginning in the mid-twentieth century, populations in the eastern and midwestern U.S. began to decline and many have since been extirpated. The distribution of Loggerhead Shrikes across the western and southern portion of the U.S. is assumed to be generally similar to historical.

Habitat Requirements and Associations:

Loggerhead Shrikes inhabit shrubsteppe, open woodland, field edges, and occasionally riparian areas. They frequently use fences, shelterbelts, and windrows along agricultural fields or pastures for foraging activities. Presence and abundance in shrubsteppe areas are positively correlated with the diversity, density, and height of shrubs. Abundant bare ground and sparse herbaceous cover appear to be important habitat characteristics as well.

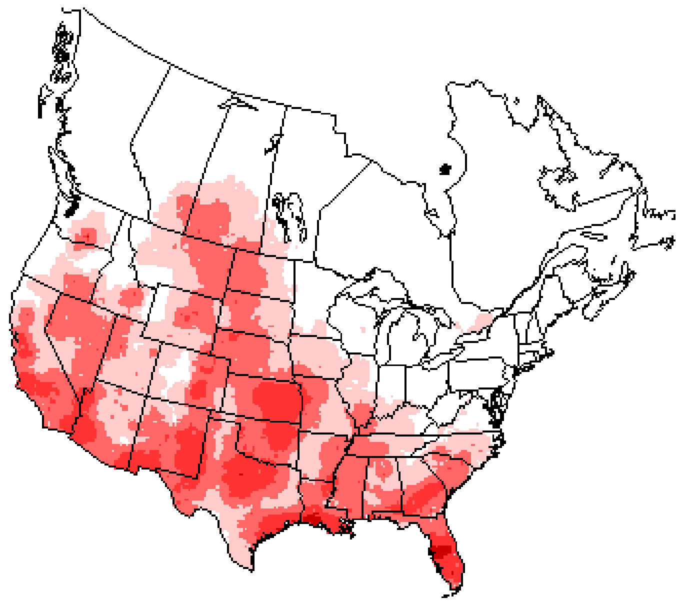

Figure 8.1. Loggerhead Shrike distribution. Darker shading indicates greater abundance.

Table 8.1. Loggerhead Shrike population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	–9.2*** *(212)*	–3.4 *(350)*	–4.3*** *(425)*
Columbia Plateau	ns *(16)*	ns *(41)*	–2.4** *(49)*
Great Basin Desert	ns *(11)*	ns *(23)*	ns *(29)*
Basin and Range	–10.5 *(14)*	ns *(21)*	–4.4** *(28)*
Wyoming Basin	–16.9*** *(14)*	ns *(23)*	ns *(30)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
*$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$; ns = not significant ($P > 0.10$).

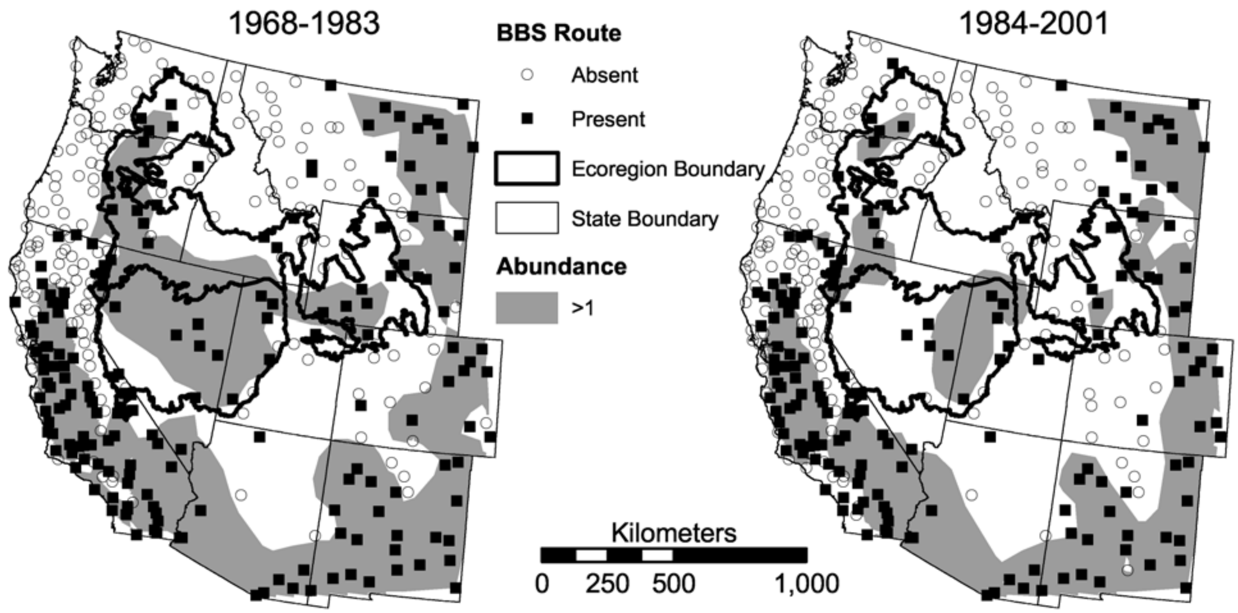

Figure 8.2. Loggerhead Shrike distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>1 bird detected) based on natural neighbor analyses of BBS routes.

BBS Data Analysis:

Standard BBS analyses indicate that Loggerhead Shrike populations have declined significantly in many parts of their range (Table 8.1). In the Western BBS region, and in the Columbia Plateau and Basin and Range physiographic provinces, populations have declined significantly over the long term. The particularly strong decline seen over 1968–1983 in the Western BBS region (–9.2% per year) diminished somewhat over 1984–2001 (–3.4% per year).

Our spatial analyses suggest that Loggerhead

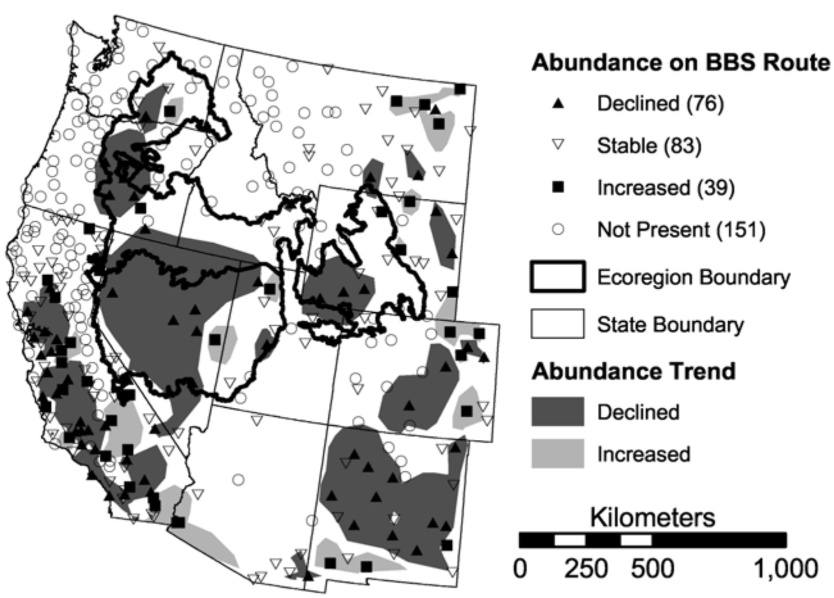

Figure 8.3. Direction of Loggerhead Shrike detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Shrike population declines are widespread and particularly severe in shrubsteppe ecoregions. The area predicted to have higher abundances (>1 bird detected per BBS route) declined by 12% in the western states, and by 31% in shrubsteppe ecoregions (Fig. 8.2). Routes with declining Loggerhead Shrike abundances are numerous and contiguous (Fig. 8.3).

Population Impacts:

Population trends of Loggerhead Shrikes in the West are comparable to trends in the central and eastern U.S. Hypotheses about the causes are many, though no single one convincingly explains the national decline. In the Intermountain West, extensive areas of shrubsteppe have been converted to agricultural lands. Frequent fires in conjunction with invading exotic annual grasses have created extensive annual grasslands that are unsuitable for Loggerhead Shrikes.

State or Federal Status/Listing

Federal: species of concern (U.S. Fish and Wildlife Service; USDA Forest Service: Rocky Mountain Region; USDI Bureau of Land Management: Idaho, Nevada, Wyoming)

Idaho: species of concern

Oregon: species of concern

Washington: candidate for listing as threatened

References:

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, A. L. Zimmerman, and B. R. Euliss. 2001e. Effects of management practices on grassland birds: Loggerhead Shrike (revised version). U.S. Geological Survey, Northern Prairie Wildlife Research Center. Jamestown, ND.

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Wiens, J. A., and J. T. Rotenberry. 1981. Habitat associations and community structure of birds in shrubsteppe environments. Ecological Monographs 51:21–42.

Yosef, R. 1996. Loggerhead Shrike (*Lanius ludovicianus*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 231. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Gray Vireo
(*Vireo vicinior*)

Current and Historical Distribution:

The current distribution of Gray Vireos (Fig. 9.1.) is assumed to be generally similar to historical, though data are lacking. However, in southeastern California, Gray Vireos no longer occur in many historical locations.

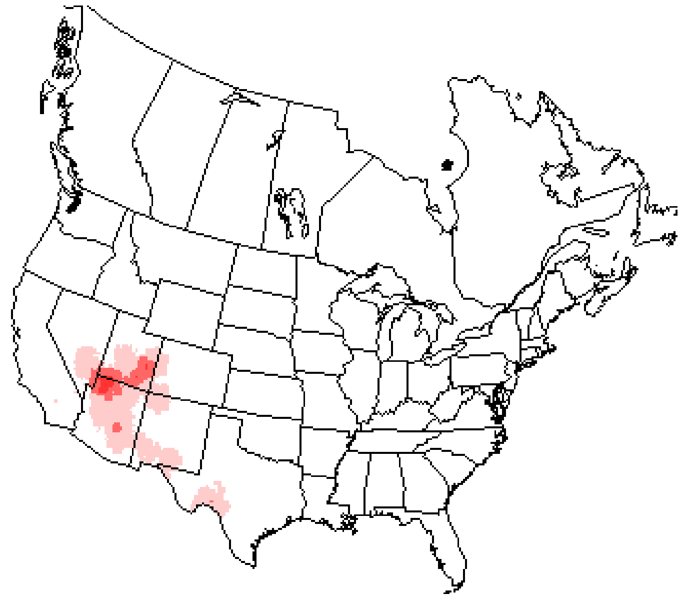

Figure 9.1. Gray Vireo distribution. Darker shading indicates greater abundance.

Habitat Requirements and Associations:

The Gray Vireo inhabits arid, shrubby, open pinyon/juniper and oak woodlands. Specific habitat requirements and associations of this species are poorly known.

BBS Data Analysis:

Standard BBS analyses suggest that Gray Vireo populations in the Western BBS region are stable (Table 9.1). However, Gray Vireo populations are poorly documented by the BBS, so this result cannot be viewed as definitive. Data from the shrubsteppe physiographic provinces are largely nonexistent. Gray Vireos were detected too infrequently in shrubsteppe ecoregions for any meaningful spatial analyses to be done.

Table 9.1. Gray Vireo population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (*n*[a])		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns[b] *(7)*	ns *(30)*	ns *(35)*
Columbia Plateau	—	—	—
Great Basin Desert	—	—	—
Basin and Range	—	ns[b] *(2)*	ns[b] *(2)*
Wyoming Basin	—	—	—

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Population Impacts:

Population dynamics and factors that influence populations of Gray Vireos are poorly documented. In California, habitat loss is thought to be the primary cause of population and range declines. Although considerable pinyon/juniper habitat has been modified or converted for agricultural purposes, impacts to Gray Vireos are poorly documented. The effects of livestock grazing and nest parasitism on Gray Vireos are not well documented, but based on data from other vireo species, these factors could influence local populations significantly.

State or Federal Status/Listing:

Federal: species of concern (U.S. Fish and Wildlife Service; USDI Bureau of Land Management: Nevada)

Reference:

Barlow, J. C., S. N. Leckie, and C. T. Baril. 1999. Gray Vireo (*Vireo vicinior*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 447. The Birds of North America, Inc., Philadelphia, PA.

Horned Lark
(*Eremophila alpestris*)

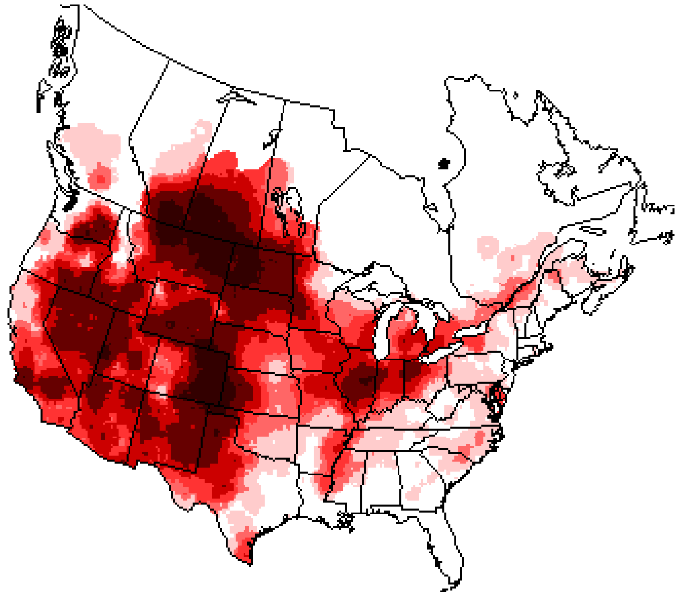

Figure 10.1. Horned Lark distribution. Darker shading indicates greater abundance.

Taxonomic Equivalents:

Eremophila alpestris lamprochroma, Eremophila alpestris utahensis, Eremophila alpestris sierrae

Current and Historical Distribution:

Horned Lark distribution in the eastern United States expanded dramatically with the conversion of forests to agricultural lands in the 1800s and early 1900s. However, a trend of reforestation began in the 1940s and has produced range contractions across the East. In the West, the current distribution of Horned Larks is assumed to be generally similar to historic; no large-scale changes in range have been documented (Fig. 10.1).

Habitat Requirements and Associations:

Horned Larks inhabit grassland, shrubsteppe, desert, and alpine areas across the West. Additionally, Horned Larks readily use human-altered landscapes, including agricultural lands, heavily grazed pastures, and fallow fields. Horned Lark presence and abundance are correlated with sparse shrub cover, short herbaceous vegetation, and abundant bare ground.

BBS Data Analysis:

Standard BBS analyses suggest that Horned Lark populations have declined significantly (Table 10.1). In the Western BBS region, populations declined significantly over all periods, and the rate of decline more than doubled between 1968–1983 and 1984–2001. Of the shrubsteppe physiographic provinces, only the Columbia Plateau showed a significant population trend, which was negative.

Table 10.1. Horned Lark population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	–1.4* *(292)*	–3.3*** *(560)*	–2.8*** *(640)*
Columbia Plateau	ns *(27)*	–2.1** *(69)*	–3.3*** *(71)*
Great Basin Desert	ns *(13)*	ns *(25)*	ns *(30)*
Basin and Range	ns *(20)*	ns *(35)*	ns *(41)*
Wyoming Basin	ns *(22)*	ns *(44)*	ns *(50)*

[a]Number of BBS routes included in analysis.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$).

Our spatial analyses support the conclusion that Horned Lark populations have declined. The area predicted to have higher abundances (>15 birds detected per BBS route) declined by

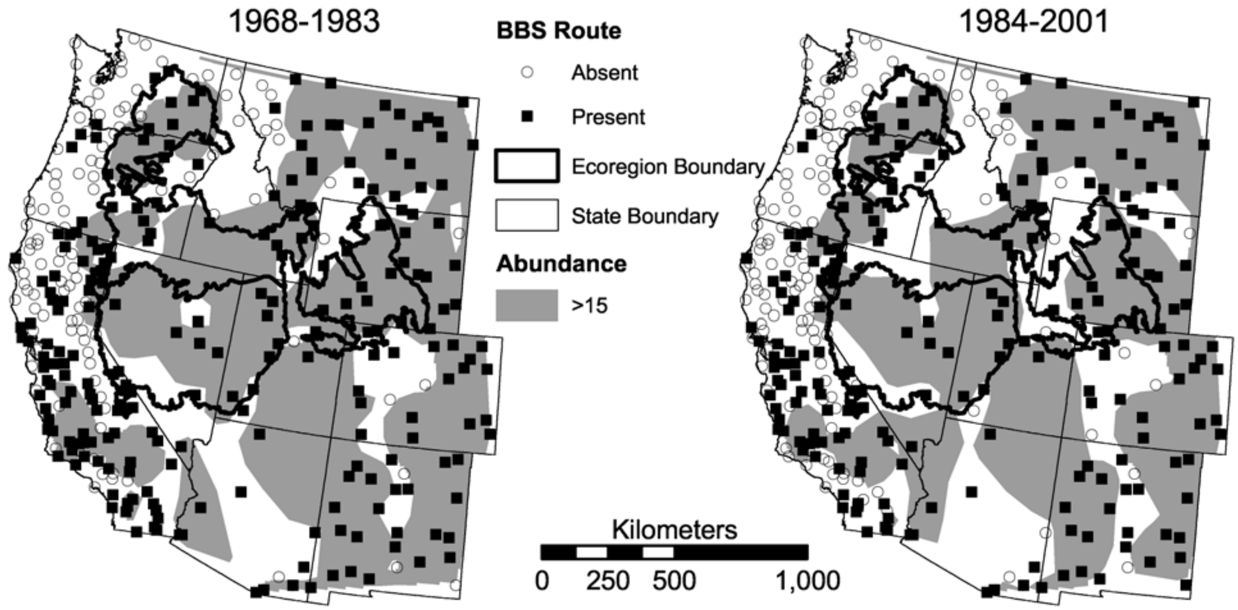

Figure 10.2. Horned Lark distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>15 birds detected) based on natural neighbor analyses of BBS routes.

6% in the western states and by 9% in the shrubsteppe ecoregions (Fig. 10.2). Routes with reduced abundances are spread across most of the West, greatly outnumbering those routes with increased abundances (132 vs. 73, Fig. 10.3).

Population Impacts:

Source areas for Horned Lark populations are generally unknown. The proclivity of this species for using agricultural and heavily grazed areas makes it susceptible to impacts of farming, trampling, and poisoning. However, it is doubt-

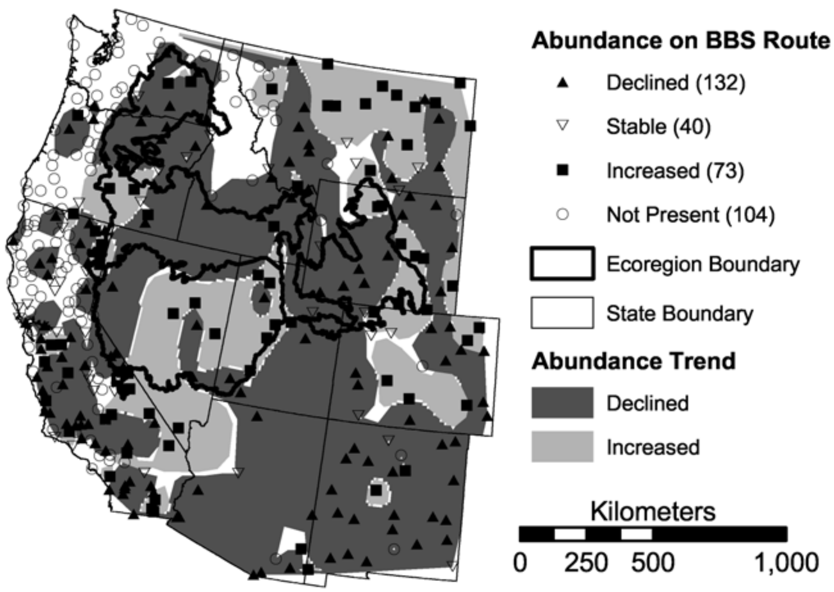

Figure 10.3. Direction of Horned Lark detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

ful that these disturbances are responsible for such widespread population decline. Frequent fires, as well as moderate or heavy livestock grazing, are often beneficial to populations. At the same time, both of these activities promote the invasion of exotic annual grasses, and the long-term ability of annual grasslands to meet Horned Lark habitat requirements is unknown.

State or Federal Status/Listing:

Oregon: species of concern (*E. a. strigata,* of the Willamette Valley; occurs only outside region of interest)

References:

Beason, R. C. 1995. Horned Lark (*Eremophila alpestris*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 195. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Dinkins, M. F., A. L. Zimmerman, J. A. Dechant, B. D. Parkin, D. H. Johnson, L. D. Igl, C. M. Goldade, and B. R. Euliss. 2001. Effects of management practices on grassland birds: Horned Lark (revised version). U.S. Geological Survey, Northern Prairie Wildlife Research Center. Jamestown, ND.

Sage Thrasher
(*Oreoscoptes montanus*)

Current and Historical Distribution:

The current distribution of Sage Thrashers (Fig. 11.1.) is assumed to be generally similar to historical; no large-scale changes have been documented.

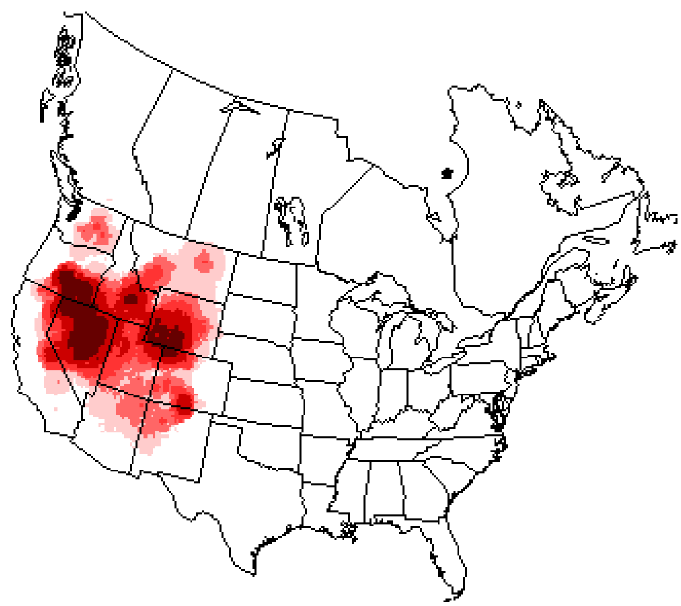

Figure 11.1. Sage Thrasher distribution. Darker shading indicates greater abundance.

Habitat Requirements and Associations:

The Sage Thrasher is a shrubsteppe obligate, inhabiting landscapes dominated by big sagebrush. Presence and abundance are positively correlated with shrub cover and habitat patch size, but negatively correlated with grass cover and disturbed areas.

BBS Data Analysis:

Standard BBS analyses suggest that Sage Thrasher population trends are mixed (Table 11.1). Some areas exhibited no population trends, but significant recent declines were evident in the Columbia Plateau and Basin and Range physiographic provinces. Only the Basin and Range region showed a significant long-term trend, which was negative.

Our spatial analyses also suggest that Sage Thrasher population trends are mixed. The area predicted to have higher abundances (>5 birds detected per BBS route) remained stable in the western states, but increased by 6% in the shrubsteppe ecoregions (Fig. 11.2). Route abundances of Sage Thrashers were mixed, with no obvious spatial pattern (Fig. 11.3).

Population Impacts:

Habitat destruction, degradation, and

fragmentation are the greatest threats to Sage Thrasher populations. Activities that destroy shrub cover (e.g. fire, chaining, herbicide application, agricultural conversion) eliminate local populations of Sage Thrashers until shrubs recolonize. Livestock grazing, which often results in greater shrub cover, can positively influence Sage Thrasher populations. Nest parasitism is not a problem as this species ejects cowbird eggs.

State or Federal Status/Listing:

Federal: species of concern (USDI Bureau of Land Management: Wyoming)

Washington: species of concern

Table 11.1. Sage Thrasher population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(282)*	ns *(98)*	ns *(255)*
Columbia Plateau	ns *(58)*	ns *(17)*	–1.4* *(55)*
Great Basin Desert	ns *(19)*	ns[b] *(3)*	ns *(18)*
Basin and Range	–1.4* *(44)*	ns *(18)*	–1.1* *(37)*
Wyoming Basin	ns *(51)*	ns *(21)*	ns *(45)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$).

References:

Knick, S., and J. Rotenberry. 1995. Landscape characteristics of fragmented shrubsteppe habitats and breeding passerine birds. Conservation Biology 9:1059–1071.

Paige, C., and S. Ritter. 1999. Birds in a sagebrush sea: managing sagebrush habitats for bird communities. Partners in Flight, Western Working Group. Boise, ID.

Reynolds, T. D., T. D. Rich, and D. A. Stephens. 1999. Sage Thrasher (*Oreoscoptes montanus*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 463. The Birds of North America, Inc., Philadelphia, PA.

Wiens, J. A, and J. T. Rotenberry. 1981. Habitat associations and community structure of birds in shrubsteppe environments. Ecological Monographs 51:21–42.

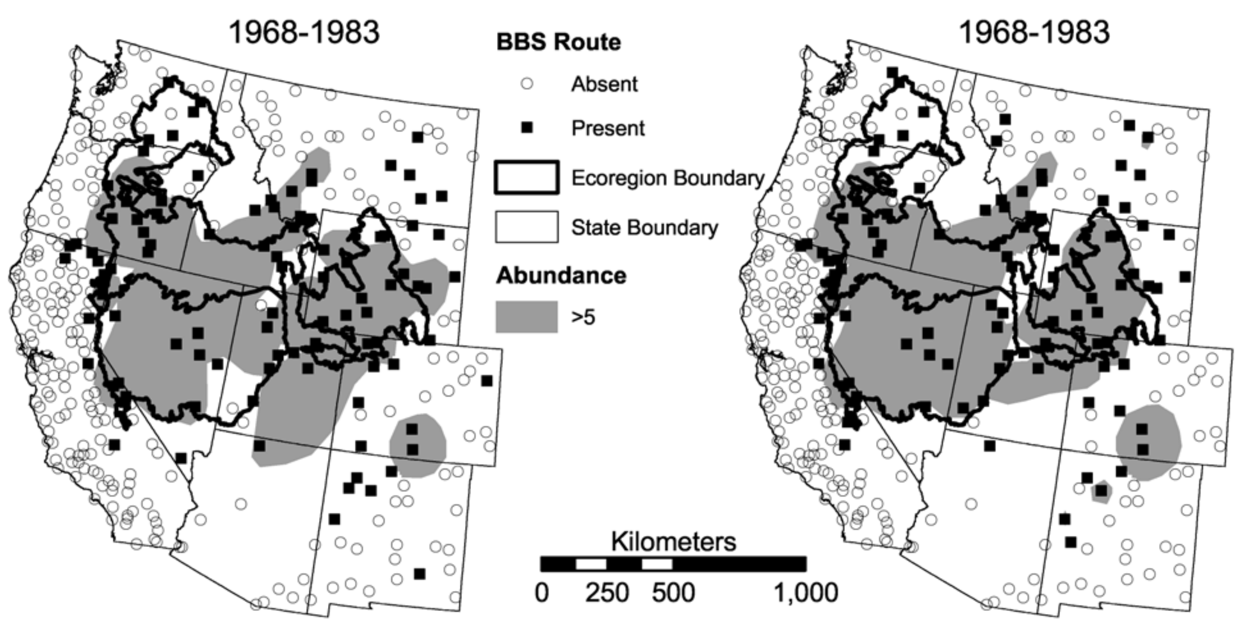

Figure 11.2. Sage Thrasher distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>5 birds detected) based on natural neighbor analyses of BBS routes.

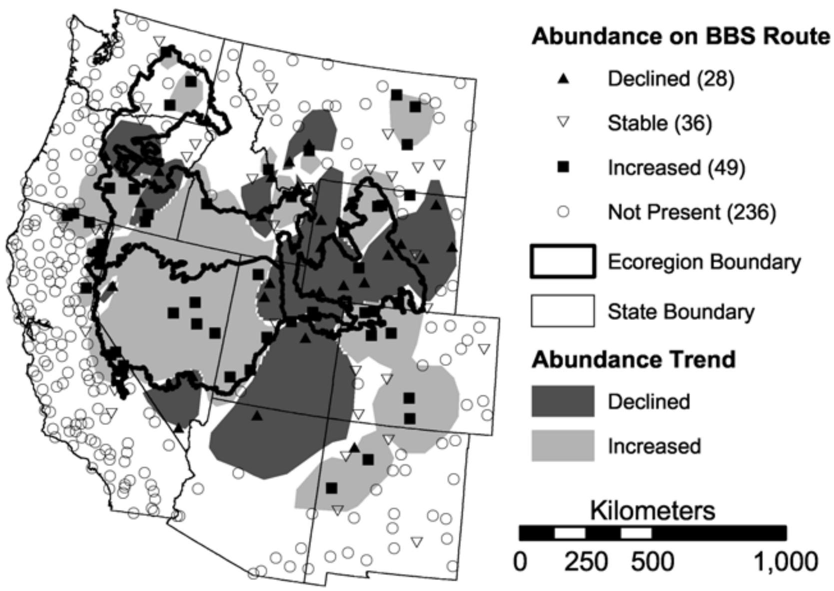

Figure 11.3. Direction of Sage Thrasher detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Virginia's Warbler
(*Vermivora virginiae*)

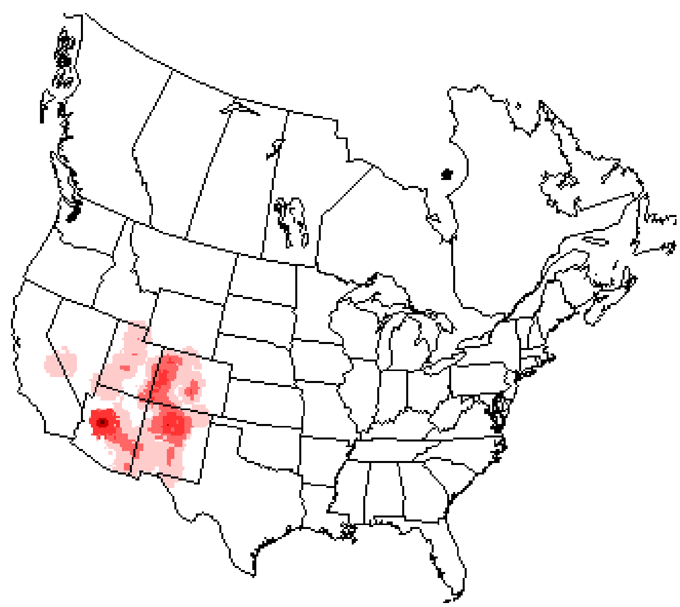

Figure 12.1. Virginia's Warbler distribution. Darker shading indicates greater abundance.

Current and Historical Distribution:

The current distribution of Virginia's Warblers (Fig. 12.1) is assumed to be generally similar to historical, but data are lacking. This species is patchily distributed, even in the heart of its distribution. It is often absent from apparently suitable habitat.

Habitat Requirements and Associations:

Virginia's Warblers are found primarily in pinyon/juniper and oak woodlands of the arid Southwest. They also occur locally in mountain mahogany, mixed conifers, and deciduous shrublands. Presence is strongly associated with steep draws and shrubby vegetation, but factors influencing abundance are essentially unknown.

BBS Data Analysis:

Standard BBS analyses suggest that Virginia's Warbler populations are stable. In the Western BBS region, no significant long or short-term trends are evident (Table 12.1). Data from the shrubsteppe physiographic provinces are largely nonexistent. Virginia's Warblers were detected too infrequently in the shrubsteppe ecoregions for any meaningful spatial analyses.

Population Impacts:

Factors influencing Virginia's Warbler populations are poorly known, as are most aspects of this species' biology. Habitat destruction and degradation, mainly via agricultural conversion, frequent fires, and livestock grazing, are probably the main influences on populations, but the extent is unknown. Virginia's Warblers may be confined to a narrow range of habitat conditions, and this may explain their fragmented distribution. Virginia's Warblers are cowbird hosts, but parasitism rates and effects on productivity are unknown.

State or Federal Status/Listing:

Federal: species of concern (U.S. Fish and Wildlife Service; USDI Bureau of Land Management: Idaho)

Table 12.1. Virginia's Warbler population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(15)*	ns *(77)*	ns *(81)*
Columbia Plateau	—	—	—
Great Basin Desert	—	—	—
Basin and Range	—	ns[b] *(5)*	ns[b] *(5)*
Wyoming Basin	—	—	—

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Reference:

Olson, C. R., and T. E. Martin. 1999. Virginia's Warbler (*Vermivora virginiae*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 477. The Birds of North America, Inc., Philadelphia, PA.

Green-tailed Towhee (*Pipilo chlorurus*)

Current and Historical Distribution:

The current distribution of Green-tailed Towhees is assumed to be generally similar to historical; no large-scale changes in distribution have been documented (Fig. 13.1).

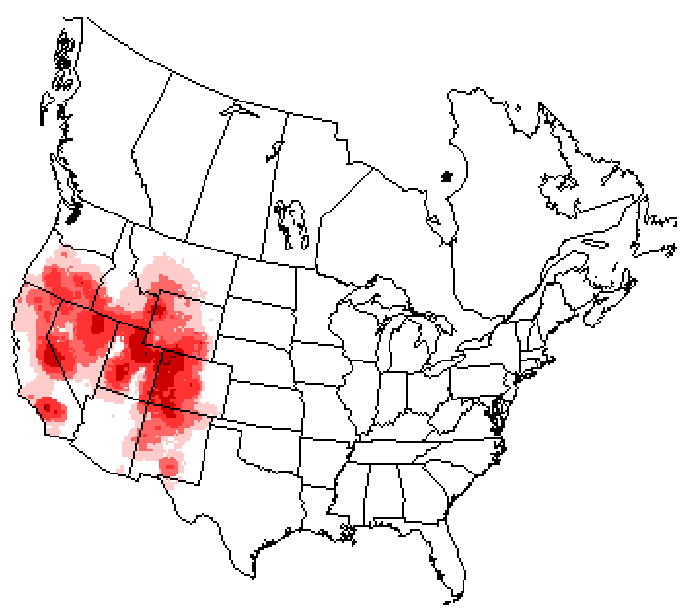

Figure 13.1. Green-tailed Towhee distribution. Darker shading indicates greater abundance.

Habitat Requirements and Associations:

Green-tailed Towhees inhabit mixed shrublands and disturbed coniferous or deciduous woodlands across the western United States. In shrubsteppe, presence and abundance are correlated positively with increased shrub species diversity, shrub cover, and taller shrubs. In other habitats, Green-tailed Towhees use mainly shrubby areas with sparse trees.

Table 13.1. Green-tailed Towhee population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	–4.0* *(90)*	ns *(268)*	ns *(290)*
Columbia Plateau	ns[b] *(3)*	ns *(16)*	ns *(16)*
Great Basin Desert	—	—	—
Basin and Range	ns *(11)*	ns *(25)*	ns *(30)*
Wyoming Basin	–32.0** *(11)*	ns *(24)*	ns *(30)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
*$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

BBS Data Analysis:

Standard BBS analyses suggest that Green-tailed Towhee populations are stable. No significant long-term trend was evident in any area. However, populations did decline significantly from 1968–1983 in the Western BBS region.

Our spatial analyses suggest that Green-tailed Towhee populations have increased. The area predicted to have potentially higher abundances (>1 bird detected per BBS route) increased by 6% in the western states and by 16% in shrubsteppe provinces (Fig. 13.2). Routes with increased abundances are located centrally within the distribution of Green-tailed Towhees (Fig. 13.3).

Population Impacts:

Habitat destruction and degradation are the primary influences on Green-tailed Towhee populations. Livestock grazing, agricultural development, and frequent fire have impacted shrub communities across the West. Loss or simplification of shrub cover results in population reduction or elimination. In areas of continuous forest, logging may be beneficial if shrubs are allowed to regenerate.

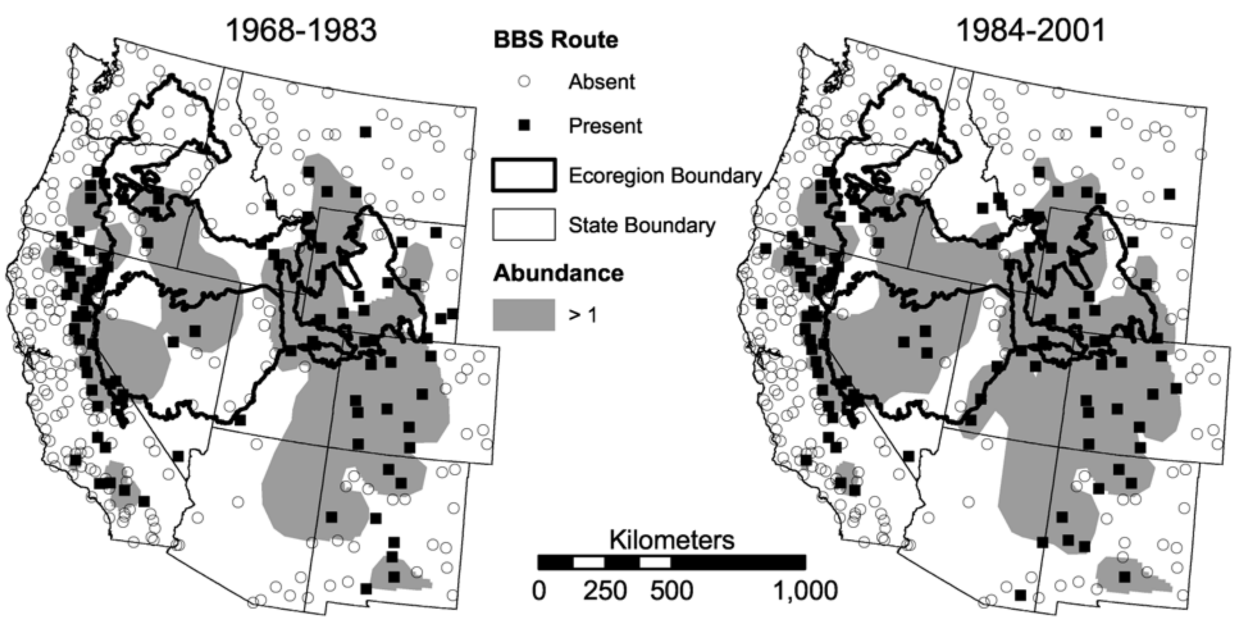

Figure 13.2. Green-tailed Towhee distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>1 bird detected) based on natural neighbor analyses of BBS

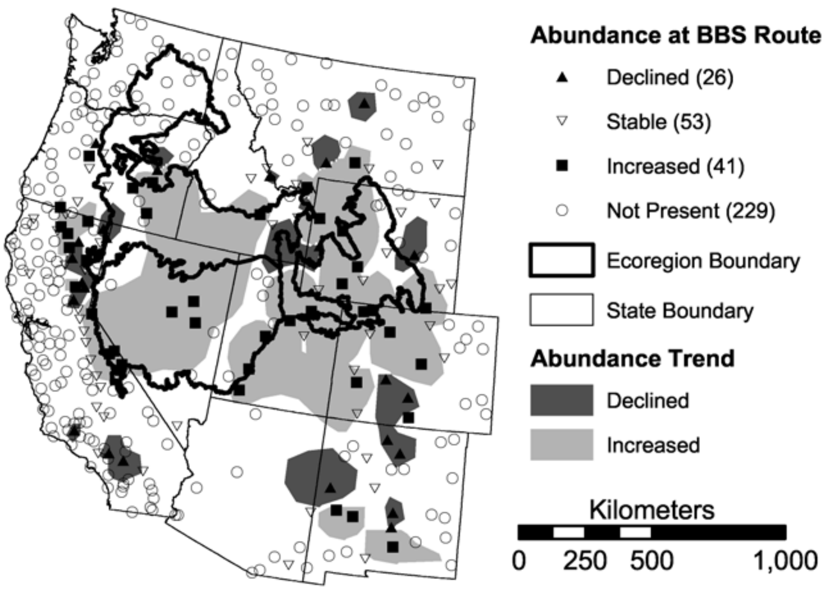

Figure 13.3. Direction of Green-tailed Towhee detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

State or Federal Status/Listing

Federal: species of concern (USDA Forest Service: Pacific Region)

References:

Dobbs, R. C., P. R. Martin, and T. E. Martin. 1998. Green-tailed Towhee (*Pipilo chlorurus*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 368. The Birds of North America, Inc., Philadelphia, PA.

Knopf, F. K., J. A. Sedgewick, and D. B. Inkley. 1990. Regional correspondence among shrubsteppe bird habitats. Condor 92:45–53.

Wiens, J., and J. Rotenberry. 1981. Habitat associations and community structure of birds in shrubsteppe environments. Ecological Monographs 51:21–42.

Chipping Sparrow
(*Spizella passerina*)

Regional Taxonomic Equivalents:

Spizella passerina arizonae

Current and Historical Distribution:

In the western United States, the current distribution of Chipping Sparrows is assumed to be generally similar to historical; no large-scale changes in distribution have been documented (Fig. 14.1). In the eastern U.S., Chipping Sparrows have expanded their range by occupying agricultural and urban landscapes.

Habitat Requirements and Associations:

Chipping Sparrows use a variety of habitats across their distribution, including open coniferous forests with grassy or shrubby understories, woodland edges, and ecotones of human-modified landscapes. Specific habitat characteristics that influence presence and abundance are poorly known.

BBS Data Analysis:

Standard BBS analyses suggest that Chipping Sparrow populations have declined (Table 14.1). In the Western BBS region, populations declined significantly over the long-term. Data from the shrubsteppe physiographic provinces are sparse, but the Wyoming Basin showed a significant long-term decline.

Our spatial analyses support the conclusion that Chipping Sparrow populations have declined. The area predicted to have higher abundances (>5 birds detected per BBS route) declined by 7% in the western states, but remained stable in the shrubsteppe ecoregions (Fig. 14.2). Routes with reduced abundances were clustered in the Northwest, Southwest, and California (Fig. 14.3).

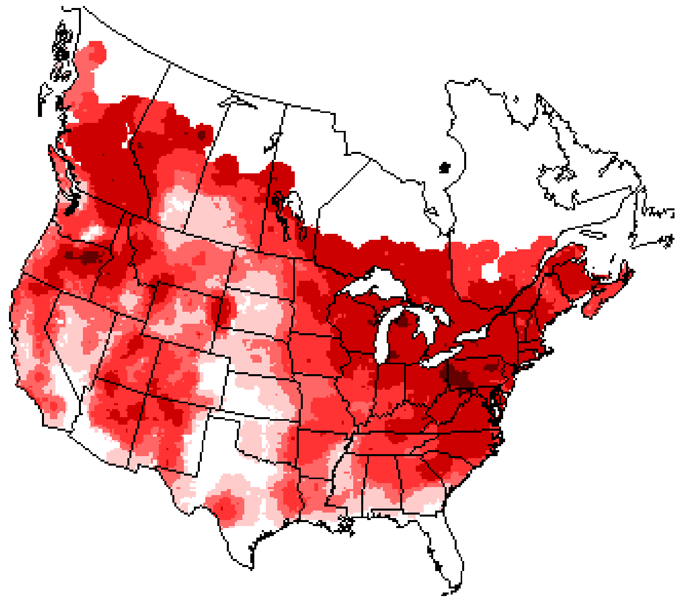

Figure 14.1. Chipping Sparrow distribution. Darker shading indicates greater abundance.

Table 14.1. Chipping Sparrow population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n[a])		
	1968–1983	1984–2001	1968–2001
Western BBS Region	–2.8*** *(335)*	ns *(683)*	–1.5** *(763)*
Columbia Plateau	13.6[b] *(9)*	ns *(18)*	ns *(20)*
Great Basin Desert	—	—	—
Basin and Range	–12.6*[b] *(8)*	ns *(26)*	ns *(29)*
Wyoming Basin	–11.9*[b] *(7)*	ns *(12)*	–8.1* *(16)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

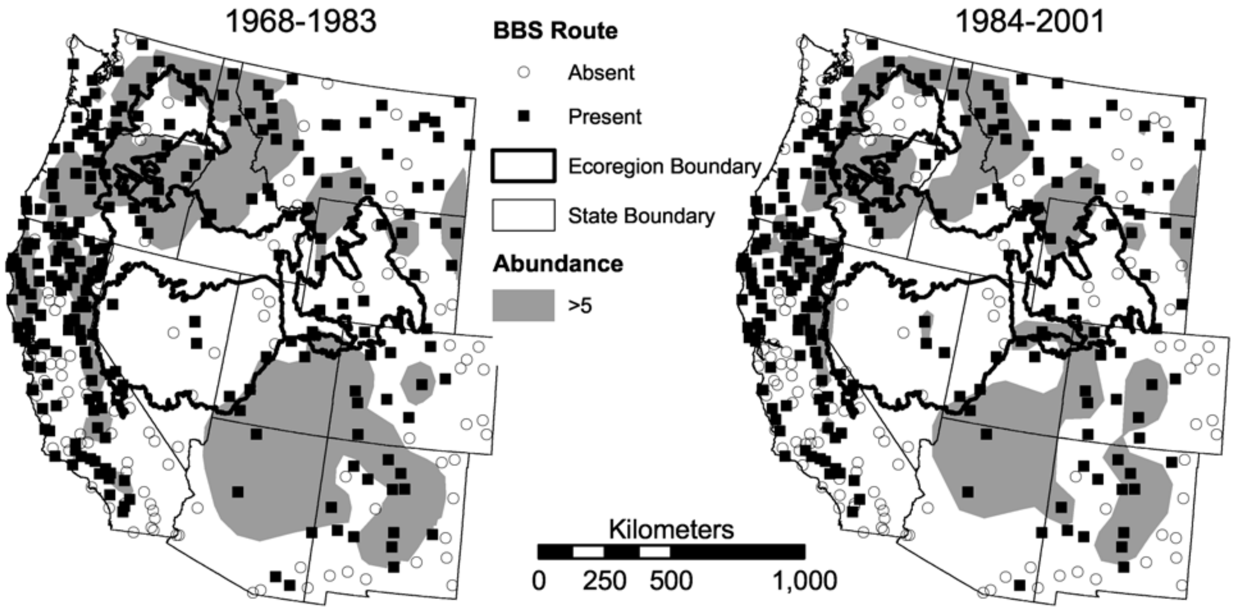

Figure 14.2. Chipping Sparrow distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>5 birds detected) based on natural neighbor analyses of BBS routes.

Population Impacts:

Although Chipping Sparrow populations are declining in the western U.S., eastern and central U.S. populations are stable or increasing (2.1% per year, $P < 0.001$), respectively. The basis for this dichotomy is unknown, and the factors underlying population declines in the West are unclear. Due to the considerable flexibility of habitat use demonstrated by Chipping Sparrows, habitat loss is not viewed as a primary concern for the species. Predation and nest parasitism are frequent sources of nest failure and abandonment, but their role in long-term population trends is not known.

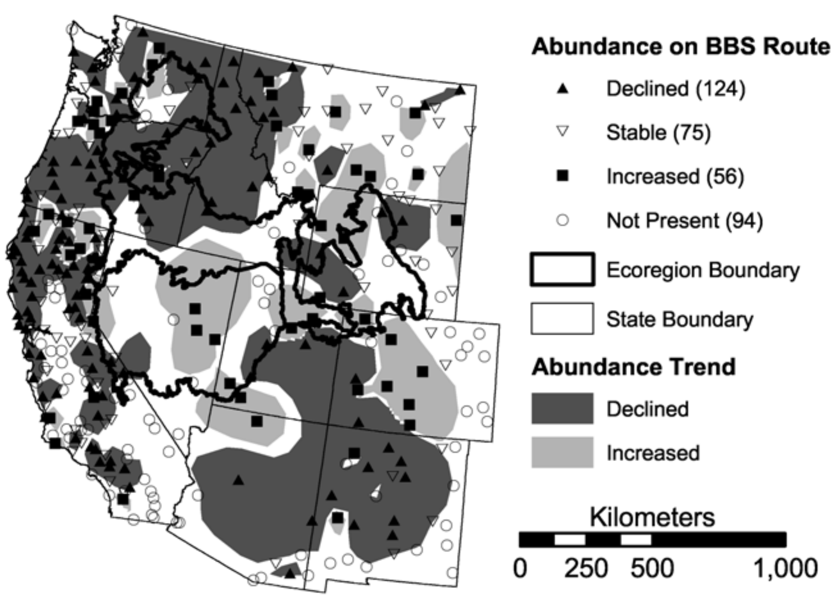

Figure 14.3. Direction of Chipping Sparrow detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

State or Federal Status/Listing:

Not listed by any federal or state agency in the region of interest.

Reference:

Middleton, A. L. 1998. Chipping Sparrow (*Spizella passerina*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 334. The Birds of North America, Inc., Philadelphia, PA.

Brewer's Sparrow
(*Spizella breweri*)

Regional Taxonomic Equivalents:

Spizella breweri breweri

Current and Historical Distribution:

The current distribution of Brewer's Sparrows (Fig. 15.1) is assumed to be similar to historical; no large-scale changes in range have been documented.

Habitat Requirements and Associations:

The Brewer's Sparrow is a shrubsteppe obligate species, closely associated with big sagebrush (Short 1984, Paige and Ritter 1999). It can also be found in shrubby openings of pinyon/juniper and mountain mahogany woodlands (Rotenberry et al. 1999). Presence and abundance of Brewer's Sparrows are correlated positively with total shrub cover, bare ground, taller shrubs, patch size, and habitat heterogeneity; they are negatively correlated with grass and salt shrub cover (Wiens and Rotenberry 1980, 1981).

BBS Data Analysis:

Standard BBS analyses suggest that Brewer's Sparrow populations have declined (Table 15.1). In the Western BBS region, Brewer's Sparrow populations declined significantly over the long term. In the shrubsteppe physiographic provinces, populations declined significantly

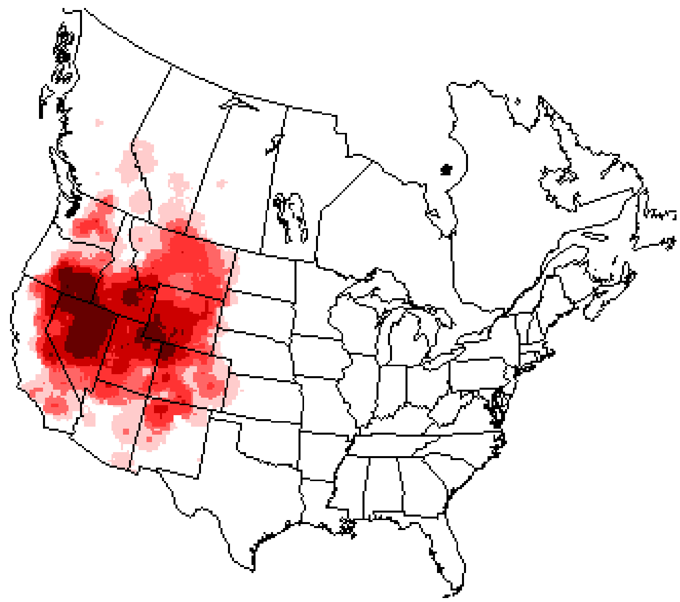

Figure 15.1. Brewer's Sparrow distribution. Darker shading indicates greater abundance.

Table 15.1. Brewer's Sparrow population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n[a])		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(132)*	ns *(357)*	–2.7*** *(383)*
Columbia Plateau	ns *(19)*	ns *(58)*	–3.5** *(62)*
Great Basin Desert	ns[b] *(7)*	ns *(21)*	ns *(23)*
Basin and Range	ns *(19)*	ns *(40)*	ns *(46)*
Wyoming Basin	ns *(20)*	2.6* *(44)*	ns *(49)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
*$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$; ns = not significant ($P > 0.10$).

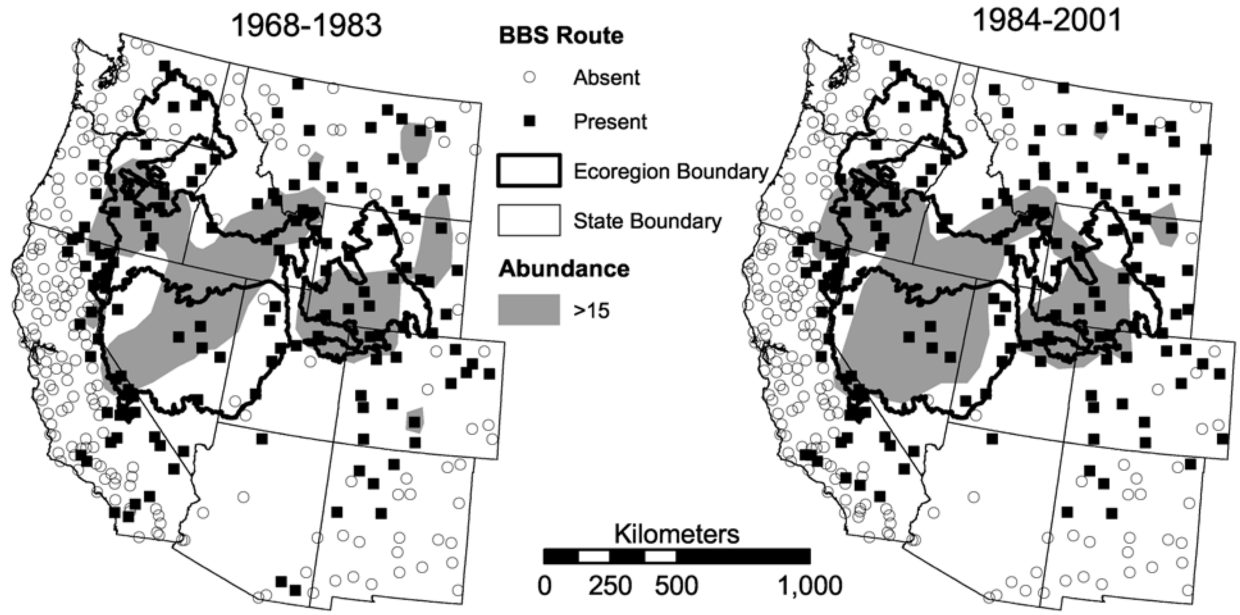

Figure 15.2. Brewer's Sparrow distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>15 birds detected) based on natural neighbor analyses of BBS

over the long term in the Columbia Plateau; populations in the Wyoming Basin, however, increased significantly during 1984–2001.

Our spatial analyses suggest that population trends are mixed. The area predicted to have higher Brewer's Sparrow abundances (>15 birds detected per BBS route) remained stable in the western states, and increased by 12% in the shrubsteppe ecoregions (Fig. 15.2). Many routes with reduced abundances were located at the periphery of Brewer's Sparrow distribution, in contrast to routes with increased abundance, many of which were located centrally (Fig. 15.3).

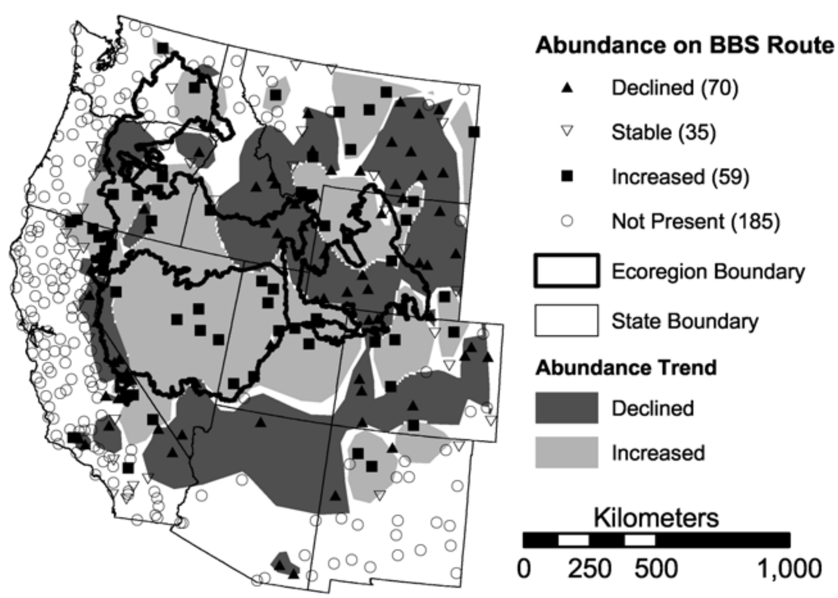

Figure 15.3. Direction of Brewer's Sparrow detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Population Impacts:

Habitat destruction and degradation are the primary threats to Brewer's Sparrow populations. Activities that destroy shrub cover (e.g. frequent fire, chaining, herbicides, agricultural conversion, etc.) negatively impact populations. Brewer's Sparrows show both negative and positive population responses to grazing, depending on habitat type and intensity. This species is a cowbird host and rates of parasitism are influenced by grazing and habitat fragmentation.

State or Federal Status/Listing:

Federal: species of concern (U.S. Fish and Wildlife Service; USDI Bureau of Land Management: Idaho and Wyoming)

References:

Paige, C., and S. Ritter. 1999. Birds in a sagebrush sea: managing sagebrush habitats for bird communities. Partners in Flight, Western Working Group. Boise, ID.

Rotenberry, J. T., M. A. Patten, and K. L. Preston. 1999. Brewer's Sparrow (*Spizella breweri*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 390. The Birds of North America, Inc., Philadelphia, PA.

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Wiens, J., and J. Rotenberry. 1981. Habitat associations and community structure of birds in shrubsteppe environments. Ecological Monographs 51:21–41.

Vesper Sparrow
(*Pooecetes gramineus*)

Regional Taxonomic Equivalents:

Pooecetes gramineus confinis, *Pooecetes gramineus altus*

Current and Historical Distribution:

The distribution of Vesper Sparrows in the western United States is generally assumed to be similar to historical; no large-scale changes in distribution have been documented (Fig. 16.1). In the eastern U.S., agricultural development facilitated range expansion into the early 1900s, but subsequent reforestation has reduced or eliminated many of these populations, and the species is now rare over much of its former eastern range.

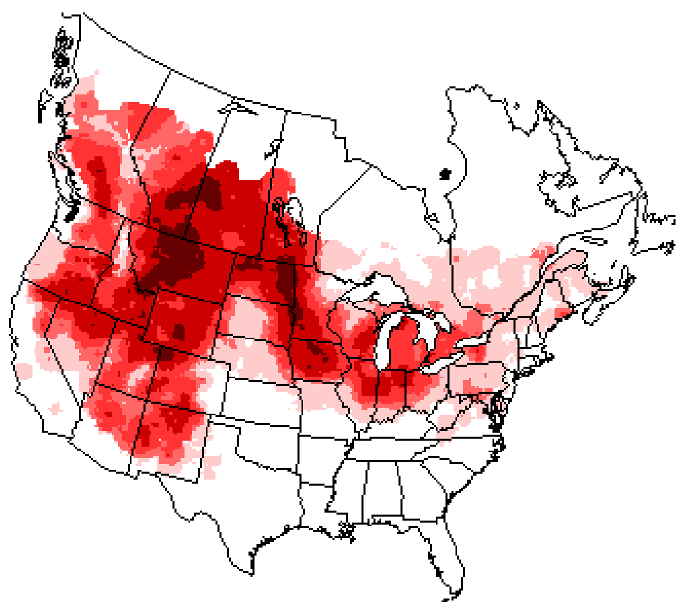


Figure 16.1. Vesper Sparrow distribution. Darker shading indicates greater abundance.

Habitat Requirements and Associations:

The Vesper Sparrow is a generalist grassland species that inhabits prairie, meadow, grassland, shrubsteppe, open woodland, and agricultural areas. Better habitat is characterized by short, patchy herbaceous vegetation, low shrub cover, bare ground, and broadleaved flowering plants (Dechant et al. 2001g). Vesper Sparrows typically avoid mesic areas or plant communities with tall, dense herbaceous vegetation.

BBS Data Analysis:

Standard BBS analyses suggest that Vesper Sparrow populations are stable (Table 16.1). No significant long-term population trends are evident in either the Western BBS region or the shrubsteppe physiographic provinces. Populations in the Wyoming Basin declined significantly over 1968–1983, but increased significantly (although at a much slower rate) over 1984–2001.

Our spatial analyses indicate that Vesper Sparrow populations have increased. The area predicted to have higher abundances (>5 birds detected per BBS route) expanded by 9% in the western states and by 17% in the shrubsteppe ecoregions (Fig. 16.2). The spatial arrangement of route abundance trends is patchy, showing no coherent regional trends (Fig. 16.3).

Table 16.1. Vesper Sparrow population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(214)*	ns *(539)*	ns *(590)*
Columbia Plateau	ns *(17)*	ns *(56)*	ns *(58)*
Great Basin Desert	—	ns[b] *(2)*	ns[b] *(3)*
Basin and Range	22.8** *(11)*	ns *(30)*	ns *(34)*
Wyoming Basin	–7.9*** *(20)*	3.3*** *(43)*	ns *(49)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
*$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Population Impacts:

Habitat destruction and degradation are the primary threats to Vesper Sparrow populations in the Intermountain West. Extensive areas of native shrubsteppe have been converted to agricultural lands. Even though Vesper Sparrows frequently use these areas, high rates of

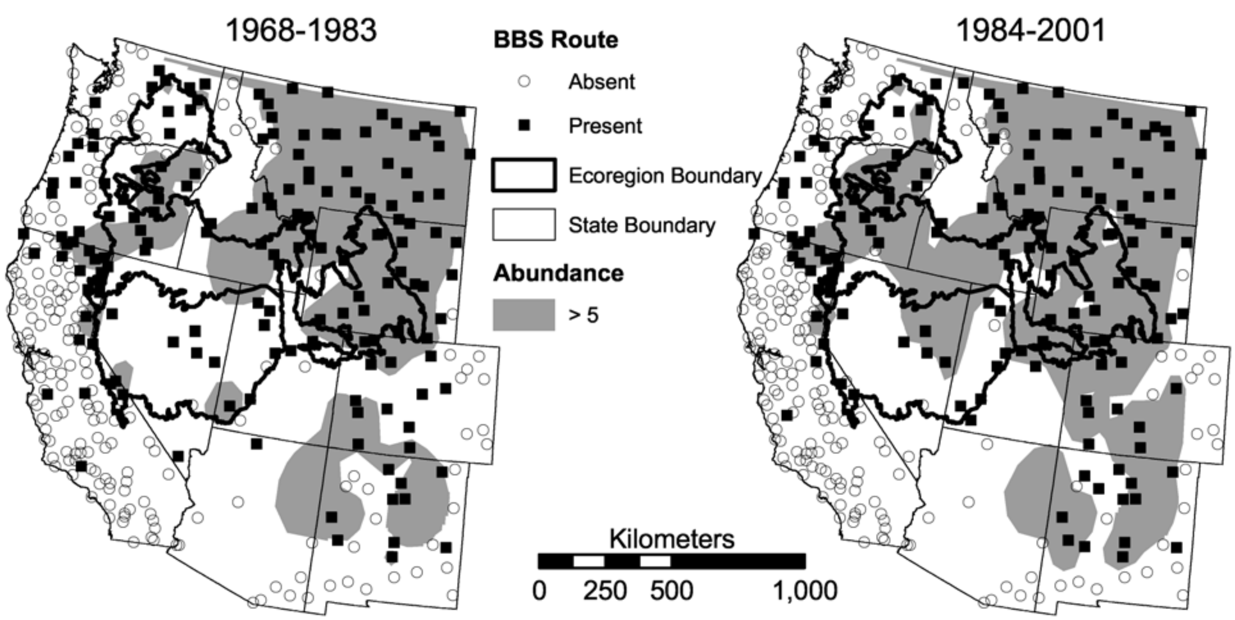


Figure 16.2. Vesper Sparrow distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>5 birds detected) based on natural neighbor analyses of BBS routes.

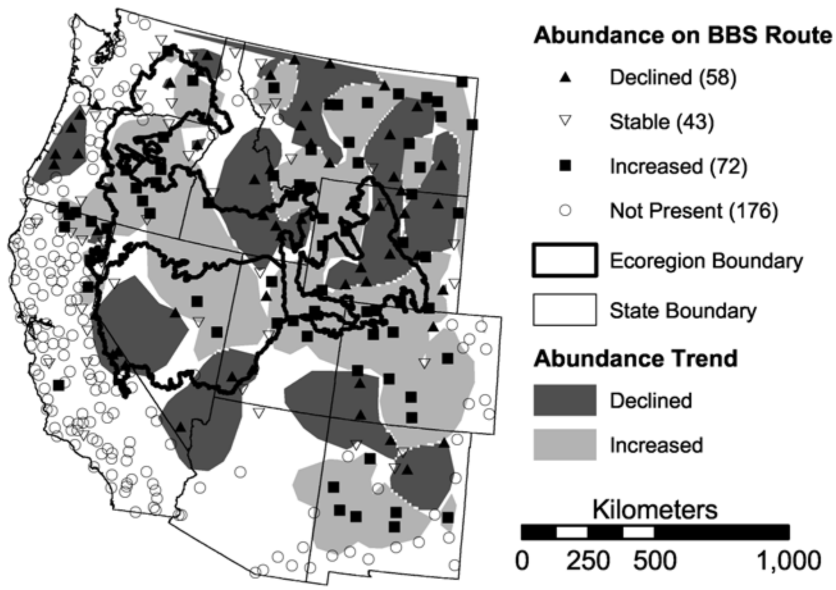


Figure 16.3. Direction of Vesper Sparrow detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

nest failure due to farming can render them population sinks. Frequent fires, in conjunction with invasive grasses, have created grasslands dominated by exotic annuals in place of native perennial grasses. Heavy livestock grazing has increased shrub cover and negatively impacted populations. During periods of drought, poor range conditions created by livestock grazing increase rates of nest abandonment and failure. Vesper Sparrows are frequent cowbird hosts; rates of parasitism are correlated with habitat fragmentation and edge proximity.

State or Federal Status/Listing:

Federal: species of concern (USDI Bureau of Land Management: Nevada)

Oregon: *Pooecetes gramineus affinis*, which occurs only outside the region of interest, is a species of concern.

References:

Dechant, J. A., M. F. Dinkins, D. H. Johnson, L. D. Igl, C. M. Goldade, and B. R. Euliss. 2001g. Effects of management practices on grassland birds: Vesper Sparrow (revised version). U.S. Geological Survey, Northern Prairie Wildlife Research Center. Jamestown, ND.

Jones, S. L., and J. E. Cornely. 2002. Vesper Sparrow (*Pooecetes gramineus*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 624. The Birds of North America, Inc., Philadelphia, PA.

Lark Sparrow
(*Chondestes grammacus*)

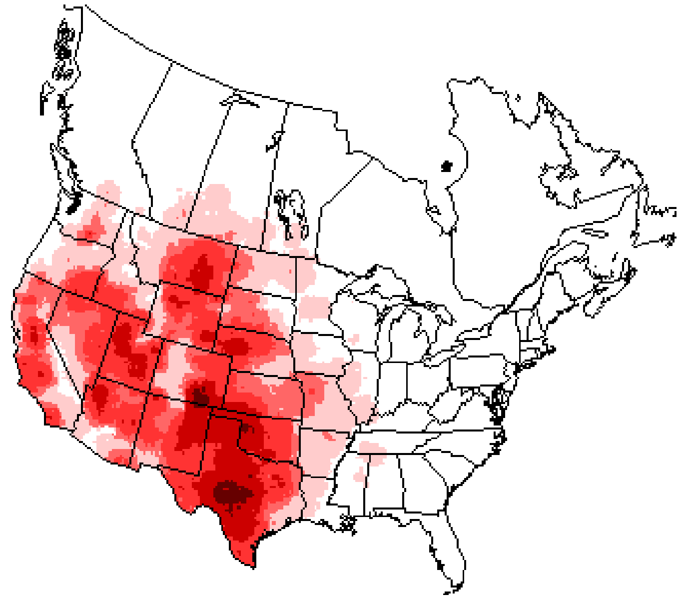


Figure 17.1. Lark Sparrow distribution. Darker shading indicates greater abundance.

Regional Taxonomic Equivalents:

Chondestes grammacus strigatus

Current and Historical Distribution:

From the 1800s through the early 1900s, Lark Sparrow distribution in the central and eastern United States expanded dramatically as forests were converted to agricultural lands. Since the mid-1900s, this trend has reversed and accelerated as agricultural lands have been allowed to go fallow and return to deciduous forest. In the West, the current distribution of Lark Sparrows is assumed to be similar to historic; no large-scale changes in distribution have been documented (Fig. 17.1).

Habitat Requirements and Associations:

Lark Sparrows are found in a variety of open habitats and ecotones, including grasslands, shrubsteppe, and open woodlands. They prefer areas with sparse to moderate shrub cover, abundant bare ground, and patches of moderate to heavy herbaceous cover. Woodland–shrubland or woodland–grassland ecotonal areas are used if the tree cover is low to moderate.

BBS Data Analysis:

Standard BBS analyses suggest that Lark Sparrow populations have declined (Table 17.1). In the Western BBS region, populations declined during 1984–2001. In the shrubsteppe physiographic provinces, no population trends were evident.

Table 17.1. Lark Sparrow population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(186)*	–2.3*** *(399)*	ns *(463)*
Columbia Plateau	ns *(17)*	ns *(53)*	ns *(57)*
Great Basin Desert	—	ns *(13)*	ns *(14)*
Basin and Range	ns[b] *(7)*	ns *(27)*	ns *(30)*
Wyoming Basin	ns *(11)*	ns *(25)*	ns *(32)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Our spatial analyses of BBS data seem at odds with these trends. The area predicted to have higher abundances (>5 birds detected per BBS route) increased by 12% in western states and by 16% in the shrubsteppe ecoregions (Fig. 17.2). Routes where Lark Sparrow abundances declined were grouped in California and the western Columbia Plateau ecoregion. Routes

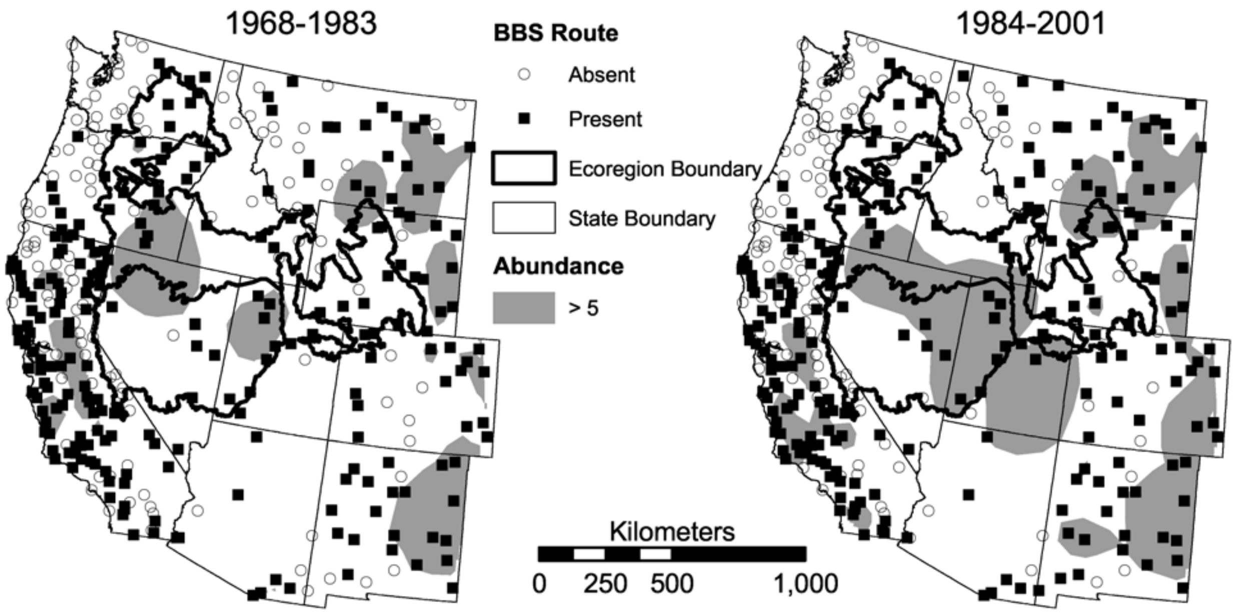


Figure 17.2. Lark Sparrow distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>5 birds detected) based on natural neighbor analyses of BBS routes

with increased detections comprised much of the central and eastern portion of the Western BBS region (Fig. 17.3).

POPULATION IMPACTS:

Lark Sparrow ecology is surprisingly little studied, and influences on populations are not well known. Agricultural development has converted large areas of native shrubsteppe to farmlands, which are mostly unsuitable for Lark Sparrows. Fire (both too frequent and too infrequent) and livestock grazing have converted large areas of shrubsteppe to monocultures of exotic annual grasses or to pure sagebrush

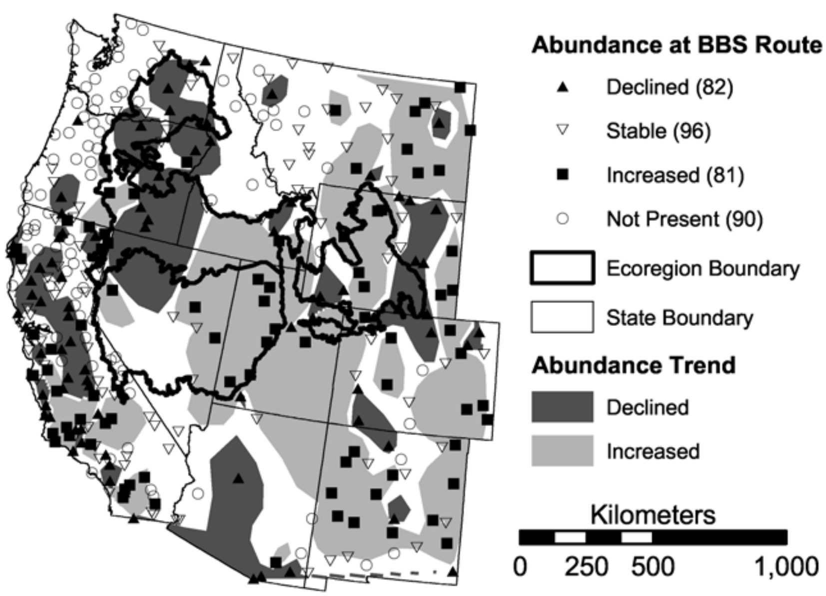


Figure 17.3. Direction of Lark Sparrow detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

stands, both of which Lark Sparrows generally avoid.

STATE OR FEDERAL STATUS/LISTING:

Not listed by and federal or state agencies in the region of interest.

REFERENCES:

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, B. D. Parkin, and B. R. Euliss. 2001d. Effects of management practices on grassland birds: Lark Sparrow (revised version). U.S. Geological Survey, Northern Prairie Wildlife Research Center. Jamestown, ND.

Martin, J. W., and J. R. Parrish. 2000. Lark Sparrow (*Chondestes grammacus*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 488. The Birds of North America, Inc., Philadelphia, PA.

Black-throated Sparrow (*Amphispiza bilineata*)

REGIONAL TAXONOMIC EQUIVALENTS:

Amphispiza bilineata deserticola

CURRENT AND HISTORICAL DISTRIBUTION:

The Black-throated Sparrow is found throughout the arid Intermountain West and southwestern United States (Fig. 18.1). Current distribution is assumed to be similar to historical; no large-scale changes in distribution have been documented.

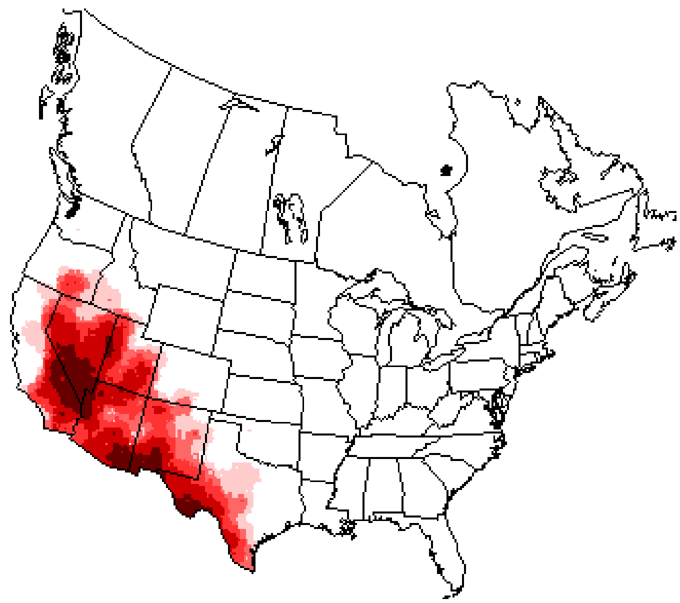


Figure 18.1. Black-throated Sparrow distribution. Darker shading indicates greater abundance.

HABITAT REQUIREMENTS AND ASSOCIATIONS:

The Black-throated Sparrow is not closely associated with any specific habitat type, but is found in a variety of arid shrub communities, particularly desert shrub, shrubsteppe, mesquite, and open pinyon/juniper woodlands. Presence and abundance of Black-throated Sparrows are correlated with moderate shrub cover, tall vegetation, shrub species richness, and dead woody cover.

BBS DATA ANALYSIS:

Standard BBS analyses suggest that Black-throated Sparrow populations have declined (Table 18.1). In the Western BBS region, populations declined significantly over the long-term and the years 1984–2001. The only reliable population trends from shrubsteppe provinces were from the Columbia Plateau, where populations declined significantly.

Our spatial analyses suggest that Black-throated Sparrow populations have expanded. The area predicted to have higher abundances (>5 birds detected per BBS route) increased by 6% in the western states and by 18% in the shrubsteppe ecoregions (Fig. 18.2). Abundance patterns were mixed, with routes in the northern portions of the species range showing increased abundances (Fig. 18.3).

Population Impacts:

Black-throated Sparrows are thought to be particularly sensitive to urbanization. Conversion of native habitats to urban or agricultural areas has negatively affected local Black-throated Sparrow populations, although the extent is unknown. Data on the impacts of livestock grazing are few and those available indicate mixed effects. Levels of nest predation and parasitism of Black-Throated Sparrows are poorly known. Drought reduces the number of breeding attempts and clutch sizes.

State or Federal Status/Listing:

Federal: species of concern (USDI Bureau of Land Management: Idaho)

Oregon: species of concern

References:

Johnson, M. J., C. van Riper III, and K. M. Pearson. 2002. Black-throated Sparrow (*Amphispiza bilineata*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 637. The Birds of North America, Inc., Philadelphia, PA.

Paige, C., and S. Ritter. 1999. Birds in a sagebrush sea: managing sagebrush habitats for bird communities. Partners in Flight, Western Working Group. Boise, ID.

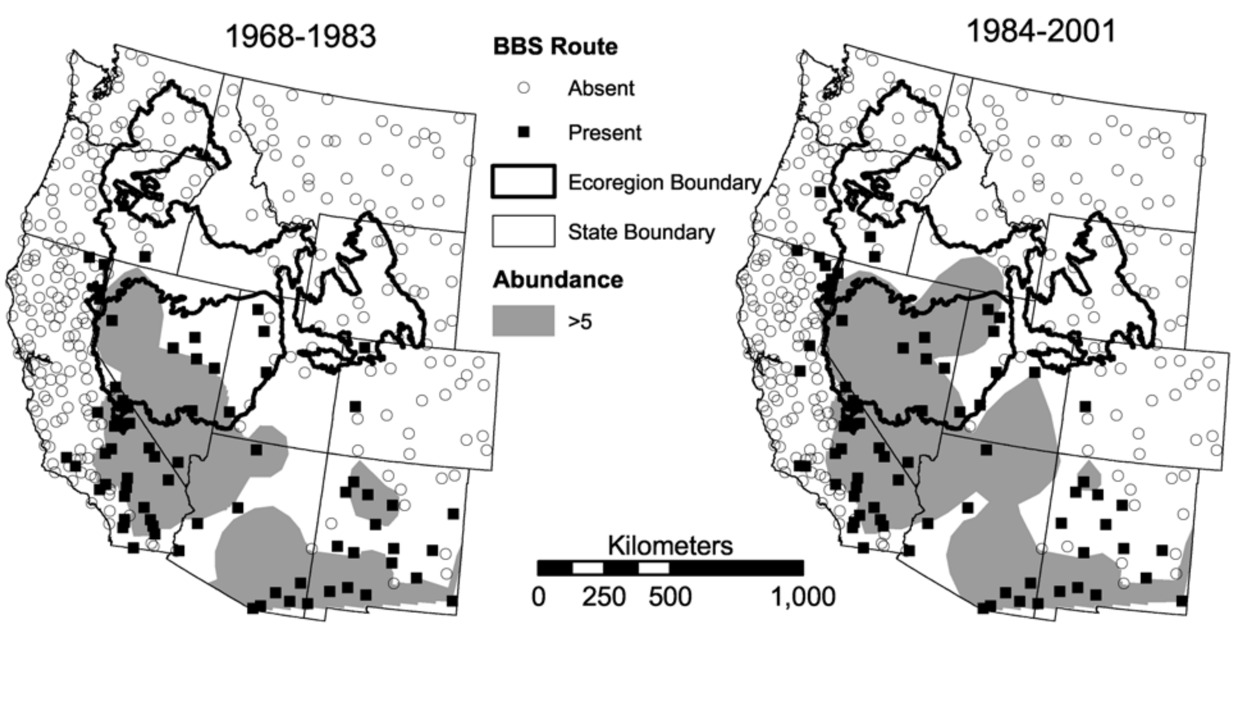
Weins, J., and J. Rotenberry. 1981. Habitat associations and community structure of birds in shrubsteppe environments. Ecological Monographs 51:21–41.

Table 18.1. Black-throated Sparrow population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns	–2.8***	–1.9**
	(100)	*(225)*	*(258)*
Columbia Plateau	–1.8*[b]	–18.7**	–12.1*
	(4)	*(16)*	*(17)*
Great Basin Desert	10.3	ns	ns
	(14)	*(24)*	*(29)*
Basin and Range	50.8*[b]	ns	ns
	(10)	*(26)*	*(30)*
Wyoming Basin	—	—	—

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Figure 18.2. Black-throated Sparrow distribution on BBS routes, 1968–1983 and 1984–2001. Shading represents potential locations of higher abundance (>5 birds detected) based on natural neighbor analyses of BBS routes.



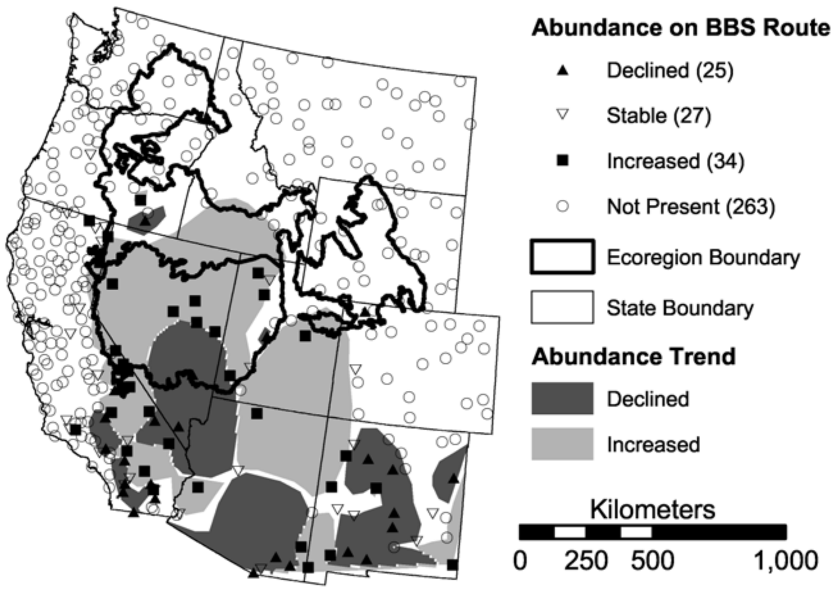


Figure 18.3. Direction of Black-throated Sparrow detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Sage Sparrow (*Amphispiza belli*)

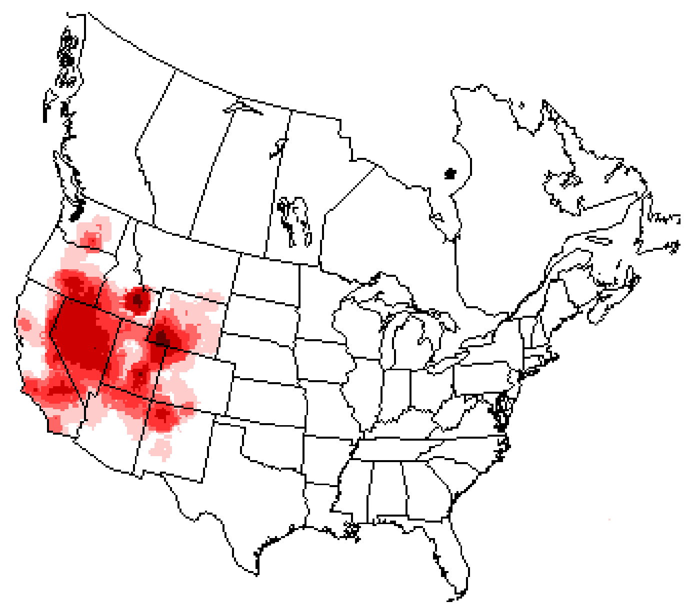


Figure 19.1. Sage Sparrow distribution. Darker shading indicates greater abundance.

Regional Taxonomic Equivalents:

Amphispiza belli nevadensis

Current and Historical Distribution:

The current distribution of Sage Sparrows (Fig. 19.1) is assumed to be generally similar to historical; no large-scale changes in distribution have been documented.

Habitat Requirements and Associations:

The Sage Sparrow is an obligate of shrub-steppe landscapes of the western United States. It is particularly associated with big sagebrush, although it also may be found in many mixed shrub communities. Presence and abundance commonly are correlated with greater shrub cover, abundant bare ground, and sparse grass cover (Knick and Rotenberry 1995). High site fidelity in concert with habitat fragmentation may confound species presence or absence in many locations.

BBS Data Analysis:

Standard BBS analyses suggest that Sage Sparrow populations are stable (Table 19.1).

Over the long term, no significant population trends were apparent. In 1984–2001, however, populations increased significantly in the Western BBS region, and in the Great Basin and Basin and Range physiographic provinces.

Our spatial analyses suggest that Sage Sparrow populations are experiencing moderate declines. The area predicted to have higher abundances (>5 birds detected per BBS route) remained stable in the western states but declined by 9% in the shrubsteppe ecoregions (Fig. 19.2). BBS routes centrally located within the shrubsteppe ecoregions showed reduced abundances, while routes located peripherally showed no changes (Fig. 19.3).

Table 19.1. Sage Sparrow population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	–4.5* *(84)*	3.0** *(176)*	ns *(215)*
Columbia Plateau	ns *(13)*	ns *(33)*	ns *(38)*
Great Basin Desert	ns[b] *(8)*	3.7** *(14)*	ns *(18)*
Basin and Range	ns *(13)*	3.6** *(25)*	ns *(30)*
Wyoming Basin	ns *(13)*	ns *(23)*	ns *(29)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$).

Population Impacts:

Habitat destruction, degradation, and fragmentation are the chief threats to Sage Sparrow populations. Agricultural conversion, frequent fire, livestock grazing, and range "improvements" (e.g. shrub treatments, exotic grass plantings, etc.) all negatively influence Sage Sparrow populations. Additionally, these factors frequently promote other impacts, such as predation and nest parasitism.

State or Federal Status/Listing:

Federal: threatened (applies to *A. b. clementeae* only; this subspecies occurs only outside

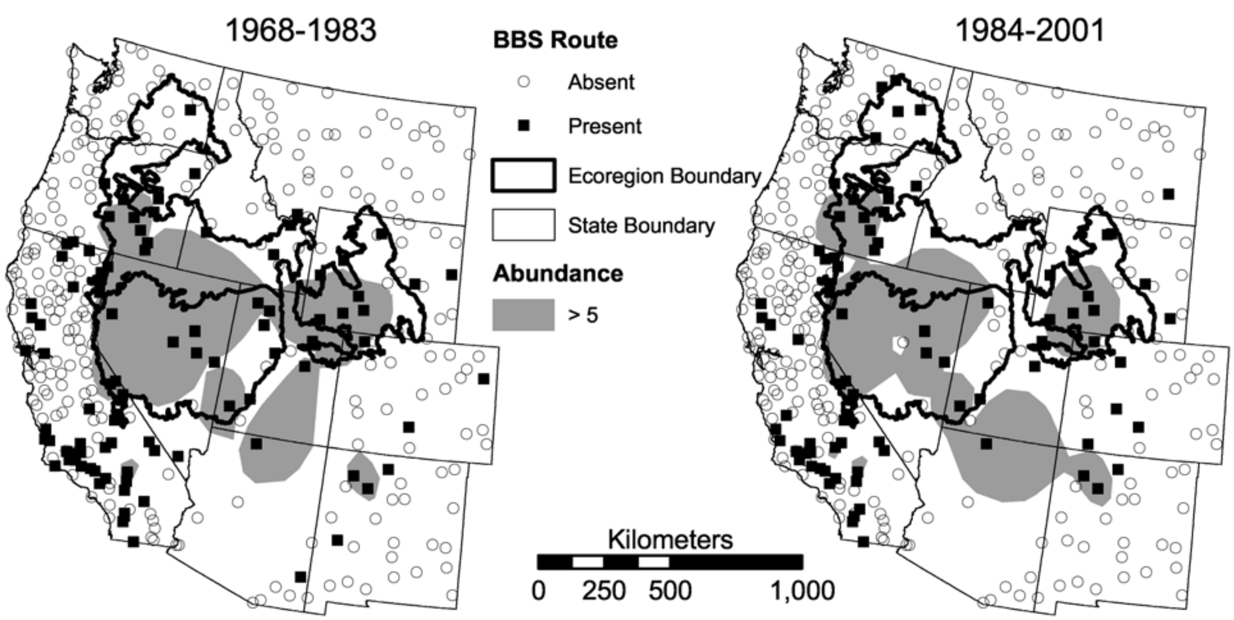


Figure 19.2. Sage Sparrow distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>5 birds detected) based on natural neighbor analyses of BBS routes.

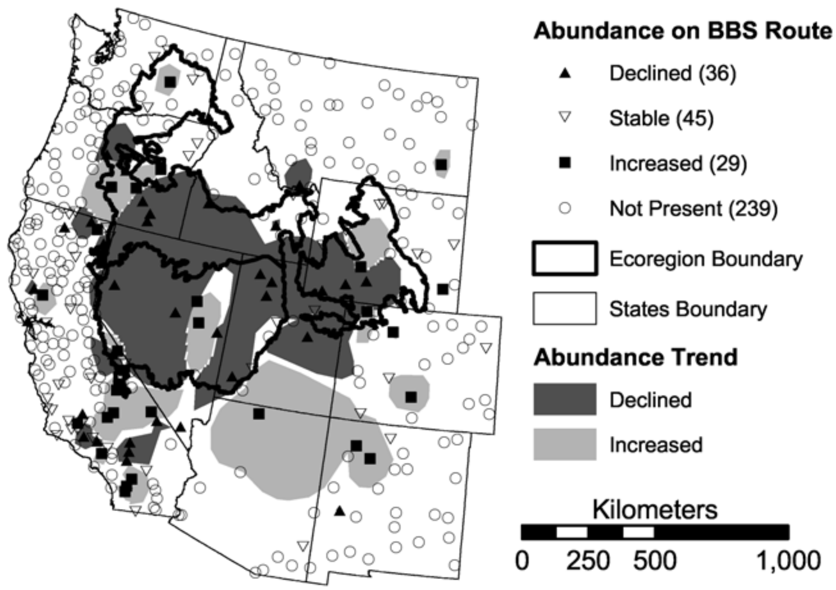


Figure 19.3. Direction of Sage Sparrow detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

the region of interest); species of concern (U.S. Fish and Wildlife Service; USDI Bureau of Land Management: Idaho, Oregon, and Wyoming)

Oregon: species of concern

Washington: species of concern

References:

Knick, S., and J. Rotenberry. 1995. Landscape characteristics of fragmented shrubsteppe habitats and breeding passerine birds. Conservation Biology 9:1059–1071.

Martin, J. W., and B. Carlson. 1998. Sage Sparrow (*Amphispiza belli*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 326. The Birds of North America, Inc., Philadelphia, PA.

Paige, C., and S. Ritter. 1999. Birds in a sagebrush sea: managing sagebrush habitats for bird communities. Partners in Flight, Western Working Group. Boise, ID.

Savannah Sparrow
(*Passerculus sandwichensis*)

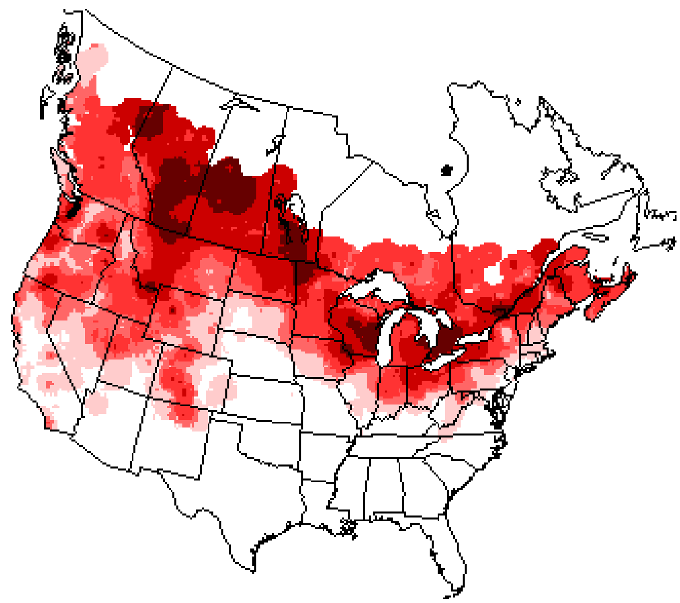


Figure 20.1. Savannah Sparrow distribution. Darker shading indicates greater abundance.

Regional Taxonomic Equivalents:

Passerculus sandwichensis nevadensis

Current and Historical Distribution:

Across the western United States, the distribution of Savannah Sparrows is assumed generally to be similar to historical (Fig. 20.1). In the eastern U.S., some insular populations and subspecies that use specialized habitats have varied in distribution.

Habitat Requirements and Associations:

Savannah Sparrows inhabit native grasslands, cultivated fields, roadsides, saltmarshes, and other grassy habitats. They prefer areas with short to intermediate vegetation heights and moderate cover. Presence and abundance are correlated with reduced shrub cover and increased leaf litter, grass, and broadleaved flowering plant cover. Densities generally decline as grasslands are invaded by shrubs.

BBS Data Analysis:

Standard BBS analyses suggest that Savannah Sparrow populations are stable (Table 20.1). In the Western BBS region, no long-term trends were evident, even though populations increased significantly during 1968–1983. Of the shrubsteppe physiographic provinces, only populations in the Wyoming Basin exhibited a significant trend, which was positive for 1984–2001.

Our spatial analyses suggest that Savannah Sparrow populations are slightly increasing. The area predicted to have higher abundances (>5 birds detected per BBS route) increased by 7% for both the western states and the shrubsteppe ecoregions (Fig. 20.2). Routes with increased Savannah Sparrow abundances were numerous and widespread (Fig. 20.3).

Table 20.1. Savannah Sparrow population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (*n*[a])		
	1968–1983	1984–2001	1968–2001
Western BBS Region	1.7* *(206)*	ns *(502)*	ns *(552)*
Columbia Plateau	ns *(15)*	ns *(56)*	ns *(61)*
Great Basin Desert	—	ns[b] *(5)*	ns[b] *(6)*
Basin and Range	—	ns *(17)*	ns *(19)*
Wyoming Basin	ns[b] *(8)*	9.0* *(26)*	ns *(33)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
*$P \le 0.05$; **$P \le 0.01$; ***$P \le 0.001$; ns = not significant ($P > 0.10$); — = no data.

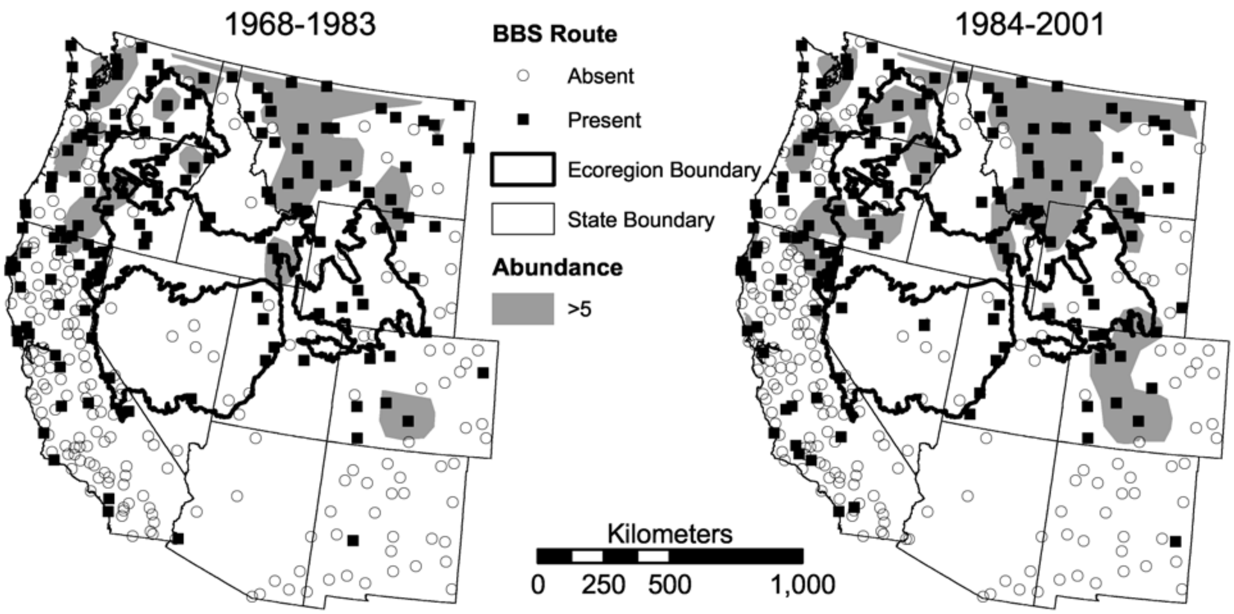


Figure 20.2. Savannah Sparrow distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>5 birds detected) based on natural neighbor analyses of BBS

Population Impacts:

In the Intermountain West, Savannah Sparrow populations respond negatively to livestock grazing (Knopf 1994). Fires, which negatively impact populations in the short term, are beneficial over the longer term. Habitat fragmentation reduces abundances and individuals may avoid grassland fragments smaller than 10 ha. It is assumed that Savannah Sparrow populations have benefited from the conversion of forests or shrublands to agricultural fields and grasslands because they readily nest there. Research suggests, however, that these new habitats may not

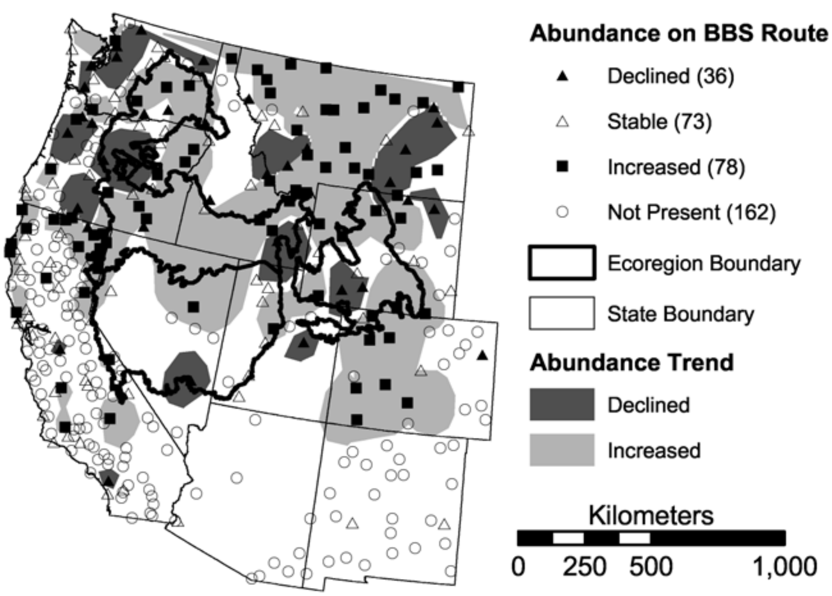


Figure 20.3. Direction of Savannah Sparrow detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

be equivalent to native grassland habitats and can function as population sinks. The effect of exotic annual grasses on Savannah Sparrow populations is not known, but is likely to be negative as the species favors denser cover than that provided by invasive annual grasses.

State or Federal Status/Listing:

Not listed by and federal or state agencies within the region of interest.

References:

Knopf, F. L. 1994. Avian assemblages in altered grasslands, p. 247–257. *In* J. R. Jehl and N. K. Johnson [eds.], A century of avifaunal change in North America. Studies in Avian Biology 15.

Swanson, D. 2001. Effects of management practices on grassland birds: Savannah Sparrow (revised version). U.S. Geological Survey, Northern Prairie Wildlife Research Center. Jamestown, ND.

Wheelwright, N. T., and J. Rising. 1993. Savannah Sparrow (*Passerculus sandwichensis*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 45. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Grasshopper Sparrow (*Ammodramus savannarum*)

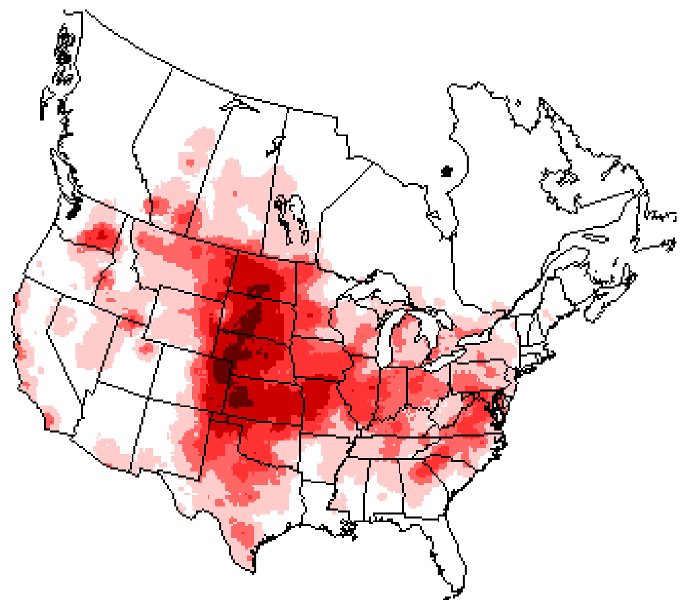


Figure 21.1. Grasshopper Sparrow distribution. Darker shading indicates greater abundance.

Regional Taxonomic Equivalents:

Ammodramus savannarum pepallidus

Current and Historical Distribution:

In the western United States, the distribution of Grasshopper Sparrows (Fig. 21.1) is assumed to be generally similar to historical. Populations in the central and eastern U.S. have declined significantly, and the species' distribution has shifted somewhat. The best-documented changes in distribution are in New England and Florida, where some populations have been eliminated.

Habitat Requirements and Associations:

The Grasshopper Sparrow is widely distributed in grasslands. Habitat preferences vary across its distribution, but presence and abundance are generally correlated positively with grass cover, leaf litter abundance, and homogenous habitat. Negative correlates include increasing bare ground, shrub diversity, and shrub cover.

BBS Data Analysis:

Standard BBS analyses suggest that Grasshopper Sparrow populations have declined catastrophically (Table 21.1). In the Western BBS region, populations declined significantly over both the long term and during 1984–2001. Data from the shrubsteppe physiographic provinces were largely unreliable because of small sample sizes. However, Columbia Plateau populations declined significantly over the same periods.

Our spatial analyses suggest that Grasshopper Sparrow populations are relatively stable but very sparse. The area predicted to have higher abundances (>1 bird detected per BBS region) remained stable in both the western states and shrubsteppe ecoregions (Fig. 21.2). Routes showing increased and decreased Grasshopper Sparrow abundances were disjunct, but most of the areas indicating increased abundances were along the northern and eastern portion of the western BBS region (Fig. 21.3), which is along the periphery of the Grasshopper Sparrow's core region of greatest abundance (Fig. 21.1).

Table 21.1. Grasshopper Sparrow population trends (% change per year) as calculated by standard BBS analysis.

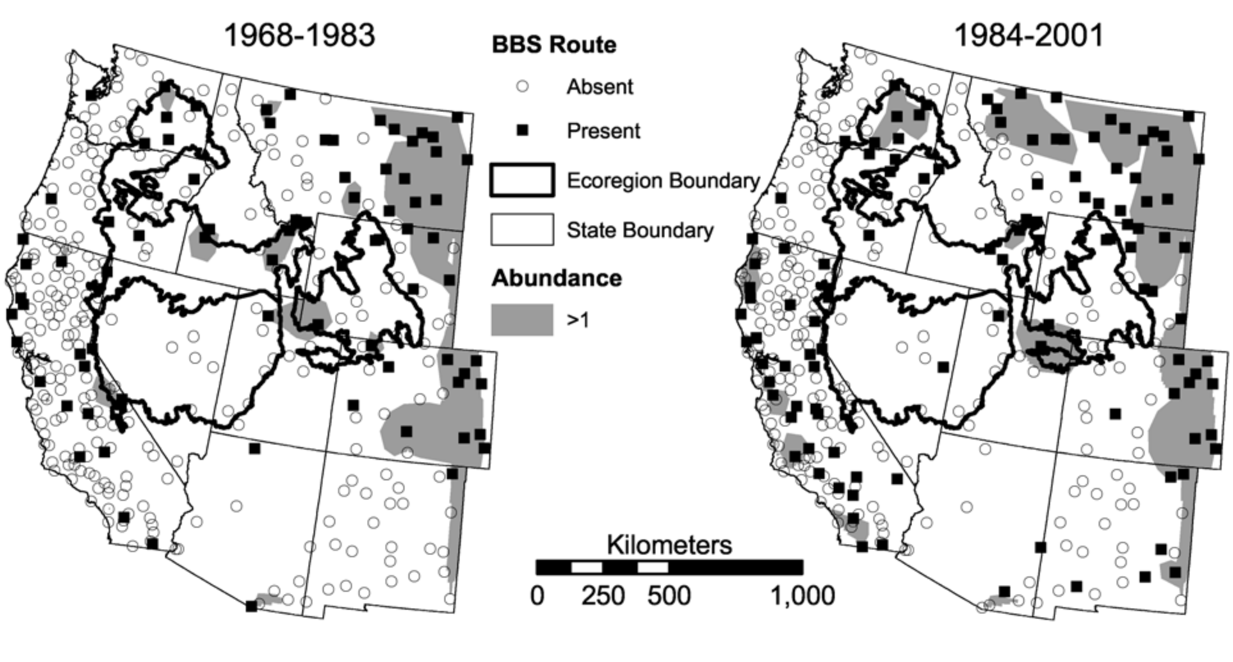
	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(47)*	–12.1** *(118)*	–5.9*** *(144)*
Columbia Plateau	ns[b] *(6)*	–8.4** *(25)*	–6.2** *(27)*
Great Basin Desert	—	ns[b] *(3)*	ns[b] *(3)*
Basin and Range	—	ns[b] *(3)*	ns[b] *(6)*
Wyoming Basin	ns[b] *(6)*	ns[b] *(6)*	–33.0** *(12)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Population Impacts:

The greatest threat to Grasshopper Sparrow populations is habitat destruction and degradation. The destruction of native grassland habitats by agricultural conversion has dramatically influenced many populations. Although this species will often attempt to nest in agricultural areas (particularly Conservation Reserve Program grasslands), success rates are often lower than in native habitats. In western landscapes, livestock grazing is a negative influence on populations, and is the primary mechanism

Figure 21.2. Grasshopper Sparrow distribution on BBS routes, 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>1 bird detected) based on natural neighbor analyses of BBS routes.



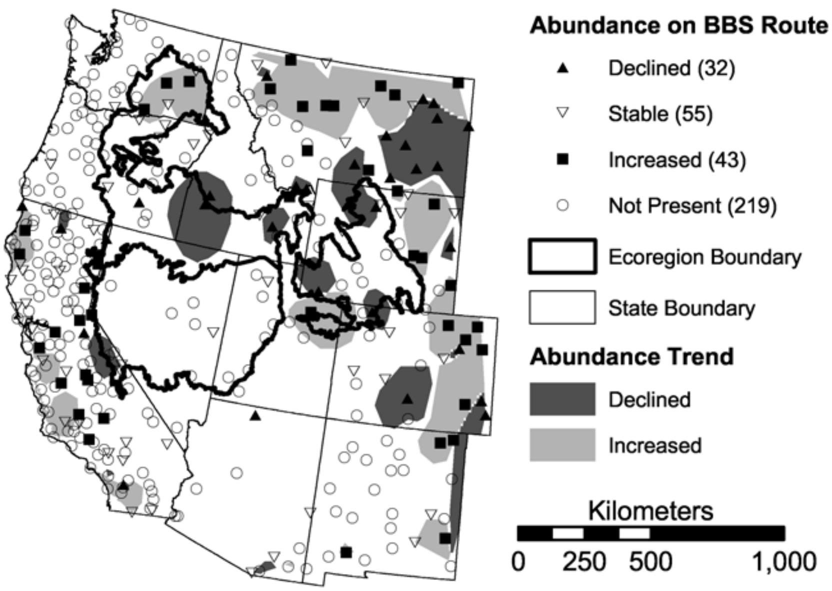


Figure 21.3. Direction of Grasshopper Sparrow detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

of habitat degradation. Fire in native plant communities at appropriate return intervals is beneficial. Where fire-return intervals have been altered by human activities and native vegetation has been invaded or replaced by exotic herbaceous species, Grasshopper Sparrow populations have declined.

State or Federal Status/Listing:

Federal: species of concern (USDI Bureau of Land Management: Utah)

Oregon: species of concern

Utah: species or concern

Wyoming: species of concern

References:

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, M. P. Nenneman, and B. R. Euliss. 2001c. Effects of management practices on grassland birds: Grasshopper Sparrow (revised version). U.S. Geological Survey, Northern Prairie Wildlife Research Center. Jamestown, ND.

Rotenberry, J., and J. Wiens. 1980. Habitat structure, patchiness and avian communities in North American steppe vegetation: a multivariate analysis. Ecology 61: 1228–1250.

Vickery, P. D. 1996. Grasshopper Sparrow (*Ammodramus savannarum*). *In* A. Poole and F. Gill. [eds.], The birds of North America, No. 239. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

White-crowned Sparrow (*Zonotrichia leucophrys*)

Regional Taxonomic Equivalents:

Zonotrichia leucophrys gambelii, Zonotrichia leucophrys oriantha

Current and Historical Distribution:

The current distribution of White-crowned Sparrows is assumed to be generally similar to historical; no large-scale changes in distribution have been documented (Fig. 22.1). Populations in the Cascade Mountains may have benefited from increased availability of shrub-dominated habitats that follow logging of forests. However, riparian habitat degradation has negatively impacted local distribution across the West.

Habitat Requirements and Associations:

White-crowned Sparrows inhabit riparian woodlands, open coniferous forests with extensive shrub understories, and other shrubby habitats. Habitat associations vary across the species range, but consistent features of preferred habitat include patchily distributed grass, bare ground, and dense shrubs.

BBS Data Analysis:

Standard BBS analyses suggest that White-crowned Sparrow populations have declined (Table 1). In the Western BBS region, a long-term population decline is evident. This trend is driven by data from 1968–1983, when populations declined substantially. During 1984–2001, populations remained stable. Data from shrubsteppe physiographic provinces are sparse to nonexistent, and statistically unreliable.

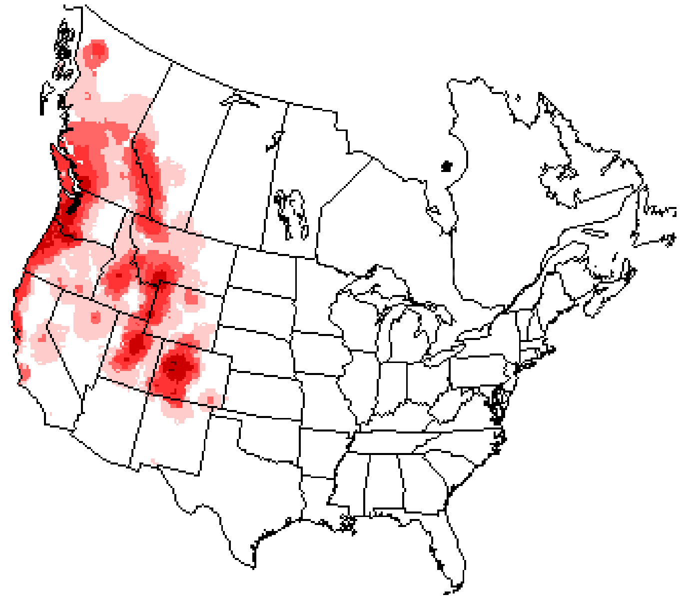


Figure 22.1. White-Crowned Sparrow distribution. Darker shading indicates greater abundance.

Table 22.1. White-crowned Sparrow population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n[a])		
	1968–1983	1984–2001	1968–2001
Western BBS Region	–4.1*** *(135)*	ns *(394)*	–1.8** *(319)*
Columbia Plateau	ns[b] *(2)*	ns[b] *(2)*	ns[b] *(3)*
Great Basin Desert	—	—	—
Basin and Range	—	—	ns[b] *(5)*
Wyoming Basin	ns[b] *(4)*	ns[b] *(6)*	ns[b] *(8)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Our spatial analyses suggest that White-crowned Sparrow populations are now stable. The area predicted to have higher abundances (>5 birds detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions (Fig. 2). The distribution of routes exhibiting increased or decreased abundances

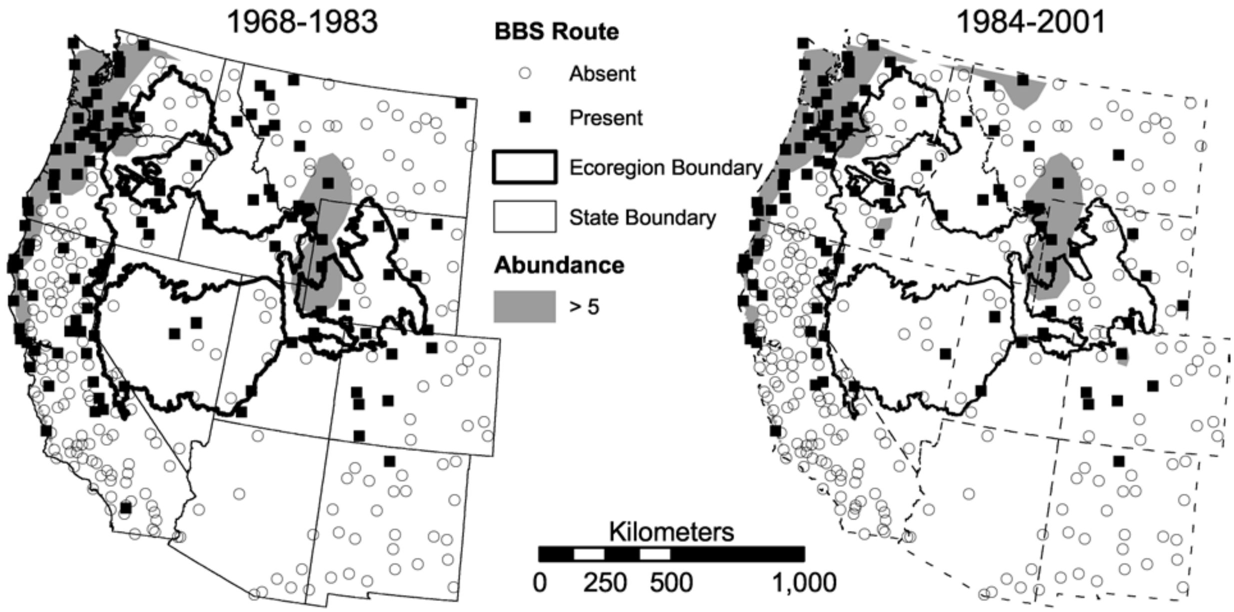


Figure 22.2. White-crowned Sparrow distribution on BBS routes, 1968–1983 and 1984–2001. Shading represents potential locations of higher abundance (>5 birds detected) based on natural neighbor analyses of BBS routes.

within the western region suggests a possible pattern of increases in the northerly portion of the range, and decreases in the southerly portion and along the Pacific Coast (Fig. 22.3).

Population Impacts:

The sources of White-crowned Sparrow population declines are poorly known. Disturbances such as logging and fire can benefit populations as shrub-dominated habitats replace previously forested habitats. The extent of this benefit is not well quantified. White-crowned Sparrow populations in riparian areas have been impacted by habitat destruction and degra-

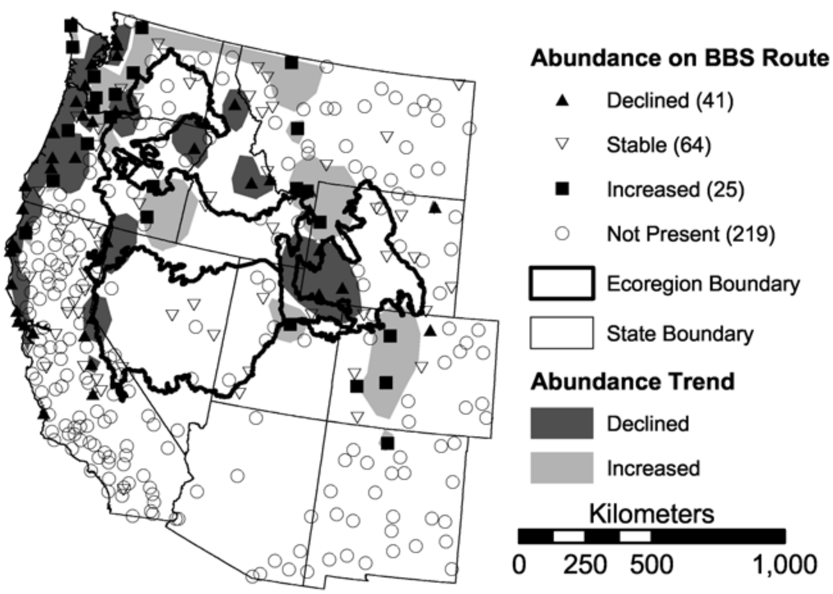


Figure 22.3. Direction of White-crowned Sparrow detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

dation. Degradation of riparian areas across the western U.S has resulted from agricultural development, livestock grazing, and exotic plant invasion, and may be a primary contributor to the relative rarity of the species in much of the Intermountain West.

State or Federal Status/Listing:

Not listed by and federal or state agencies in the region of interest.

Reference:

Chilton, G., M. C. Baker, C. Barrentine, and M. A. Cunningham. 1995. White-crowned Sparrow (*Zonotrichia leucophrys*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 183. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Western Meadowlark (*Sturnella neglecta*)

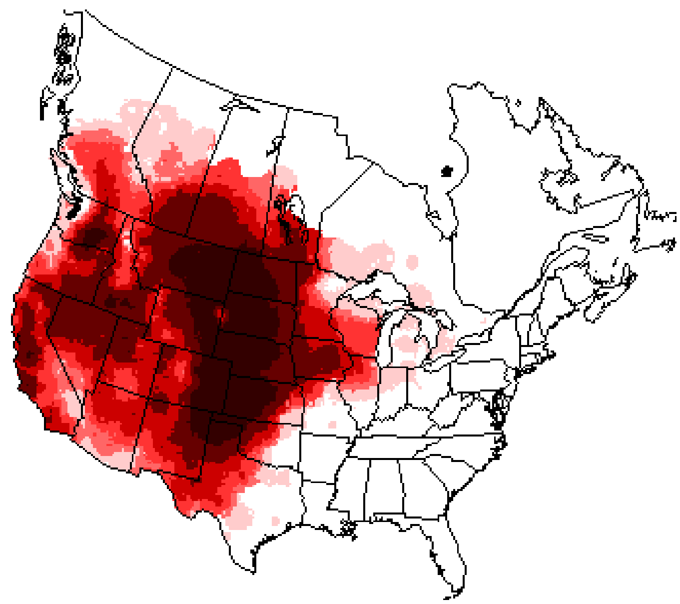


Figure 23.1. Western Meadowlark distribution. Darker shading indicates greater abundance.

Regional Taxonomic Equivalents:

Sturnella neglecta confluenta, *Sturnella neglecta neglecta*

Current and Historical Distribution:

In the western United States, the distribution of Western Meadowlarks is assumed to be generally similar to historical; no large-scale changes in distribution have been documented (Fig. 23.1).

Habitat Requirements and Associations:

The Western Meadowlark is widely distributed in grassland, shrubsteppe, sparse woodland, and agricultural areas. Habitat preferences vary across its range. In shrubsteppe habitats, presence and abundance are correlated positively with increasing herbaceous cover, leaf litter cover or depth, and sparse shrub cover. Negative correlates include increasing shrub diversity and abundance of bare ground.

BBS Data Analysis:

Standard BBS analyses suggest that Western Meadowlark populations have declined (Table 23.1). In the Western BBS region, populations declined significantly over the long-term and during 1984–2001. Of the shrubsteppe physiographic provinces, only the Columbia Plateau exhibited statistically significant population trends, which were mixed (Table 23.1).

Our spatial analysis suggests that Western Meadowlark populations are stable. The area predicted to have higher abundances (>25 birds detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions (Fig. 23.2). Routes with similar abundance trends often were adjacent, but no other readily interpretable pattern was apparent (Fig. 3).

Population Impacts:

Habitat destruction and degradation are the primary influences on Western Meadowlark populations. Extensive areas of native habitat have been converted to agricultural lands. Although Western Meadowlarks frequently use such areas, productivity is often low due to agricultural harvests and increased rates of nest predation, potentially rendering these areas population sinks. Livestock grazing can have positive or negative impacts on populations, depending on habitat type and grazing intensity. Fire in native plant communities at appropriate return intervals is beneficial. Where fire-return intervals have been altered by human activities and native vegetation has been invaded or replaced by exotic herbaceous species, meadowlark populations likely are affected negatively.

State or Federal Status/Listing:

Not listed by and federal or state agencies within the region of interest.

Table 1. Western Meadlowlark population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(409)*	–1.0** *(783)*	–1.1*** *(878)*
Columbia Plateau	2.9** *(29)*	–2.1** *(74)*	ns *(77)*
Great Basin Desert	9.3*[b] *(7)*	ns *(19)*	ns *(20)*
Basin and Range	ns *(20)*	ns *(40)*	ns *(46)*
Wyoming Basin	ns *(23)*	ns *(44)*	ns *(50)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$).

References:

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 2001h. Effects of management practices on grassland birds: Western Meadowlark (revised version). U.S. Geological Survey, Northern Prairie Wildlife Re-

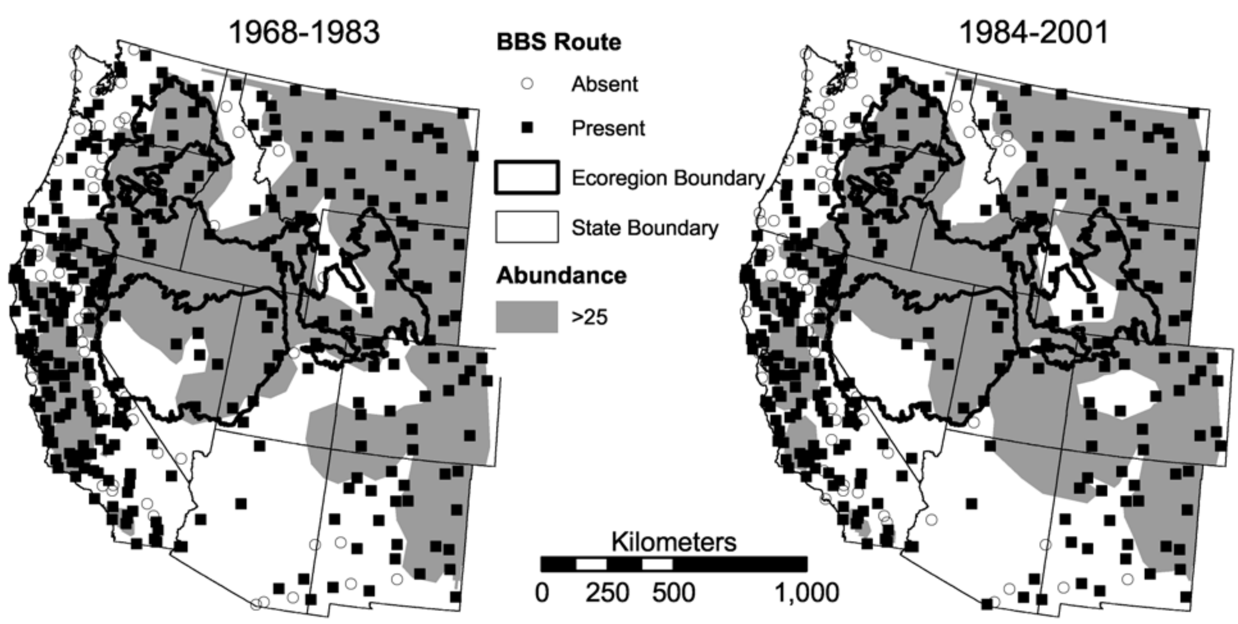


Figure 2. Western Meadowlark distribution on BBS routes during 1968–1983 and 1984–2001. Shading represents potential locations of higher abundance (>25 birds detected) based on natural neighbor analyses of BBS routes.

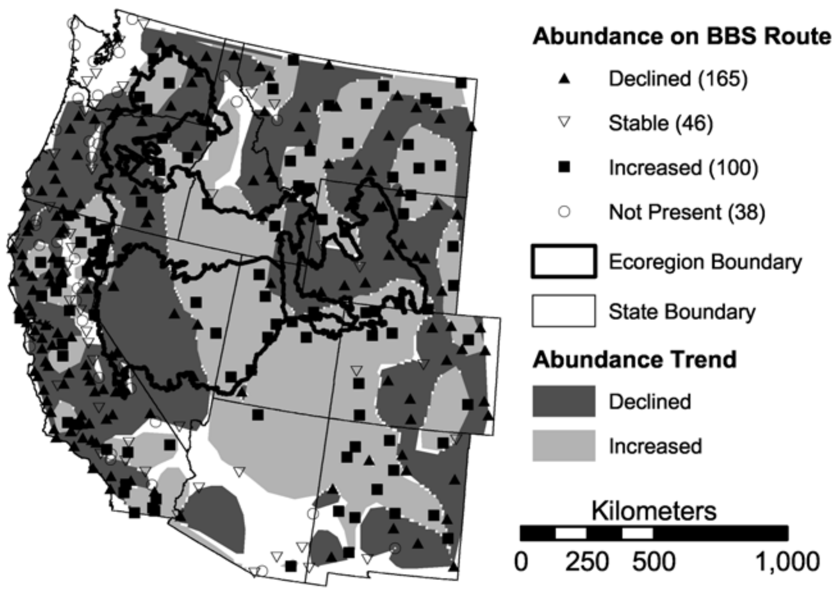


Figure 23.3. Direction of Western Meadowlark detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

search Center. Jamestown, ND.

Lanyon, W. E. 1994. Western Meadowlark (*Sturnella neglecta*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 104. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Wiens, J. A., and J. T. Rotenberry. 1981. Habitat associations and community structur e of birds in shrubsteppe environments. Ecological Monographs 51:21–42.

Brewer's Blackbird (*Euphagus cyanocephalus*)

Current and Historical Distribution:

The distribution of Brewer's Blackbirds west of the Rocky Mountains is assumed to be generally similar to historical, with no documented large-scale changes in distribution. In the West, however, the species has expanded locally to exploit human-altered landscapes. Prior to 1900, Brewer's Blackbirds occurred eastward as far as Minnesota. Beginning in the early twentieth century, the species expanded eastward, eventually spreading across Minnesota, Wisconsin, and Michigan (Fig. 24.1).

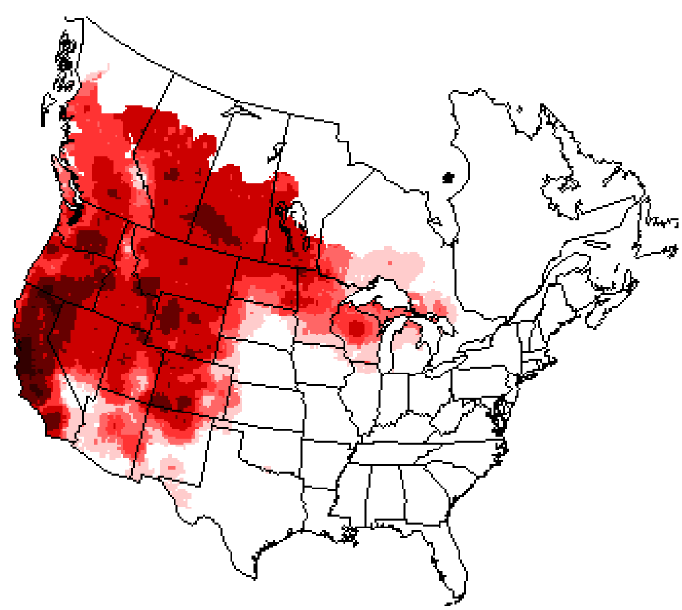


Figure 24.1. Brewer's Blackbird distribution. Darker shading indicates greater abundance.

Habitat Requirements and Associations:

Brewer's Blackbirds use a variety of habitats, frequently occurring commensally with humans in rural and urban settings. Nesting occurs in woodlands, shrublands, or riparian areas, commonly on the edges of open areas or near water. Foraging occurs in areas with extensive bare ground or short vegetation (e.g. pastures, mowed agricultural fields, road edges, etc.).

BBS Data Analysis:

Standard BBS analyses suggest that Brewer's Blackbird populations in the Western BBS Region are declining significantly over both the long-term and during 1984–2001 (Table 24.1). With the exception of the Great Basin, most shrubsteppe physiographic provinces showed no significant changes in Brewer's Blackbird populations.

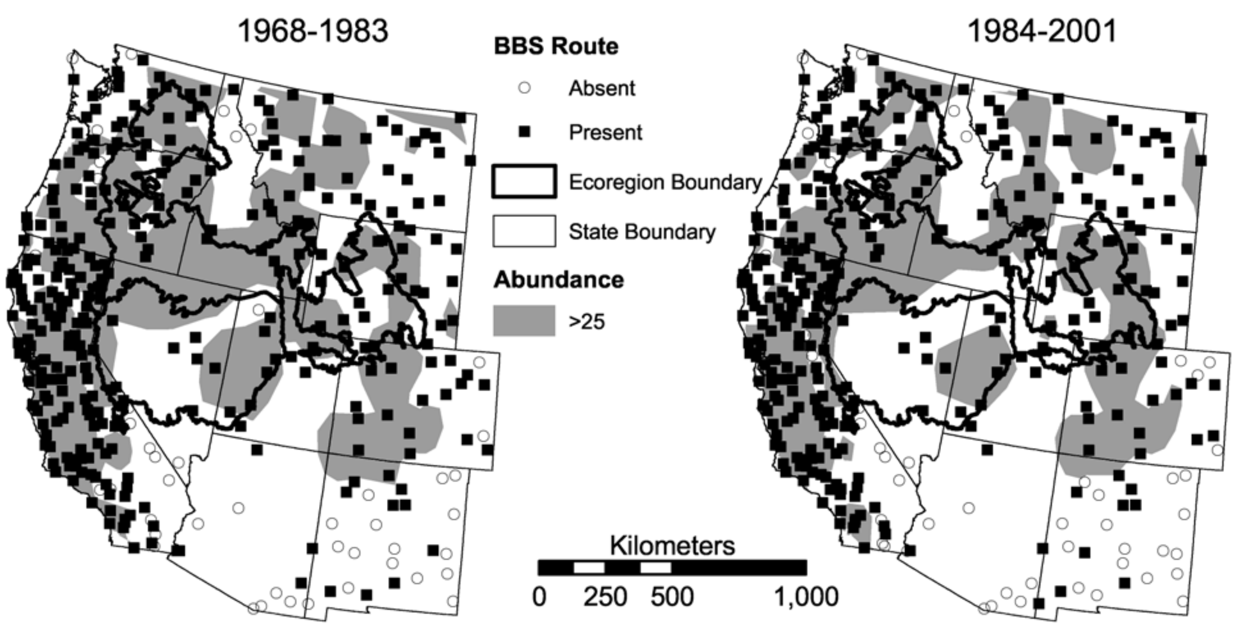
Table 24.1. Brewer's Blackbird population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(431)*	–1.9*** *(794)*	–1.5*** *(872)*
Columbia Plateau	ns *(29)*	ns *(74)*	ns *(77)*
Great Basin Desert	ns[b] *(5)*	–8.4* *(11)*	–6.6* *(14)*
Basin and Range	ns *(20)*	ns *(40)*	ns *(46)*
Wyoming Basin	ns *(23)*	ns *(43)*	ns *(48)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Our spatial analyses of BBS data support the conclusion that Brewer's Blackbird populations are in widespread decline. The area predicted to have higher abundances (>25 birds detected per BBS route) declined by 6% in western states and by 16% in the shrubsteppe ecoregions (Fig. 24.2). Routes with reduced Brewer's Blackbird abundances were spread continuously across the West (Fig. 24.3.).

Figure 24.2. Brewer's Blackbird distribution on BBS routes, 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>25 birds detected) based on natural neighbor analyses of BBS routes.



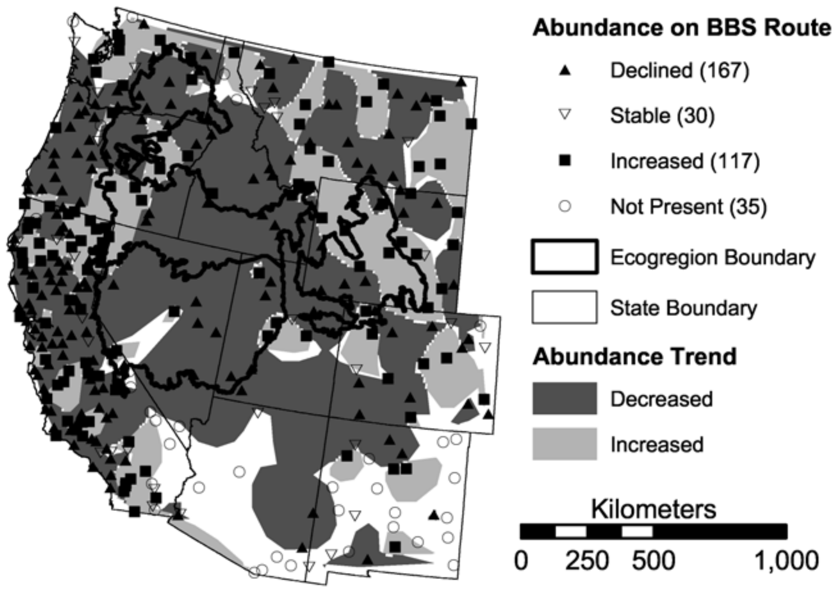


Figure 24.3. Direction of Brewer's Blackbird detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Population Impacts:

The ability of Brewer's Blackbirds to use human-altered environments has had both positive and negative effects on the abundance of this species. Agricultural and urban developments, as well as forest fragmentation, have created new habitats with plentiful food and nest sites. These newly available habitats also increase exposure to predators, nest parasites, pesticides, and pest-control activities. In natural habitats, the impacts of livestock grazing and fire to populations are poorly understood. Livestock grazing studies have shown mixed results depending on habitat type and grazing intensity. Fires can open up or expand potential foraging areas, but also eliminate nesting habitat.

State or Federal Status/Listing:

Not listed by and federal or state agencies in the region of interest.

Reference:

Martin, S. G. 2002. Brewer's Blackbird (*Euphagus cyanocephalus*). *In* A. Poole and F.

Gill [eds.], The birds of North America, No. 616. The Birds of North America, Inc., Philadelphia, PA.

Scott's Oriole
(*Icterus parisorum*)

Current and Historical Distribution:

In the southern portions of its range, the current distribution of Scott's Oriole is assumed to be generally similar to historical, although conclusive data are lacking (Fig. 25.1). Scott's Orioles have expanded their distribution northward across Nevada, central Utah, western Colorado, and into southern Idaho.

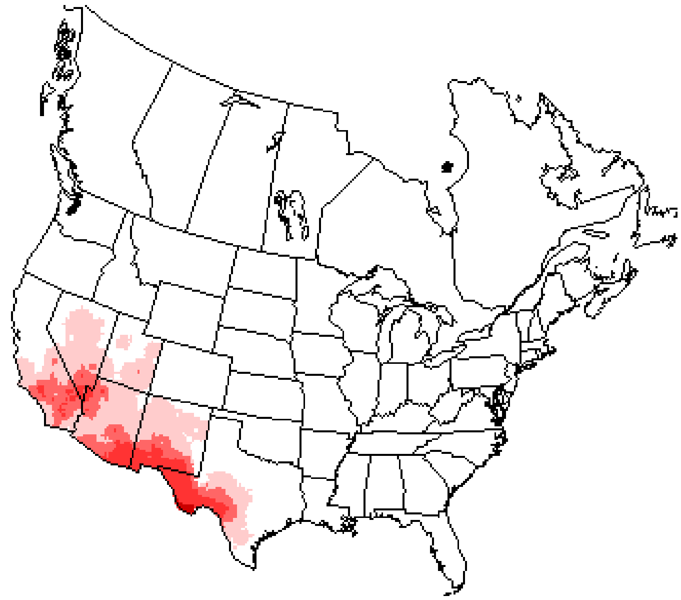


Figure 25.1. Scott's Oriole distribution. Darker shading indicates greater abundance.

Habitat Requirements and Associations:

Scott's Orioles are found in arid deserts of the Southwest and Intermountain West. They nest in pinyon/juniper woodlands, Joshua trees, and yuccas, but avoid areas of cactus-dominated desert. Scott's Oriole is a poorly studied species, and specific habitat variables that influence presence and abundance are not known.

BBS Data Analysis:

Standard BBS analyses suggest that Scott's Oriole populations are stable. No long-term or short-term trends are evident in the Western BBS region (Table 25.1). Data from the shrubsteppe physiographic provinces are sparse and statistically unreliable. Scott's Orioles were detected too infrequently in the shrubsteppe ecoregions for any meaningful spatial analyses to be performed.

Table 25.1. Scott's Oriole population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(50)*	ns *(110)*	ns *(119)*
Columbia Plateau	—	—	—
Great Basin Desert	—	ns[b] *(5)*	ns[b] *(6)*
Basin and Range	—	ns[b] *(6)*	ns[b] *(7)*
Wyoming Basin	—	—	—

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Population Impacts:

The natural history and population status of Scott's Orioles are poorly known. Habitat destruction and degradation likely pose the greatest threats to populations, given the species' limited distribution and relatively specialized ecological requirements. Livestock grazing is the most common use of Scott's Oriole habitat, but the effects are unknown.

State or Federal Status/Listing:

Wyoming: species of concern

Reference:

Flood, N. J. 2002. Scott's Oriole (*Icterus parisorum*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 608. The Birds of North America, Inc., Philadelphia, PA.

Yellow-billed Cuckoo (*Coccyzus americanus*)

Regional Taxonomic Equivalents:

Coccyzus americanus occidentalis

Current and Historical Distribution:

Prior to widespread Euro-American settlement of the West 150 years ago, Yellow-billed Cuckoos were distributed widely across the western United States, breeding regularly in Washington, Oregon, Nevada, Idaho, Montana, and Utah. The destruction of riparian woodlands has significantly reduced or eliminated Yellow-billed Cuckoo populations in these states. California and Arizona harbor the greatest number of cuckoos west of the Rockies, but their populations are very low (<40 and <170 breeding pairs, respectively). Small but significant numbers of nesting pairs are found in New Mexico as well. Historically, California alone had an estimated 15,000 or more pairs of Yellow-billed Cuckoos. Yellow-billed Cuckoos now occur in reasonable abundance only in the southeastern and south-central portions of the United States (Fig. 26.1).

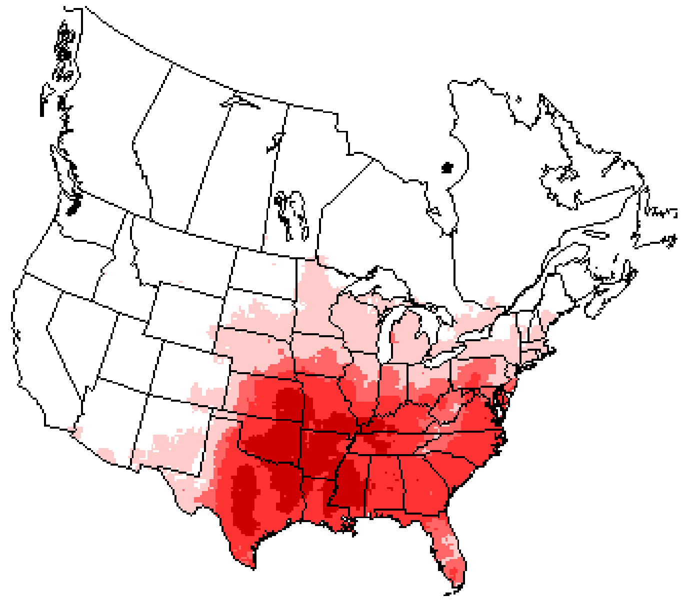


Figure 26.1. Yellow-billed Cuckoo distribution. Darker shading indicates greater abundance.

Table 26.1. Yellow-billed Cuckoo population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns[b] *(9)*	ns *(13)*	ns *(20)*
Columbia Plateau	—	—	—
Great Basin Desert	—	—	—
Basin and Range	—	—	—
Wyoming Basin	—	—	—

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Habitat Requirements and Associations:

Eastern populations of Yellow-billed Cuckoos are found in open woodlands and scrublands near water, whereas western populations are primarily riparian woodland obligates. In the West, Yellow-billed Cuckoos seem to prefer unfragmented tracts of riparian woodland for foraging and nesting. Canopy height, canopy cover, understory structure, and prey availability influence presence and abundance, but are poorly understood.

BBS Data Analysis:

Yellow-billed Cuckoo populations are poorly surveyed by the BBS (Table 26.1), resulting in statistically unreliable data. They were detected too infrequently to perform any meaningful spatial analyses in shrubsteppe ecoregions.

Population Impacts:

The steep decline of Yellow-billed Cuckoo populations in the western U.S. appears to be tied directly to riparian woodland destruction and degradation by agricultural and urban development, flood control efforts, livestock grazing, and exotic plant invasion. Pesticides have reduced populations through poisoning, reproductive failure, and loss of food sources.

State or Federal Status/Listing:

Federal: proposed for listing as endangered/threatened (western populations)

California: endangered species
Idaho: species of concern
Nevada: species of concern
Oregon: species of concern
Utah: threatened species
Washington: species of concern
Wyoming: species of concern

Reference:

Hughes, J. M. 1999. Yellow-billed Cuckoo (*Coccyzus americanus*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 418. The Birds of North America, Inc., Philadelphia, PA.

Belted Kingfisher
(*Ceryle alcyon*)

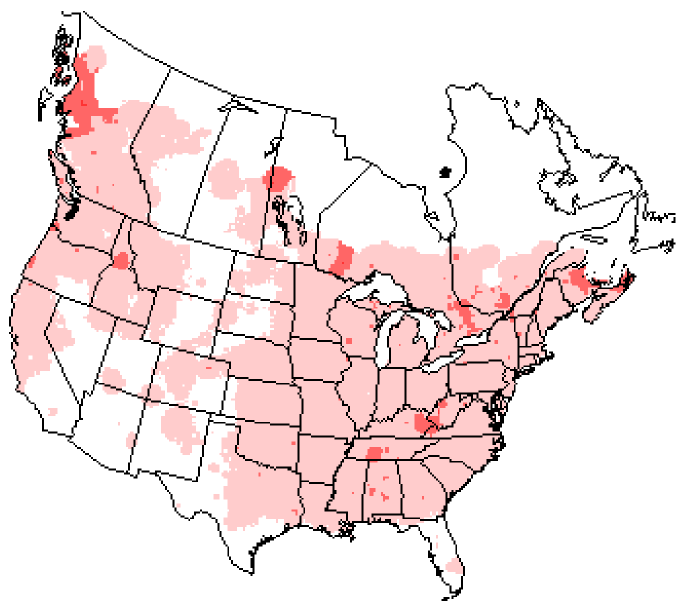


Figure 27.1. Belted Kingfisher distribution. Darker shading indicates greater abundance.

Current and Historical Distribution:

The current distribution of Belted Kingfishers (Fig. 27.1) is assumed to be generally similar to historical; no large-scale changes in range have been documented.

Habitat Requirements and Associations:

Belted Kingfishers are associated with riparian corridors that surround running or standing water. Four main features influence presence and abundance: nest site availability, hunting perch density, stream topography, and prey abundance (Davis 1982, Prose 1985, Brooks and Davis 1987). Lack of appropriate nest sites can be the major limiting factor for populations.

BBS Data Analysis:

Standard BBS analyses suggest that Belted Kingfisher populations are stable (Table 27.1). No significant long or short-term trends are evident in the Western BBS region. Data from the shrubsteppe physiographic provinces are sparse and statistically unreliable.

Our spatial analyses suggest that Belted Kingfisher populations have declined slightly. The area predicted to have higher abundances (>1 bird detected per BBS route) declined by 5% in the western states, but remained stable in the shrubsteppe ecoregions (Fig. 27.2). Due to low densities, the majority of BBS routes showed no changes in Belted Kingfisher abundance (Fig. 27.3). Nevertheless, of those routes that showed a change in abundance (n = 33), declines outnumbered increases by nearly 3:1.

Population Impacts:

Relationships between Belted Kingfisher populations and livestock grazing, exotic plant invasion, human disturbance, and other impacts to riparian communities are not well understood. Both overly sparse and excessively dense vegetation negatively influence presence. Presumably, vegetation loss and stream degradation are negative influences on populations. Streambank erosion is a significant concern, as Belted Kingfishers use these areas for nest burrows.

State or Federal Status/Listing:

Not listed by and federal or state agencies in the region of interest.

Table 27.1. Belted Kingfisher population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(147)*	ns *(258)*	ns *(316)*
Columbia Plateau	—	ns[b] *(9)*	ns *(12)*
Great Basin Desert	—	—	—
Basin and Range	—	ns[b] *(6)*	ns[b] *(6)*
Wyoming Basin	ns[b] *(3)*	—	ns[b] *(4)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

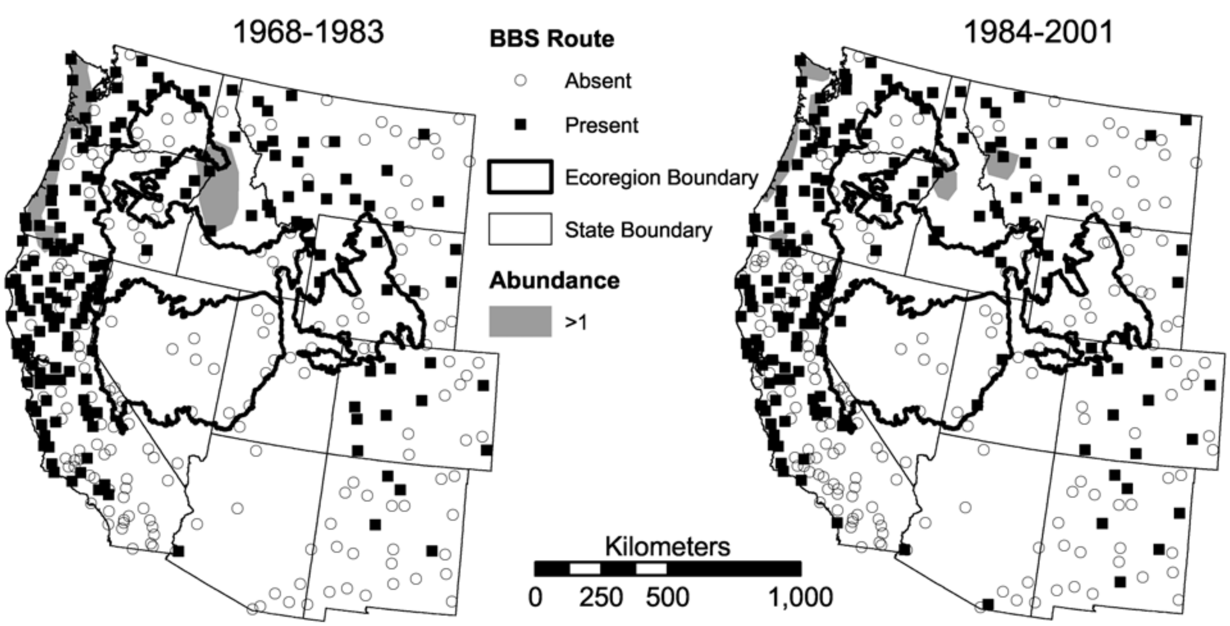
References:

Brooks, R. P., and W. J. Davis. 1987. Habitat selection by breeding Belted Kingfisher (*Ceryle alcyon*). American Midland Naturalist 117:63–70.

Davis, W. 1982. Territory size in *Megaceryle alcyon* along a stream habitat. Auk 99:353–362.

Hamas, M. J. 1994. Belted Kingfisher (*Ceryle alcyon*).

Figure 27.2. Belted Kingfisher distribution on BBS routes during 1968–1983 and 1984–2001. Shading represents regions with potentially higher abundances (>1 bird detected per BBS route), based on natural neighbor analyses of abundance.



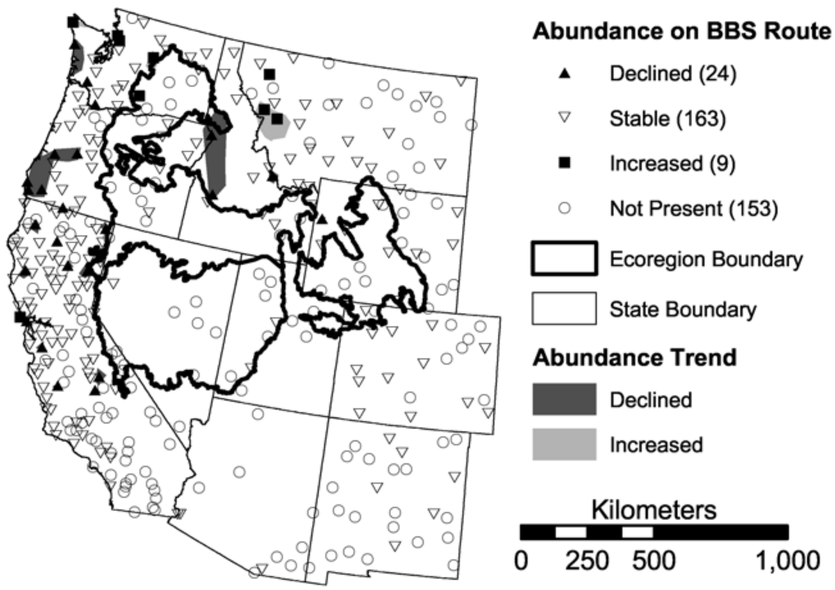


Figure 27.3. Changes in Belted Kingfisher abundances on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

In A. Poole and F. Gill [eds.], The birds of North America, No. 84. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Prose, B. 1985. Habitat suitability index models: Belted Kingfisher. USDI Fish and Wildlife Service, Biological Report 82(10.87).

Willow Flycatcher (*Empidonax traillii*)

Regional Taxonomic Equivalents:

Empidonax traillii adastus, Empidonax traillii extimus, Empidonax traillii brewsteri

Current and Historical Distribution:

The historical distribution of Willow Flycatchers is poorly known. The three western subspecies (*E. t. extimus*, *E. t. brewsteri*, and *E. t. adastus*) are thought to have been distributed widely in suitable habitat west of the Rockies. The current distribution of these subspecies (Fig. 28.1) has changed considerably, primarily due to habitat destruction. The Southwestern Willow Flycatcher (*E. t. extimus)* was listed as

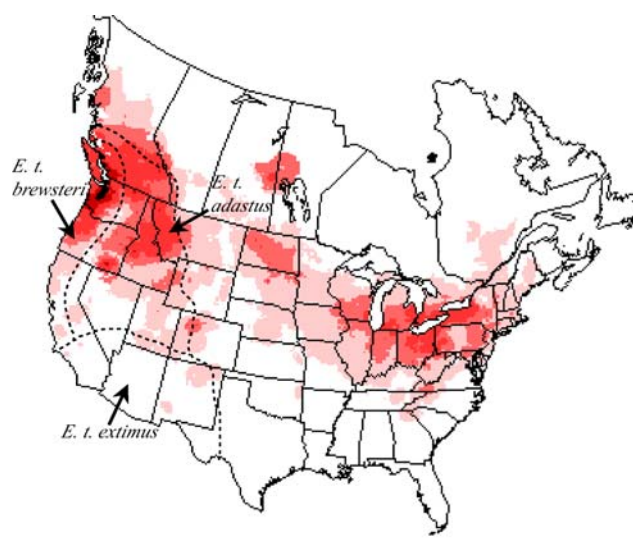


Figure 28.1. Willow Flycatcher distribution. Darker shading indicates greater abundance.

federally endangered in 1995 due to population declines and range contractions. This subspecies once was common in Arizona, southwestern Utah, and southern California, but is now extirpated from many areas of former abundance. *Empidonax traillii brewsteri* was once common along the Pacific Coast, but its California range has contracted substantially and the subspecies is now considered rare. The current distribution of *E. t. adastus* is not well understood.

Habitat Requirements and Associations:

As its name suggests, the Willow Flycatcher is an inhabitant of willow and other shrub-dominated riparian habitats, preferring shrubby areas with standing or running water. Less frequently, Willow Flycatchers also occur in dry brush uplands and riparian woodlands lacking shrubs. Areas with high densities of willow, interspersed with openings and prominent song perches, are preferred.

BBS Data Analysis:

Standard BBS analyses suggest that Willow Flycatcher populations are in decline (Table 28.1). In the Western BBS region, populations declined significantly over the long and short term. Data from the shrubsteppe physiographic provinces are sparse and statistically unreliable.

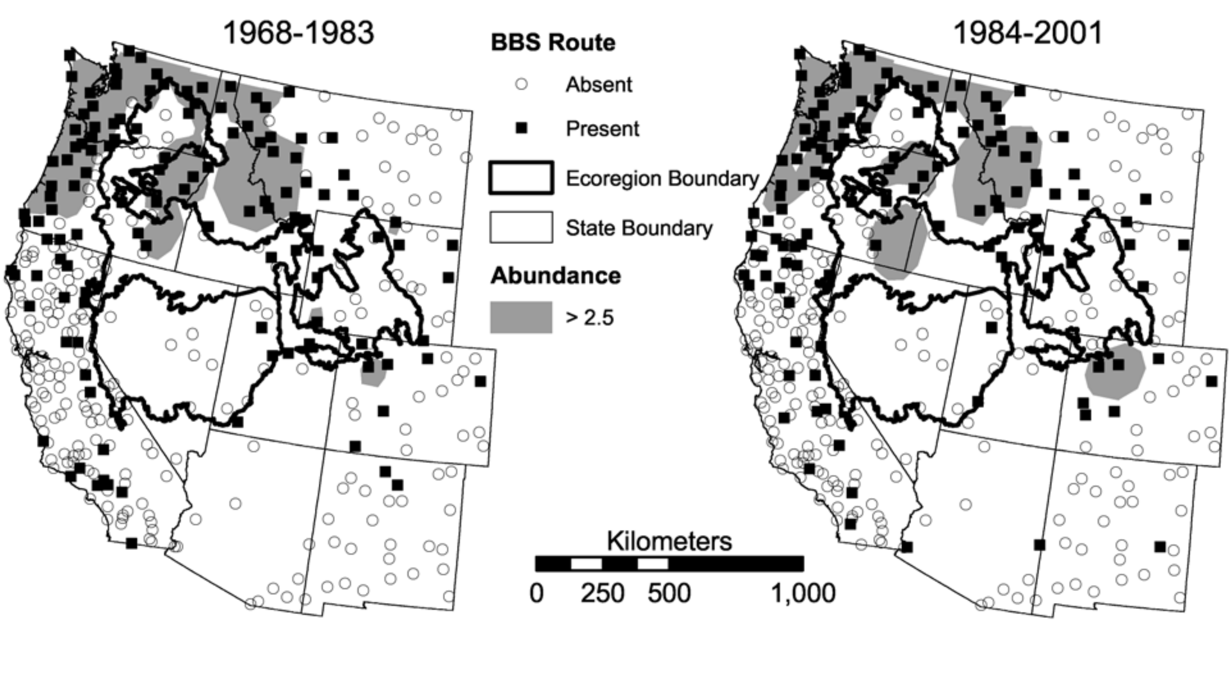
Table 28.1. Willow Flycatcher population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	–4.5***	ns	–1.9**
	(152)	*(295)*	*(333)*
Columbia Plateau	ns[b]	–6.2*	ns
	(7)	*(12)*	*(14)*
Great Basin Desert	—	—	—
Basin and Range	—	ns[b]	ns[b]
		(6)	*(7)*
Wyoming Basin	ns[b]	ns[b]	ns[b]
	(5)	*(3)*	*(7)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Our spatial analyses support the conclusion that Willow Flycatcher populations have

Figure 28.2. Willow Flycatcher distribution on BBS routes, 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>2.5 birds detected) based on natural neighbor analyses of BBS routes.



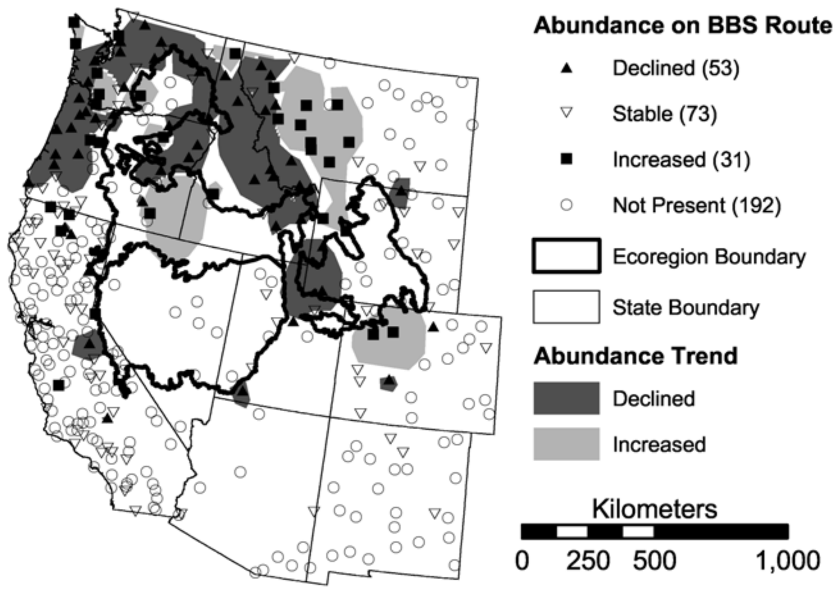


Figure 28.3. Direction of Willow Flycatcher detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

declined. The area predicted to have higher abundances (>2.5 birds detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions (Fig. 28.2). Many more routes indicate reduced abundances than increases (53 vs. 31, Fig. 28.3). Routes with reduced abundances are clumped, but the ecological factors underlying this pattern are unclear.

Population Impacts:

Widespread loss and degradation of riparian habitat are responsible for the disappearance and decline of Willow Flycatcher populations. Livestock grazing, agricultural development, urbanization, and exotic plant invasions have impacted riparian structure and function across the West. Nest parasitism and predation are factors that take a greater toll on populations when habitat is degraded and populations are small.

State or Federal Status/Listing:

Federal: endangered (*E. t. extimus*); species of concern (other subspecies, USDI Bureau of Land Management: Idaho)
California: endangered species
Nevada: species of concern
Oregon: species of concern
Utah: endangered species (*E. t. extimus* only)

References:

Sedgwick, J. A. 2000. Willow Flycatcher (*Empidonax traillii*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 533. The Birds of North America, Inc., Philadelphia, PA.

Sogge, M. K., B. E. Kus, S. J. Sferra, and M. J. Whitfield [eds.]. 2003. Ecology and conservation of the Willow Flycatcher. Studies in Avian Biology 26.

Veery
(*Catharus fuscescens*)

Regional Taxonomic Equivalents:

Catharus fuscescens salicicola, Catharus fuscescens subpallidus

Current/Historical Distribution:

The current distribution of the Veery (Fig. 29.1) is assumed to be generally similar to historical; no large-scale changes in distribution have been documented.

Habitat Requirements and Associations:

Veeries are found primarily in moist deciduous and riparian woodlands. Habitat characteristics influencing presence and absence are not well known, except that woodlands with dense shrub understories are highly preferred (Sousa 1982).

BBS Data Analysis:

Standard BBS analyses suggest that Veery populations are stable (Table 29.1). No long or short-term trends were evident in the Western BBS region. Data were largely unavailable from the shrubsteppe physiographic provinces.

Our spatial analysis supports the conclusion that populations are stable. The area predicted to have higher abundances (>1 bird detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions (Fig. 29.2). Most BBS routes showed no change in Veery abundances (Fig. 29.3), but some clustering of routes with reduced abundances was evident in the northern Rockies.

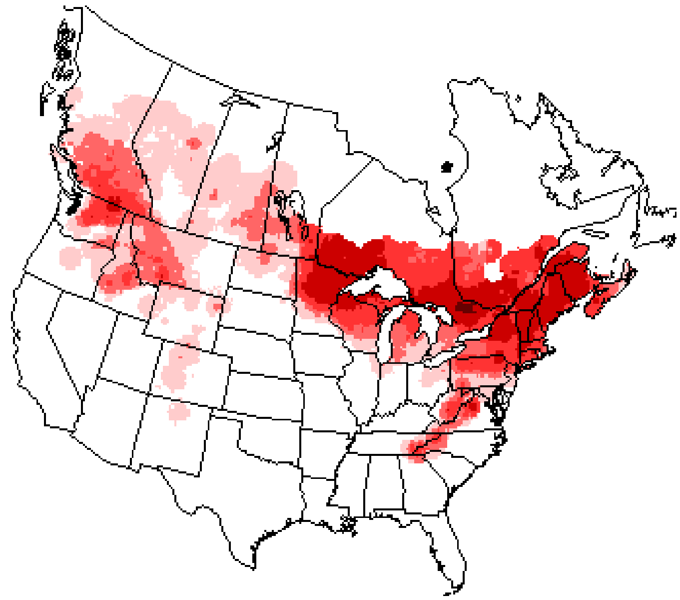


Figure 29.1. Veery distribution. Darker shading indicates greater abundance.

Table 29.1. Veery population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(73)*	ns *(131)*	ns *(149)*
Columbia Plateau	—	—	—
Great Basin Desert	—	—	—
Basin and Range	—	—	—
Wyoming Basin	—	ns[b] *(2)*	ns[b] *(3)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \le 0.05$; $^{**}P \le 0.01$; $^{***}P \le 0.001$; ns = not significant ($P > 0.10$); — = no data.

Population Impacts:

Habitat destruction, degradation, and fragmentation are the primary negative influences on Veery populations. Veeries prefer habitats with dense understories, and populations decline with simplification of vegetation structure through human activity, livestock grazing, or other means. The Veery is a common cowbird host, and cowbird parasitism often increases with fragmentation, vegetation thinning, and

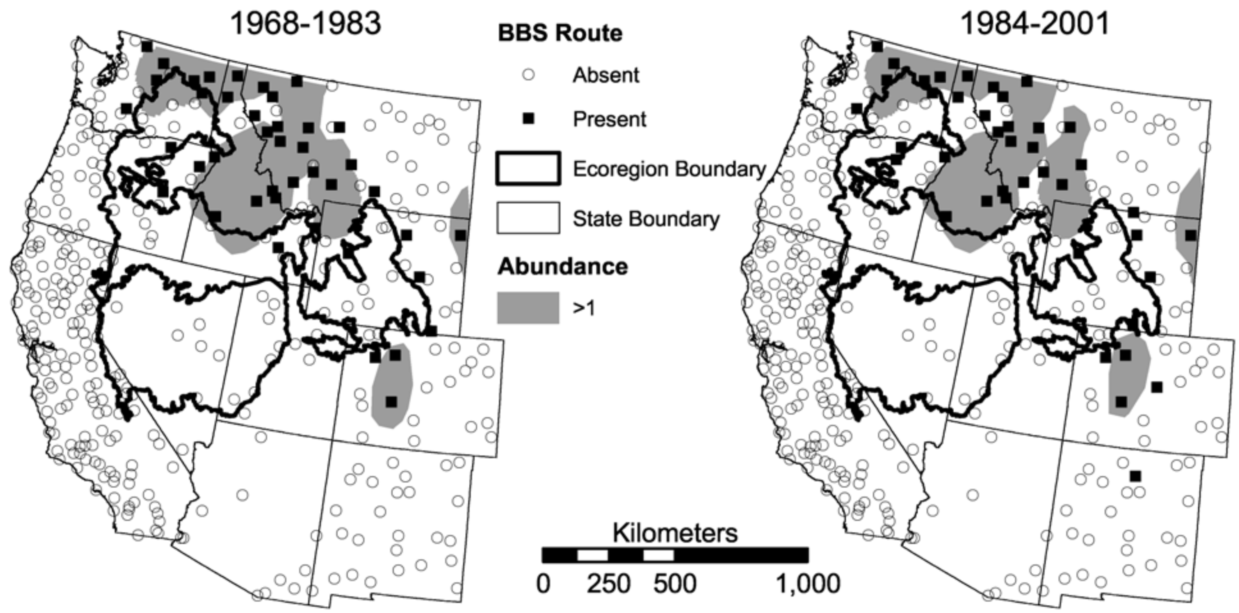


Figure 29.2. Veery distribution on BBS routes during 1968–1983 and 1984–2001 periods. Shaded areas represent potential locations of higher abundance (>1 bird detected) based on natural neighbor analyses of BBS routes.

livestock grazing. Across the Intermountain West, the Veery is associated primarily with riparian and montane aspen woodlands, habitats that have been heavily degraded by human activities over the past 150 years.

State or Federal Status/Listing:

Wyoming: species of concern

References:

Moskoff, W. 1995. Veery (*Catharus fuscescens*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 142. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Sousa, P. J. 1982. Habitat suitability index models: Veery. USDI Fish and Wildlife Service, FWA/OBS-82/10/22. Fort Collins, CO.

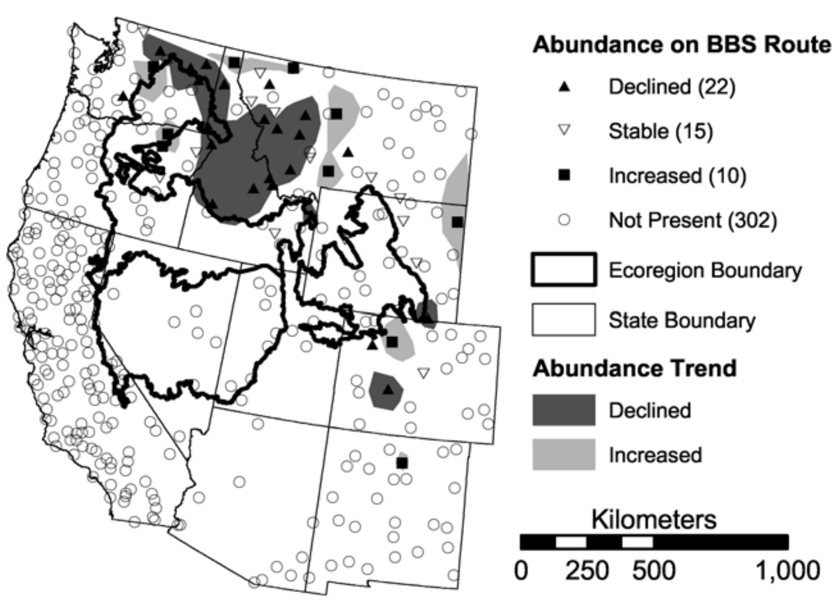


Figure 29.3. Direction of Veery detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Swainson's Thrush
(*Catharus ustulatus*)

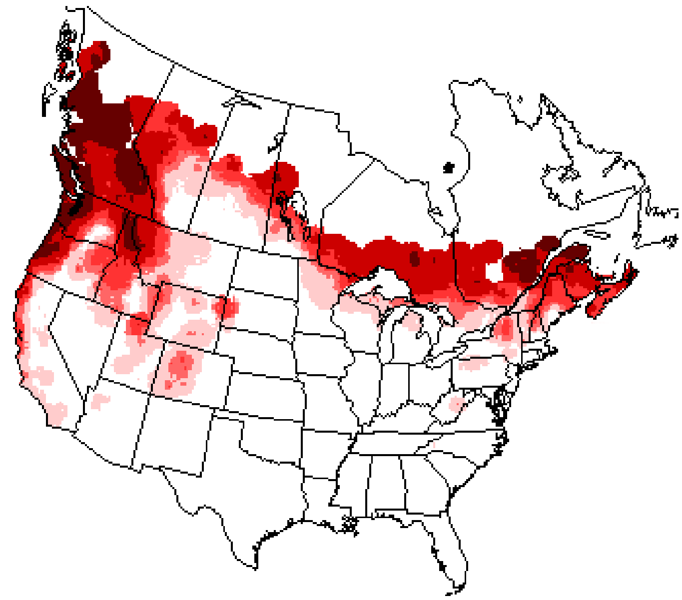


Figure 30.1. Swainson's Thrush distribution. Darker shading indicates greater abundance.

Regional Taxonomic Equivalents:

Catharus ustulatus ustulatus, *Catharus ustulatus oedicus*, *Catharus ustulatus swainsonii*

Current and Historical Distribution:

The current distribution of Swainson's Thrushes is assumed to be generally similar to historical across most of its range (Fig. 30.1). Range contractions have been reported in New England and across much of California.

Habitat Requirements and Associations:

Across the northern portion of its range, Swainson's Thrush is associated with coniferous forests. In the southern portion of its range and in many western states, however, Swainson's Thrushes primarily inhabit riparian and aspen woodlands. Preferred conditions in coniferous forest are varied; both high and low abundances have been reported in old growth, mature, and regenerating forest types. Specific habitat conditions that promote Swainson's Thrush presence and abundance in riparian and aspen woodlands have not been established clearly, but a dense deciduous understory appears to be extremely important.

BBS Data Analysis:

Standard BBS analyses suggest that Swainson's Thrush populations are stable (Table 30.1). In the Western BBS region, no significant trends are evident for either the long or short term. No data are available from the shrubsteppe physiographic provinces.

Table 30.1. Swainson's Thrush population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(188)*	ns *(376)*	ns *(411)*
Columbia Plateau	—	—	—
Great Basin Desert	—	—	—
Basin and Range	—	—	—
Wyoming Basin	—	—	—

[a]Number of BBS routes included in analysis.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Our spatial analyses of BBS data support the conclusion that populations are stable. The area predicted to have higher abundances (>1 bird detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions (Fig. 30.2). Abundance trends were mixed and showed no obvious pattern (Fig. 30.3).

Population Impacts:

In forested areas, large clearcuts negatively impact Swainson's Thrush populations. Selective cutting or light thinning of coniferous for-

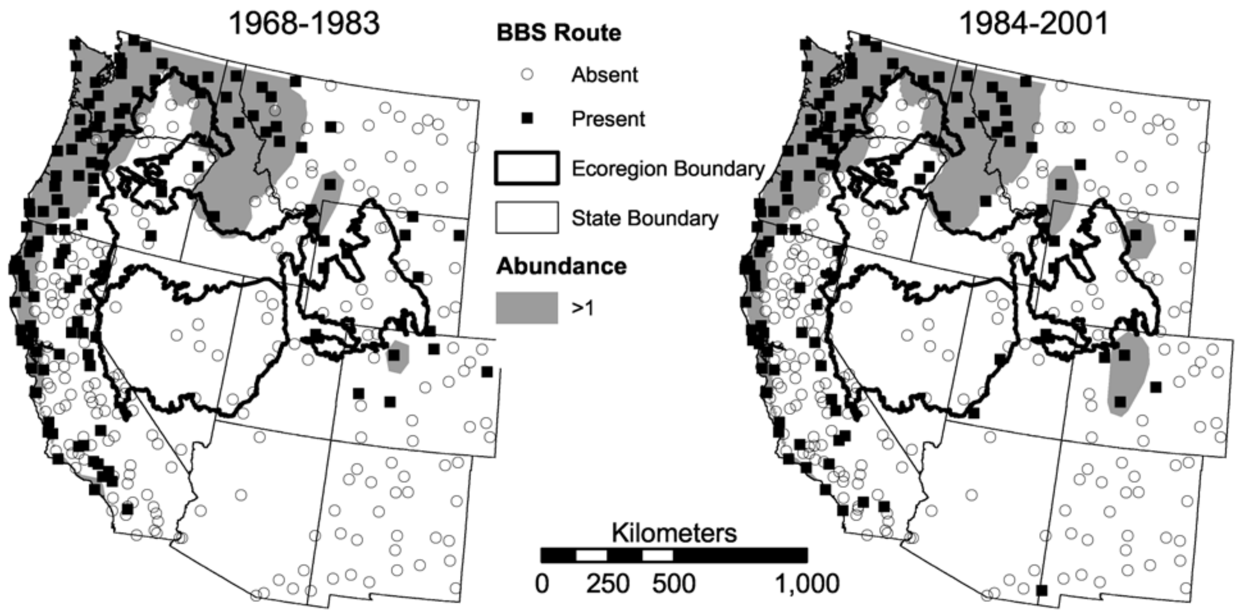


Figure 30.2. Swainson's Thrush distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>1 bird detected) based on natural neighbor analyses of BBS routes.

est may benefit populations by increasing shrub cover. In riparian areas, habitat destruction, degradation, and exotic plant invasion are all potential contributors to population declines. Livestock grazing, and other activities that result in simplification of vegetation structure, negatively impact populations.

State or Federal Status/Listing:

Not listed by any federal or state agencies in the region of interest.

Reference:

Mack, D. E., and W. Yong. 2000. Swainson's Thrush (*Catharus ustulatus*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 540. The Birds of North America, Inc., Philadelphia, PA.

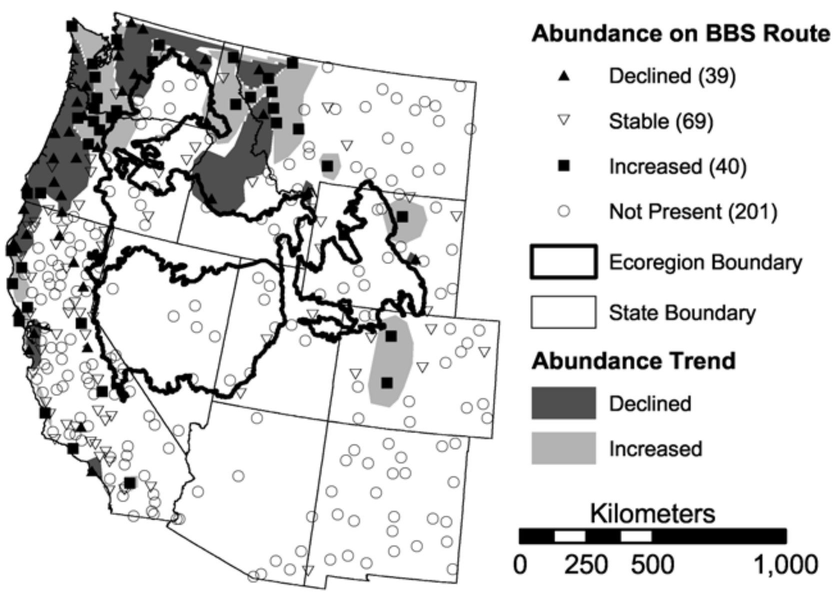


Figure 30.3. Direction of Swainson's Thrush detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Orange-crowned Warbler
(*Vermivora celata*)

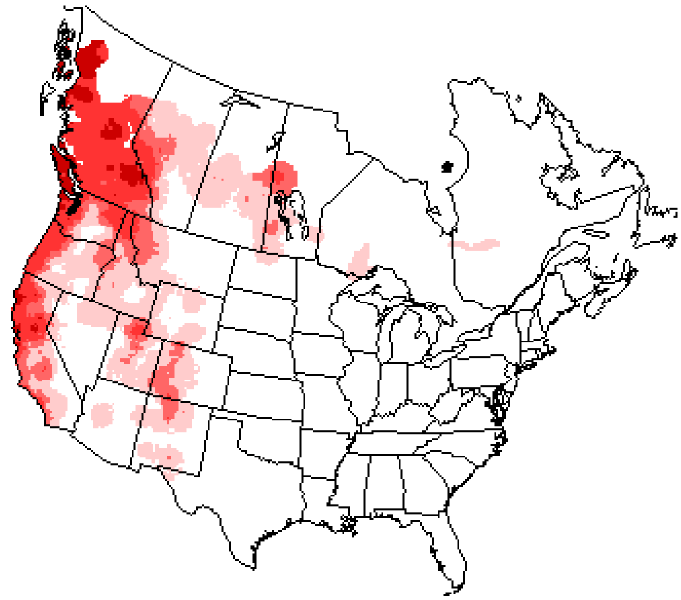


Figure 31.1. Orange-crowned Warbler distribution. Darker shading indicates greater abundance.

Regional Taxonomic Equivalents:

Vermivora celata orestera

Current and Historical Distribution:

The current distribution of the Orange-crowned Warbler is assumed to be generally similar to historical; no large-scale changes in distribution have been documented (Fig. 31.1).

Habitat Requirements and Associations:

Widespread and geographically variable in its habitat preferences, Orange-crowned Warblers inhabit riparian, coniferous, and deciduous woodlands. This species prefers areas of dense, shrubby foliage, but specific influences of presence and abundance are poorly known.

BBS Data Analysis:

Standard BBS analyses suggest that Orange-crowned Warbler populations have declined (Table 31.1). In the Western BBS region, populations declined significantly over both the long term and during 1984–2001. Data from shrubsteppe physiographic provinces are sparse and statistically unreliable.

Table 31.1. Orange-crowned Warbler population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n[a])		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(188)*	–1.7** *(422)*	–1.2** *(438)*
Columbia Plateau	—	ns[b] *(4)*	ns[b] *(5)*
Great Basin Desert	—	—	—
Basin and Range	—	ns[b] *(3)*	ns[b] *(3)*
Wyoming Basin	ns[b] *(2)*	—	ns[b] *(2)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Our spatial analyses suggest that Orange-crowned Warbler populations are stable. The area predicted to have higher abundances (>1 bird detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions (Fig. 31.2). Routes indicating trends in Orange-crowned Warbler abundances were scattered (Fig. 31.3), except along the coastal lowlands of the Pacific Northwest, where a cluster of routes with declining abundances was evident.

Population Impacts:

Few data are available concerning influences on Orange-crowned Warbler populations. Quantitative data describing suitable breeding habitat are not available. Habitat destruction

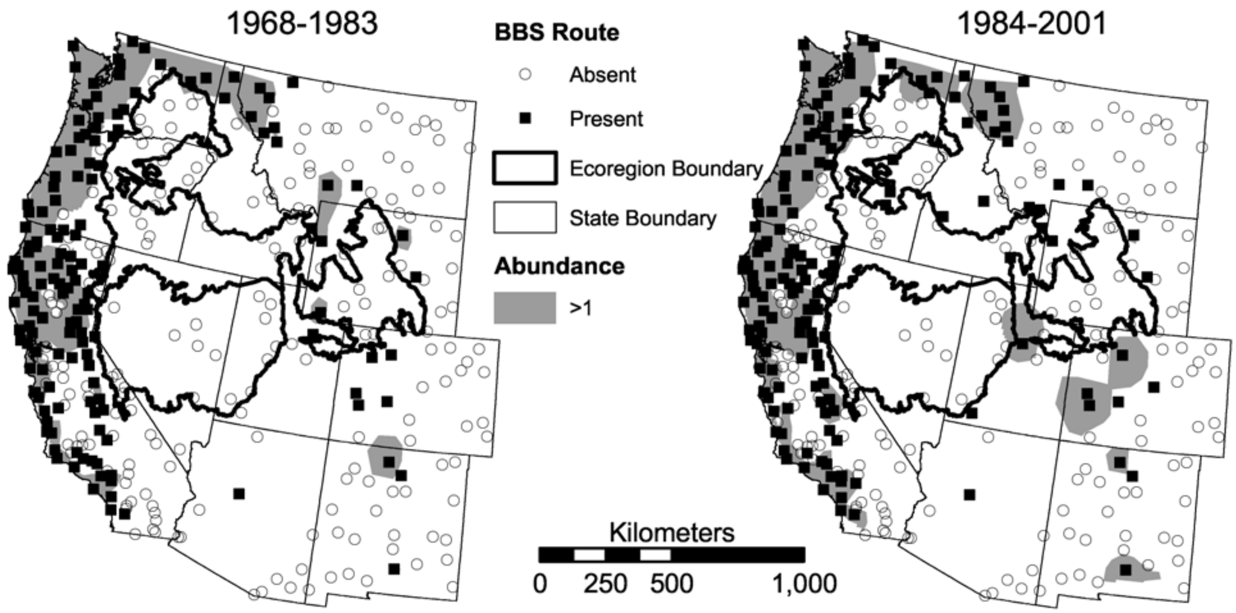


Figure 31.2. Orange-Crowned Warbler distribution on BBS routes during 1968–1983 and 1984–2001. Shading represents potential locations of higher abundance (>1 bird detected) based on natural neighbor analyses of BBS

and degradation likely influence populations most strongly, particularly in more arid landscapes. Livestock grazing in riparian and aspen woodlands and clearcut logging in forested areas negatively affect populations.

State or Federal Status/Listing:

Wyoming: species of concern

Reference:

Sogge, M. K., W. M. Gilbert, and C. van Riper III. 1994. Orange-crowned Warbler (*Vermivora celata*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 101. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

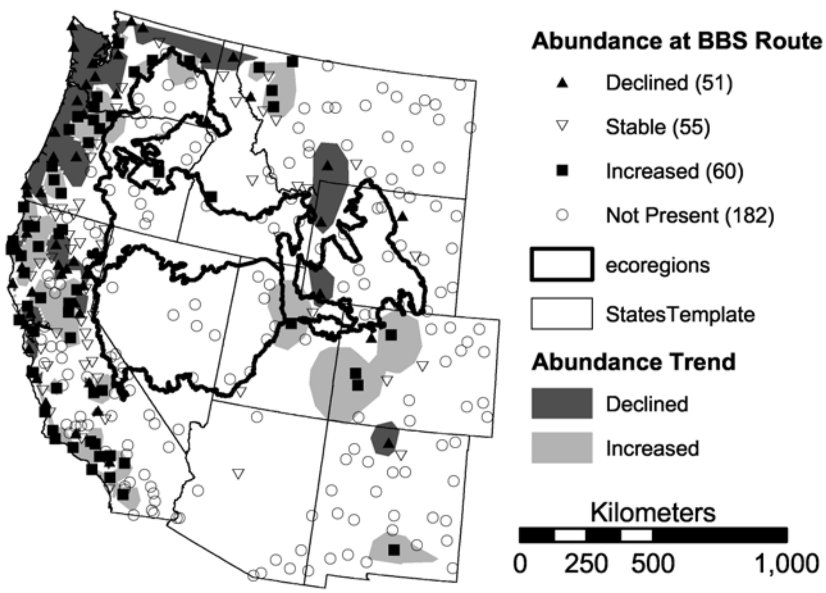


Figure 31.3. Direction of Orange-crowned Warbler detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Nashville Warbler
(*Vermivora ruficapilla*)

Taxonomic Equivalents:

Vermivora ruficapilla ridgwayi

Current and Historical Distribution:

The distribution of Nashville Warblers is split into western and eastern populations (Fig. 32.1). The current distributions of both populations are assumed to be generally similar to historical, but data are lacking.

Habitat Requirements and Associations:

Nashville Warblers prefer areas with extensive shrubby undergrowth, inhabiting deciduous and mixed coniferous forests as well as riparian woodlands. Nests are frequently located in ecotones between woodlands and clearings or openings, often close to water. Specific habitat requirements that influence presence and abundance are not well known.

BBS Data Analysis:

Standard BBS analyses suggest that Nashville Warbler populations are stable (Table 32.1). Data from the Western BBS region showed no significant long or short-term trends. No data are available from the shrubsteppe physiographic provinces.

Our spatial analyses support the conclusion that Nashville Warbler populations are stable. The area predicted to have higher abundances (>1 bird detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions (Fig. 32.2). Routes with increased Nashville Warbler abundances were continuous

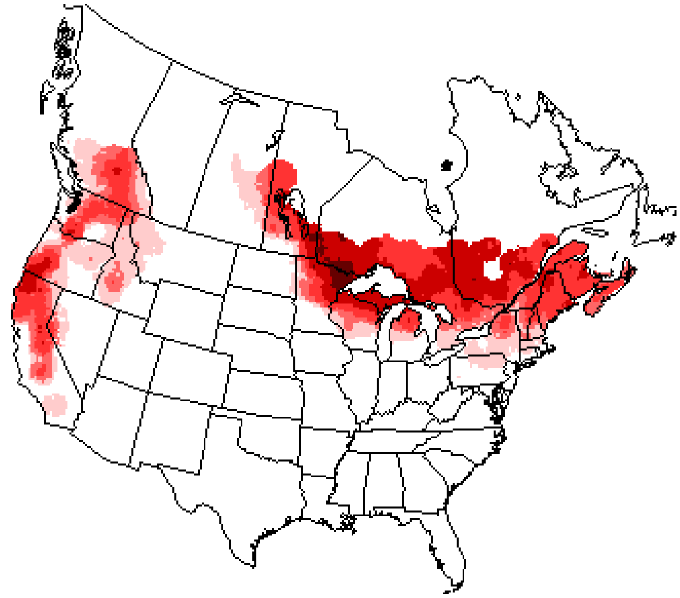


Figure 32.1. Nashville Warbler distribution. Darker shading indicates greater abundance.

Table 32.1. Nashville Warbler population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(82)*	ns *(178)*	ns *(193)*
Columbia Plateau	—	—	—
Great Basin Desert	—	—	—
Basin and Range	—	—	—
Wyoming Basin	—	—	—

[a]Number of BBS routes included in analysis.
$^*P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

along much of the Cascade and Sierra Nevada Ranges, but bounded by areas of declining numbers at the northern and southern ends of this montane region (Fig. 32.3).

Population Impacts:

Nashville Warbler populations may benefit from logging or fire in densely forested areas, by colonizing the regenerating shrub-dominated habitats. As these areas mature, Nashville Warblers abandon them. Conversely, the destruction and degradation of riparian areas and aspen

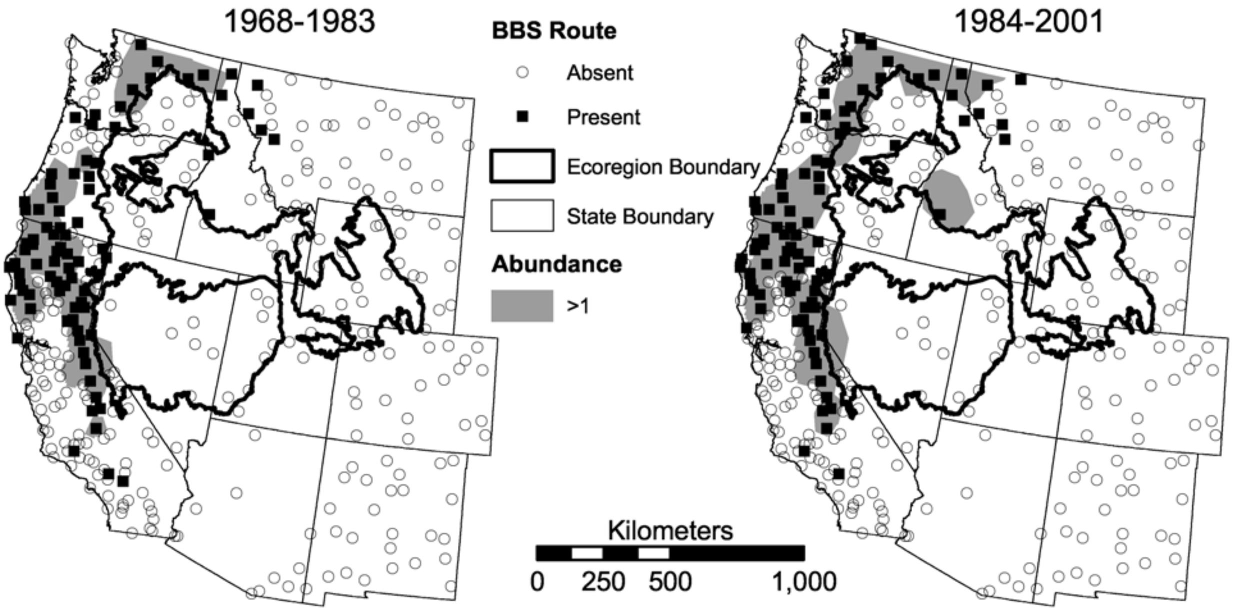


Figure 32.2. Nashville Warbler distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>1 bird detected) based on natural neighbor analyses of BBS routes.

woodlands across the Intermountain West has negatively impacted this species. Agricultural development and livestock grazing are the primary negative influences on riparian habitats in the region. Absence of fire in aspen woodlands has been a major factor in the degradation and loss of these woodlands.

State or Federal Status/Listing:

Not listed by any federal or state agencies in the region of interest.

Reference:

Williams, J. M. 1996. Nashville Warbler (*Verminora ruficapilla*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 205. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

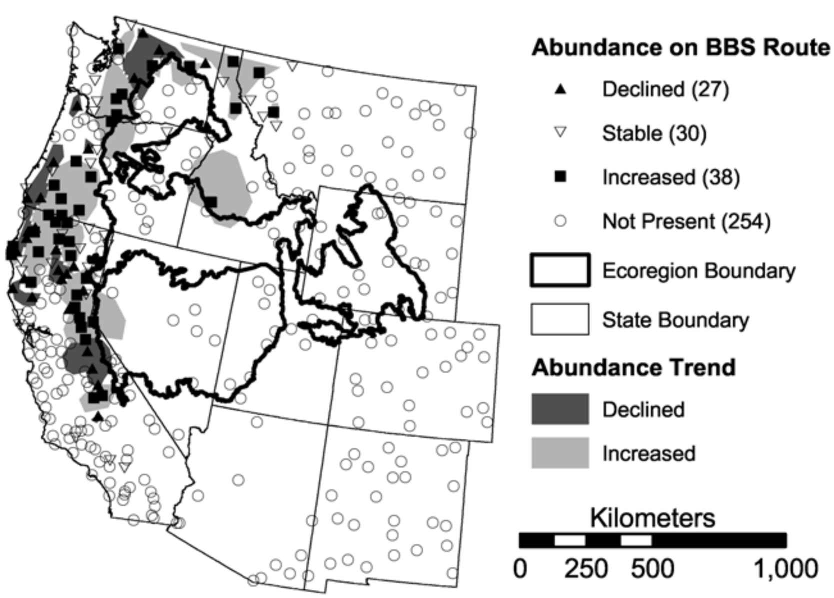


Figure 32.3. Direction of Nashville Warbler detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Yellow Warbler
(*Dendroica petechia*)

Regional Taxonomic Equivalents:

Dendroica petechia morcomi

Current and Historical Distribution:

The current distribution of Yellow Warblers is assumed to be generally similar to historical; no large-scale changes in distribution have been documented (Fig. 33.1). Logging of coniferous forests may benefit this species by creating shrub-dominated successional habitat. Destruction and degradation of riparian and other wetland areas, however, has reduced some populations.

Habitat Requirements and Associations:

The Yellow Warbler is a widely distributed species, inhabiting deciduous thickets, woodlands, and riparian areas. Dense stands of willows and alders characterize preferred nesting habitat. Yellow Warblers avoid nesting in sparse shrub stands and closed-canopy coniferous forests.

BBS Data Analysis:

Standard BBS analyses suggest that Yellow Warbler populations are stable. In the Western BBS region, no significant population trends were evident. Of the shrubsteppe physiographic provinces, only the Wyoming Basin showed a statistically reliable long-term trend, which was positive.

Our spatial analysis supports the conclusion that Yellow Warbler populations are stable. The area predicted to have higher abundances (>5 birds detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions (Fig. 33.2). Routes with similar abundance trends exhibit a complex distribution, with many areas of decline in mountainous terrain (Fig. 33.3).

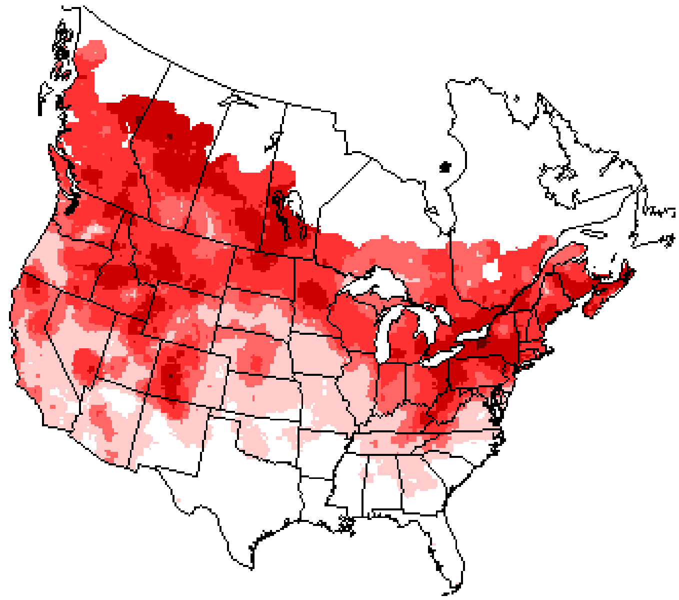


Figure 33.1. Yellow Warbler distribution. Darker shading indicates greater abundance.

Table 33.1. Yellow Warbler population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(337)*	ns *(698)*	ns *(789)*
Columbia Plateau	ns[b] *(8)*	ns *(33)*	ns *(35)*
Great Basin Desert	—	ns[b] *(4)*	ns[b] *(5)*
Basin and Range	–6.2*[b] *(5)*	ns *(25)*	ns *(27)*
Wyoming Basin	ns *(19)*	ns *(31)*	4.6 *(38)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \le 0.05$; $^{**}P \le 0.01$; $^{***}P \le 0.001$; ns = not significant ($P > 0.10$); — = no data.

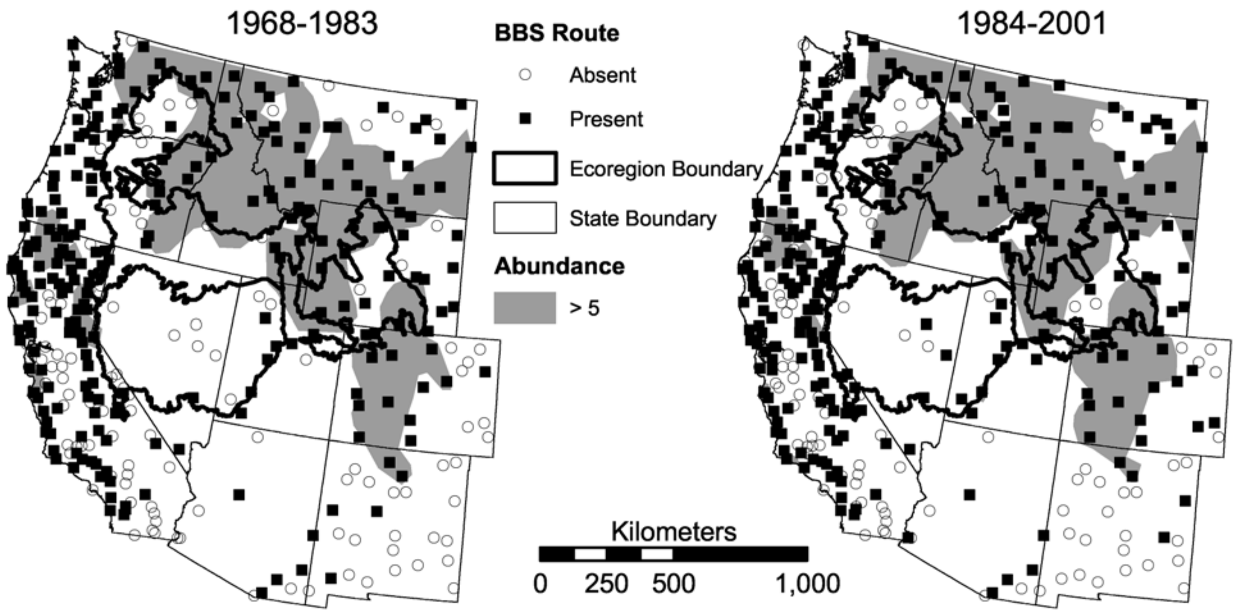


Figure 33.2. Yellow Warbler distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>5 birds detected) based on natural neighbor analyses of BBS routes.

Population Impacts:

Riparian habitat destruction and degradation are the foremost threats to Yellow Warbler populations. Livestock grazing, agricultural development, and exotic plant invasion have degraded riparian habitats across the West. The Yellow Warbler is a frequent cowbird host, and parasitism may influence trends where populations are low.

State or Federal Status/Listing:

Not listed by and federal or state agencies within the region of interest.

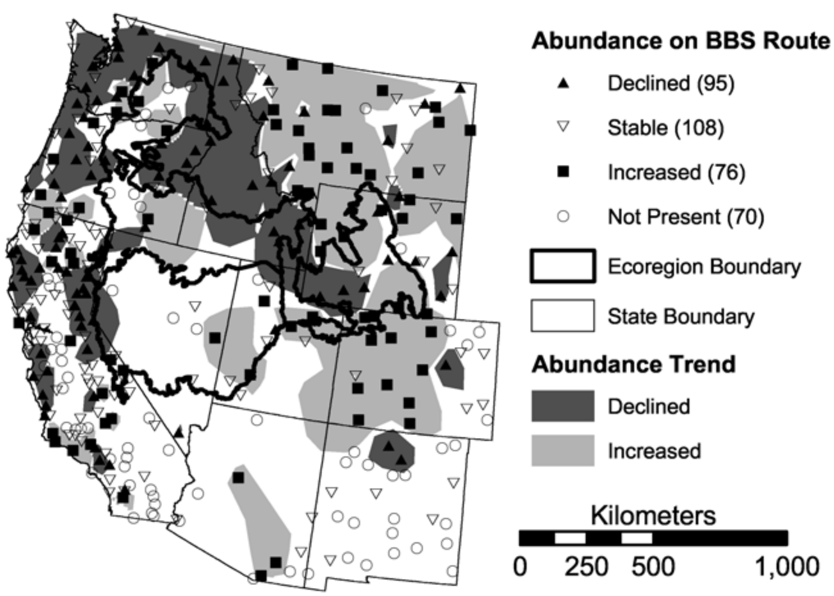


Figure 33.3. Direction of Yellow Warbler detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

References:

Lowther, P. E., C. Celada, N. K. Klein, C. C. Rimmer, and D. A. Spector. 1999. Yellow Warbler (*Dendroica petechia*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 454. The Birds of North America, Inc., Philadelphia, PA.

Schroeder, R. 1982. Habitat suitability index models: Yellow Warbler. USDI Fish and Wildlife Service, FWS/OBS-82/10.27. 7, Fort Collins, CO.

MacGillivray's Warbler (*Oporornis tolmiei*)

Regional Taxonomic Equivalents:

Oporornis tolmiei tolmiei, *Oporornis tolmiei monticola*

Current and Historical Distribution:

MacGillivray's Warblers expanded their distribution into coniferous forest landscapes in recent decades by colonizing the shrub-dominated stages of regenerating forest clearcuts. In the Intermountain West, MacGillivray's Warblers are confined largely to disjunct mountain ranges and riparian corridors. The destruction of riparian areas probably has eliminated this species from many locales in shrubsteppe ecoregions.

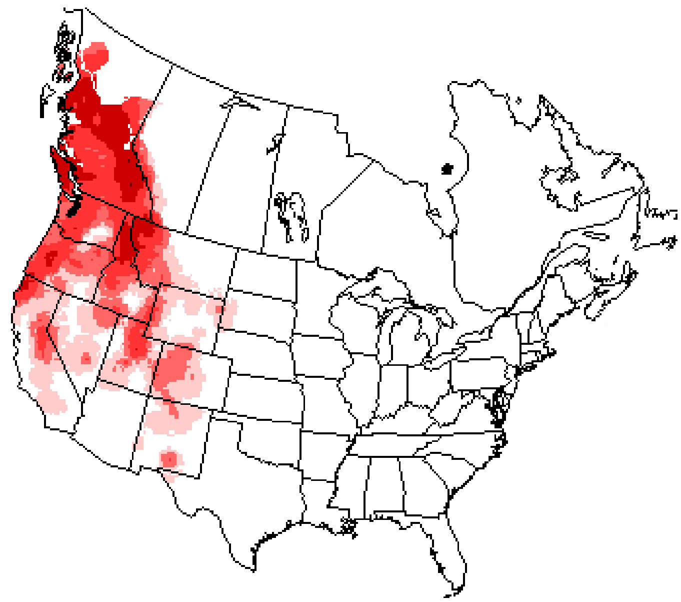


Figure 34.1. MacGillivray's Warbler distribution. Darker shading indicates greater abundance.

Habitat Requirements and Associations:

In northern and mountainous portions of its range, MacGillivray's Warblers use areas with dense undergrowth, such as regenerating clearcuts, brushy hillsides, and mixed deciduous forests. In southern and arid portions of its range, MacGillivray's Warblers use riparian areas and shrub thickets. Specific habitat characteristics that influence MacGillivray's Warbler presence and abundance are poorly known, but dense shrub cover is important.

BBS Data Analysis:

Standard BBS analyses suggest that MacGillivray's Warbler populations are stable. No

Table 34.1. MacGillivray's Warbler population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(158)*	ns *(393)*	ns *(423)*
Columbia Plateau	—	ns[b] *(3)*	ns[b] *(3)*
Great Basin Desert	—	—	—
Basin and Range	—	ns[b] *(7)*	ns[b] *(7)*
Wyoming Basin	—	—	ns[b] *(2)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

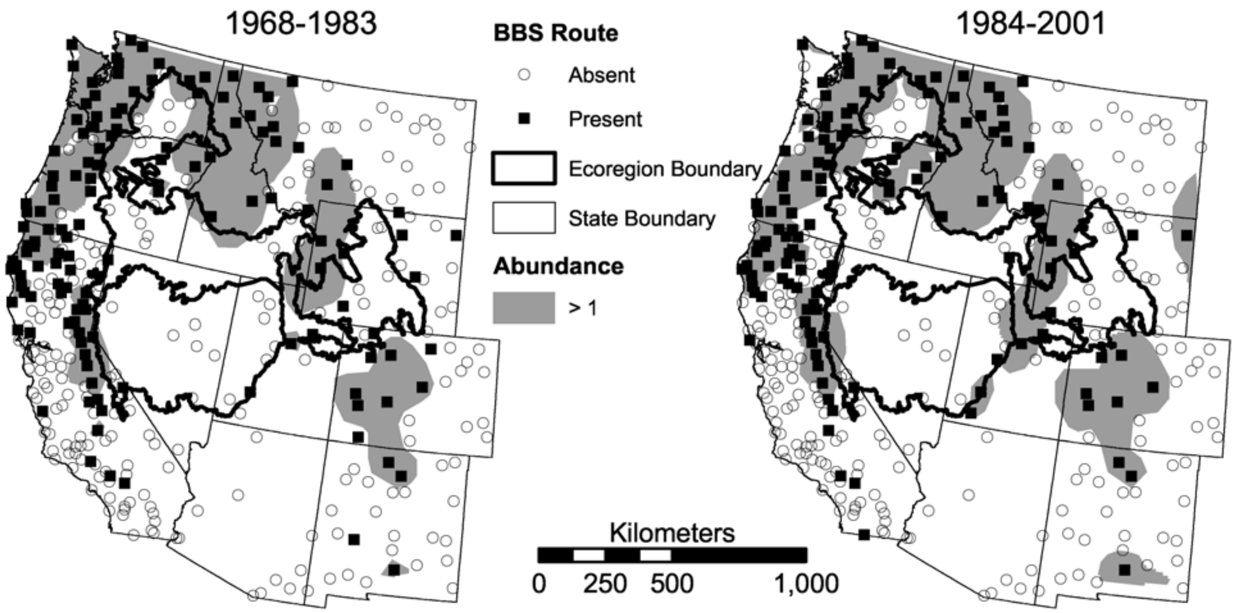


Figure 34.2. MacGillivray's Warbler distribution on BBS routes, 1968–1983 and 1984–2001. Shading represents potential locations of higher abundance (>1 bird detected) based on natural neighbor analyses of BBS routes.

significant long or short-term population trends were evident in the Western BBS region. Data from shrubsteppe physiographic provinces are sparse and statistically unreliable.

Our spatial analyses of BBS data support the conclusion that populations are stable. The area predicted to have higher abundances (>1 bird detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions (Fig. 2). Routes that showed a decline in abundance tended to occur in mountainous areas of the northern U.S. (Fig. 34.3), suggesting a potential common factor influencing these populations.

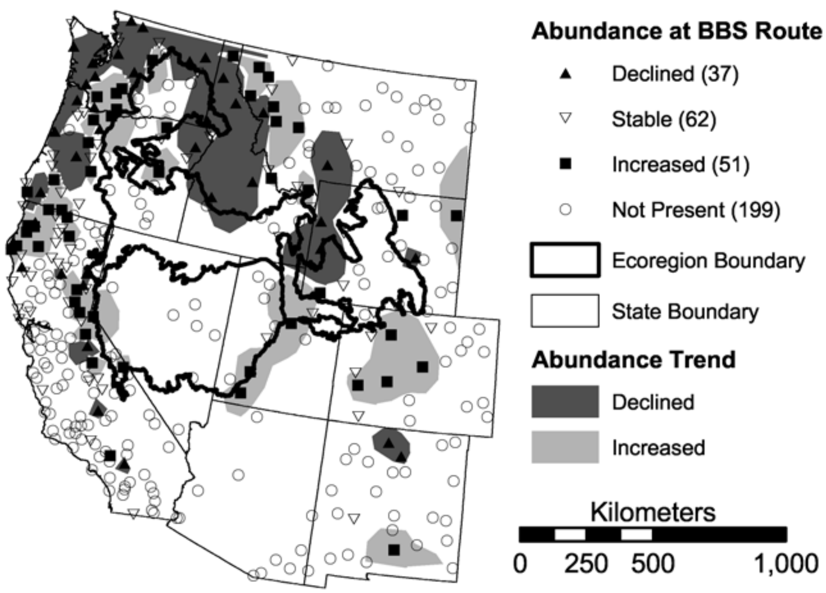


Figure 34.3. Direction of MacGillivray's Warbler detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Population Impacts:

The use of regenerating forest clearcuts by MacGillivray's Warblers has been interpreted to reflect potential population or range expansions, but this hypothesis has not been quantitatively tested. Across the Intermountain West, riparian habitats have been destroyed and degraded by agricultural development and livestock grazing. Loss or thinning of riparian shrub thickets has caused local extirpations of this species from riparian zones in arid and semiarid landscapes.

State or Federal Status/Listing:

Not listed by any federal or state agencies in the region of interest.

Reference:

Pitocchelli, J. 1995. MacGillvray's Warbler (*Oporornis tolmiei*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 159. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC.

Wilson's Warbler
(*Wilsonia pusilla*)

Regional Taxonomic Equivalents:

Wilsonia pusilla pileolata

Current and Historical Distribution:

The current distribution of Wilson's Warblers is assumed to be generally similar to historical (Fig. 35.1); no large-scale changes in distribution have been documented. However, riparian habitat loss and degradation has altered local distributions.

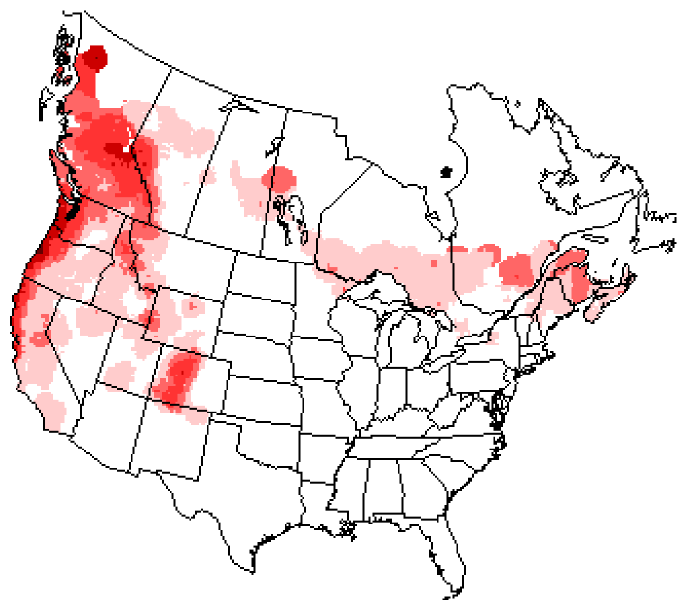


Figure 35.1. Wilson Warbler distribution. Darker shading indicates greater abundance.

Habitat Requirements and Associations:

Wilson's Warblers are found in moist shrub thickets, riparian woodlands, and early successional areas within montane and boreal forests. Preferred breeding habitat consists of dense willow or alder thickets without a dense tree overstory. Presence and abundance are correlated with shrub and deciduous tree cover.

BBS Data Analysis:

Standard BBS analyses suggest that Wilson's Warbler populations have declined (Table 35.1). In the Western BBS region, populations declined significantly both over the long-term and during 1984–2001. Data from the shrubsteppe physiographic provinces are sparse and statistically unreliable.

Our spatial analysis suggests that Wilson's Warbler populations are stable. The area predicted to have higher abundances (>1 bird detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions

(Fig. 35.2). Many routes showed no changes in abundance (Fig. 35.3), but two clusters of routes indicated reduced abundances: one from southwest Oregon through northern California, and a second in western Montana.

Population Impacts:

Research indicates that Wilson's Warbler abundance is correlated with the previous year's nest productivity, suggesting that population declines are influenced mainly by breeding habitat conditions (Chase et al. 1997). Creation of shrub-dominated areas following clearcutting may benefit populations. Activities that reduce or control shrub development, such as herbicide application or heavy livestock grazing, negatively impact populations. Riparian destruction and degradation by livestock grazing, agricultural development, and exotic plant invasion likely underlie population declines in many western areas.

State or Federal Status/Listing:

Not listed by and federal or state agencies in the region of interest.

Table 35.1. Wilson's Warbler population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n[a])		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(184)*	–2.7*** *(337)*	–1.1* *(394)*
Columbia Plateau	—	ns[b] *(5)*	ns[b] *(5)*
Great Basin Desert	—	—	—
Basin and Range	—	ns[b] *(3)*	ns[b] *(3)*
Wyoming Basin	ns[b] *(2)*	ns[b] *(3)*	ns[b] *(4)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

References:

Ammon, E. M., and W. M. Gilbert. 1999. Wilson's Warbler (*Wilsonia pusilla*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 478. The Birds of North America, Inc., Philadelphia, PA.

Chase, M. K., N. Nur, and G. Geupel. 1997. Survival, productivity, and abundance in a Wilson's Warbler population. Auk 114:354–366.

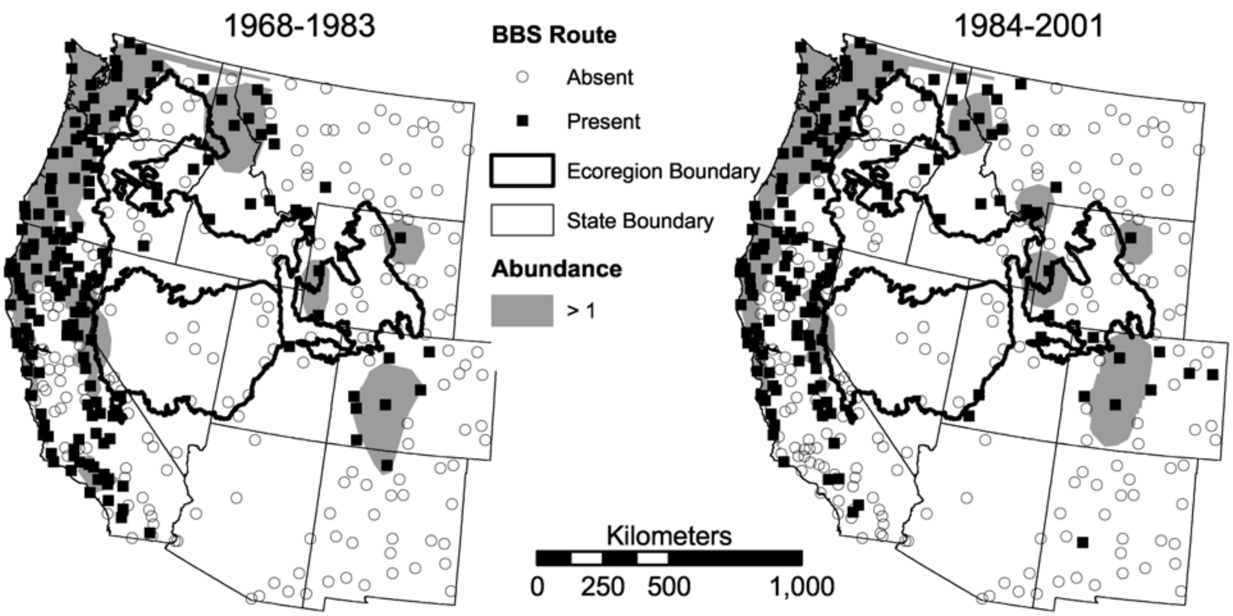


Figure 35.2. Wilson's Warbler distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>1 bird detected) based on natural neighbor analyses of BBS routes.

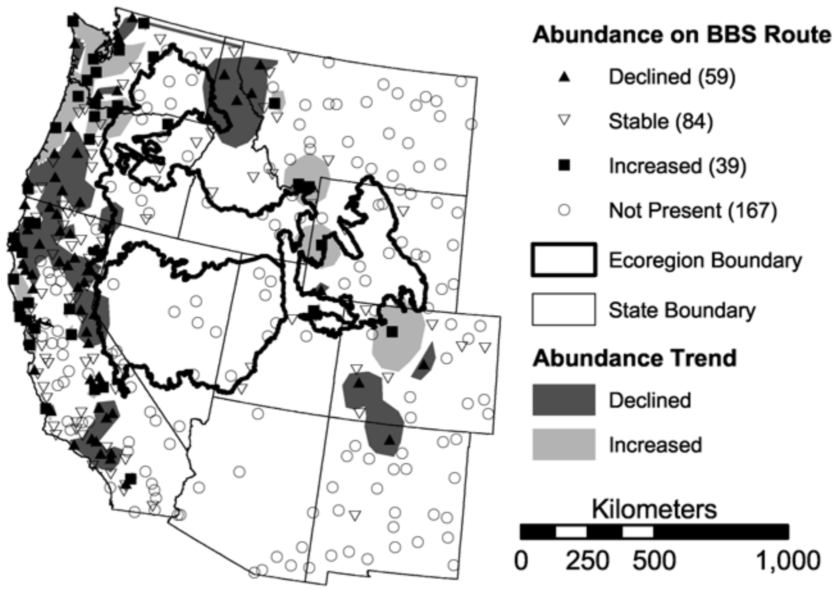


Figure 35.3. Direction of Wilson's Warbler detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Song Sparrow (*Melospiza melodia*)

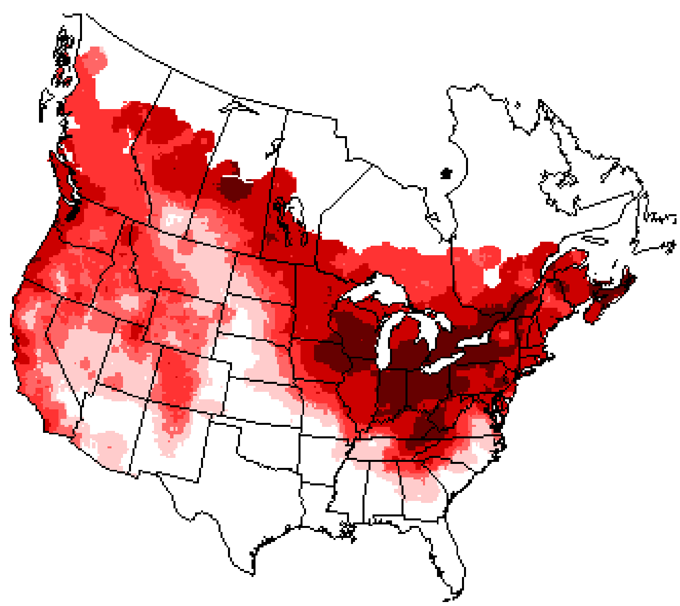


Figure 36.1. Song Sparrow distribution. Darker shading indicates greater abundance.

Regional Taxonomic Equivalents:

Melospiza melodia montana, Melospiza melodia merrilli, Melospiza melodia fallax

Current and Historical Distribution:

The current distribution of Song Sparrows (Fig. 36.1) is assumed to be generally similar to historical; no large-scale changes in range have been documented. Populations in arid regions likely have been locally extirpated due to riparian habitat loss.

Habitat Requirements and Associations:

Song Sparrows are associated with shrubby areas and moist ground. If these general conditions are met, they will inhabit a wide variety of riparian, shrub, and open forest habitats. Dense shrubs and grasses are important habitat characteristics that influence presence and abundance. Water features are locally important as well. Song Sparrows readily use urban habitats and may tolerate considerable human activity.

BBS Data Analysis:

Standard BBS analyses suggest that Song

Sparrow populations have declined slightly (Table 36.1). In the Western BBS region, populations declined during 1968–1983 and 1968–2001. Data from the shrubsteppe physiographic provinces are sparse, but the Basin and Range showed a significant positive population trend overall.

Our spatial analyses suggest that Song Sparrow populations are stable. The area predicted to have higher abundances (>5 birds detected per BBS route) remained stable in both the western states and shrubsteppe ecoregions (Fig. 36.2). The spatial pattern of increases and decreases in Song Sparrow abundance is not readily interpretable (Fig. 36.3).

Table 36.1. Song Sparrow population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n^a)		
	1968–1983	1984–2001	1968–2001
Western BBS Region	–1.8** *(339)*	ns *(723)*	-1.0*** *(784)*
Columbia Plateau	ns *(16)*	ns *(51)*	ns *(53)*
Great Basin Desert	—	ns[b] *(5)*	ns[b] *(5)*
Basin and Range	ns[b] *(6)*	ns *(24)*	10.0* *(25)*
Wyoming Basin	ns[b] *(9)*	ns *(25)*	ns *(30)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
$^{*}P \leq 0.05$; $^{**}P \leq 0.01$; $^{***}P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

Population Impacts:

Riparian habitat destruction and degradation are the greatest threats to Song Sparrow populations. In arid and semiarid parts of the Intermountain West, where suitable habitat is limited to riparian areas, livestock grazing and agricultural development have exerted a strongly negative influence on populations. Nest predation and parasitism are significant negative influences on local populations in areas where favored habitats have been disrupted.

State or Federal Status/Listing:

Not listed by any federal or state agencies in the region of interest.

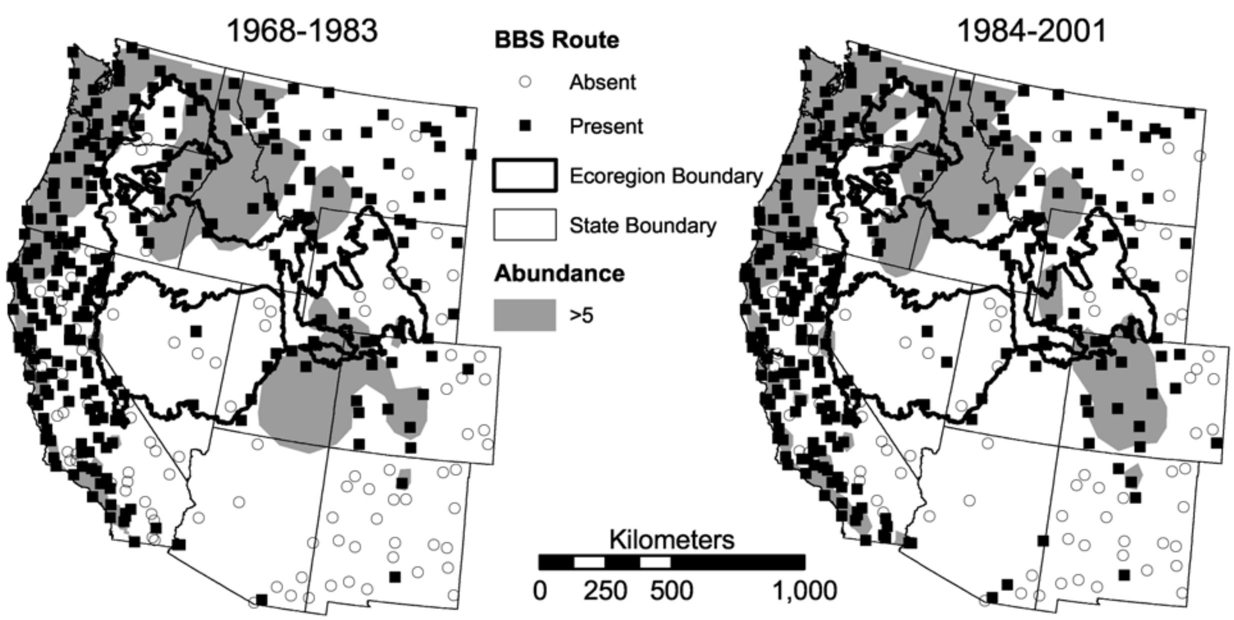


Figure 36.2. Song Sparrow distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>5 birds detected) based on natural neighbor analyses of BBS routes.

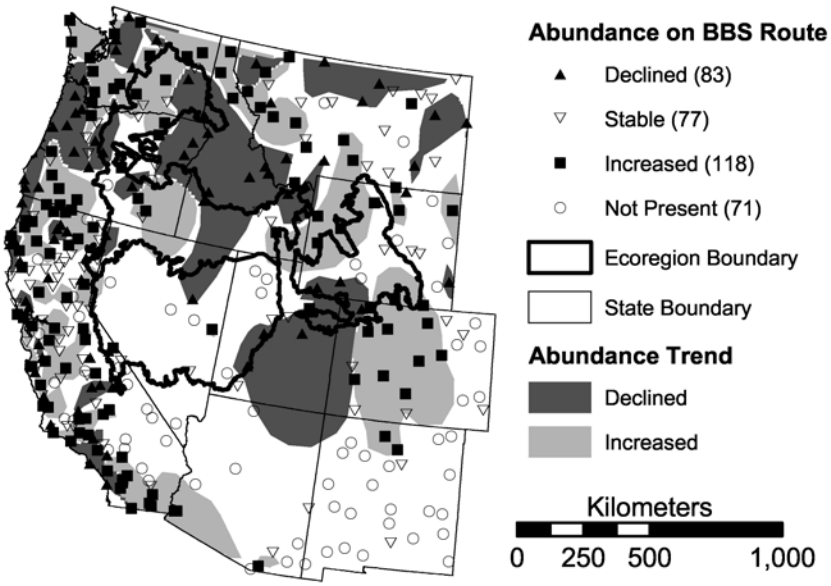


Figure 36.3. Direction of Song Sparrow detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

References:

Arcese, P., M. K. Sogge, A. Marr, and M. A. Patten. 2002. Song Sparrow (*Melospiza melodia*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 704. The Birds of North America, Inc, Philadelphia, PA.

Bullock's Oriole
(*Icterus bullockii*)

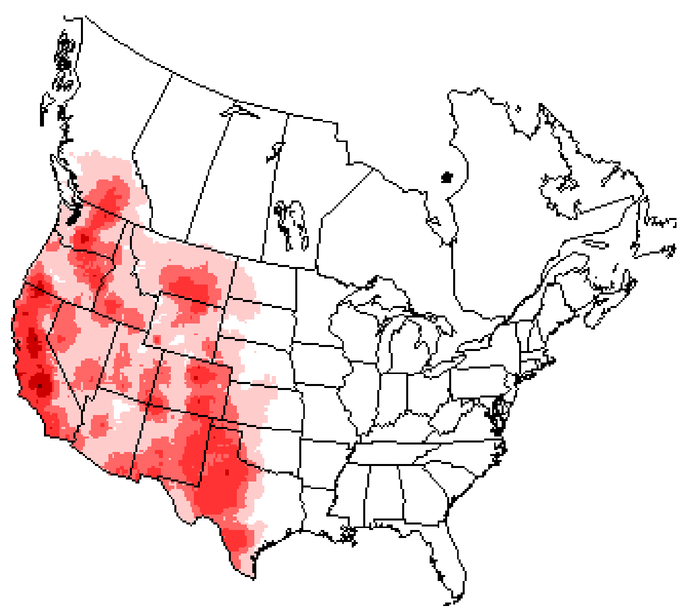


Figure 37.1. Bullock's Oriole distribution. Darker shading indicates greater abundance.

Regional Taxonomic Equivalents:

Icterus bullockii parvus

Current and Historical Distribution:

The current distribution of Bullock's Orioles is generally assumed to be similar to historical; no large-scale changes in distribution have been documented (Fig. 37.1). Local distributions have changed, primarily due to riparian habitat destruction and creation of shelterbelts and windrows.

Habitat Requirements and Associations:

Bullock's Orioles inhabit deciduous and riparian woodlands and often use shelterbelts and windrows around urban or agricultural areas. Relationships between specific habitat characteristics and Bullock's Oriole presence and abundance are poorly known, but tree density and appropriate habitat adjacent to agricultural lands are thought to be influential.

BBS Data Analysis:

Standard BBS analyses suggest that Bullock's Oriole populations in the Western BBS region have declined significantly both over the long term and during 1984–2001 (Table 37.1). These trends are driven primarily by data from California, where population declines were highly significant over the long term (–1.8% per year, $P < 0.001$). No other western state nor any of the shrubsteppe physiographic provinces exhibited significant population trends in any period.

Our spatial analysis of BBS data suggest that Bullock's Oriole populations are stable or increasing. The area predicted to have higher abundances (>2.5 birds detected per BBS route) remained stable in the western states and increased by 5% in the shrubsteppe ecoregions (Fig. 37.2). With the exception of a cluster of routes in California where abundances declined, routes showing increased and decreased Bullock's Oriole abundances are intermixed and patchy (Fig. 37.3).

Table 37.1. Bullock's Oriole population trends (% change per year) as calculated by standard BBS analysis.

	Population % change (n[a])		
	1968–1983	1984–2001	1968–2001
Western BBS Region	ns *(248)*	–1.6*** *(452)*	–1.0* *(510)*
Columbia Plateau	ns *(14)*	ns *(46)*	ns *(49)*
Great Basin Desert	ns[b] *(5)*	ns[b] *(8)*	ns[b] *(10)*
Basin and Range	ns[b] *(10)*	ns *(23)*	ns *(27)*
Wyoming Basin	ns[b] *(5)*	ns *(18)*	ns *(19)*

[a]Number of BBS routes included in analysis.
[b]Low sample size makes result statistically suspect.
*$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$; ns = not significant ($P > 0.10$); — = no data.

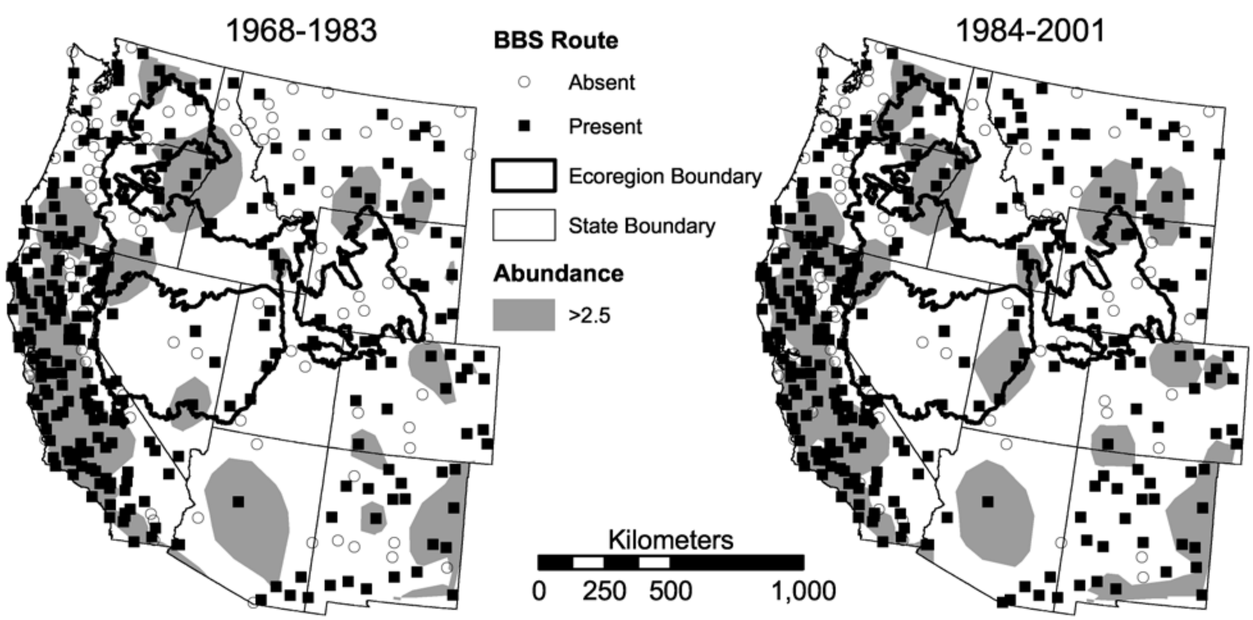


Figure 37.2. Bullock's Oriole distribution on BBS routes during 1968–1983 and 1984–2001. Shaded areas represent potential locations of higher abundance (>2.5 birds detected) based on natural neighbor analyses of BBS routes.

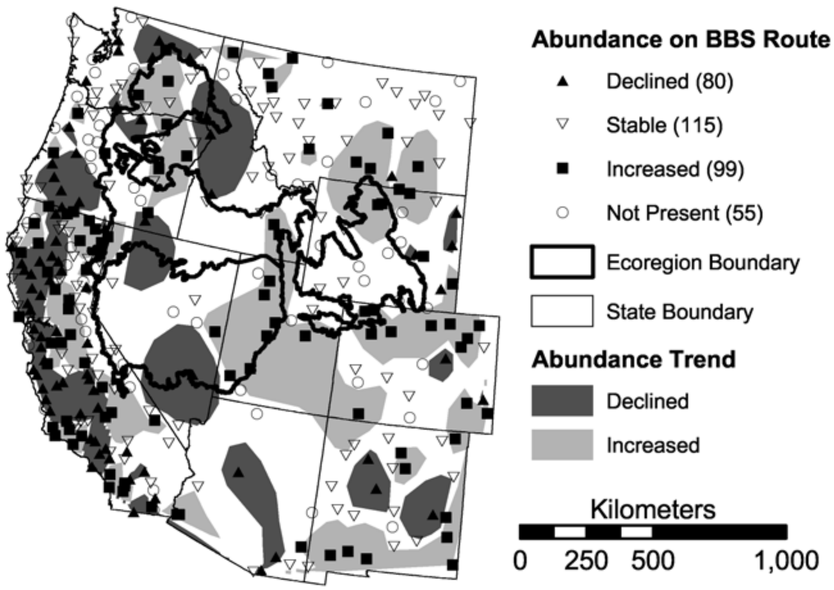


Figure 37.3. Direction of Bullock's Oriole detection frequencies on BBS routes compared between the periods 1968–1983 and 1984–2001. Shaded areas depict spatial linkages among routes with similar trends.

Population Impacts:

Loss and degradation of riparian habitats are the greatest threats to Bullock's Oriole populations. Livestock grazing, agricultural development, and exotic plant invasion have negatively impacted many riparian areas across the West. Conversely, the creation of shelterbelts and windrows has benefited populations in some locations. Pesticides may pose a significant problem for Bullock's Oriole populations in agricultural areas.

State or Federal Status/Listing:

Not listed by any federal or state agencies in the region of interest.

Reference:

Rising, J. D., and P. L. Williams. 1999. Bullock's Oriole (*Icterus bullockii*). *In* A. Poole and F. Gill [eds.], The birds of North America, No. 416. The Birds of North America, Inc., Philadelphia, PA.

SPECIES ACCOUNTS

MAMMALS OF SHRUBSTEPPE LANDSCAPES

Merriam's Shrew
(*Sorex merriami*)

Current and Historical Distribution:

The current distribution of Merriam's shrews is assumed generally similar to historical, but contemporary distribution data are sparse. In a review of the available scientific literature, Merriam's shrews were reported at eight locations. Based on known natural history traits and presumed distribution, 39 additional locations could have had Merriam's shrews, but did not (Fig. 38.1).

Habitat Requirements and Associations:

Merriam's shrews occupy drier habitats than other members of the genus *Sorex*. They have been caught most frequently in sagebrush habitats, but also occur in grasslands, mountain mahogany, rabbitbrush, bitterbrush, spiny hopsage, wet meadows, and conifer woodlands. Merriam's shrews are often found in habitats that contain sagebrush voles (*Lemmiscus curtatus*) or montane voles (*Microtus montanus*). However, research suggests that preferred habitat conditions, although poorly known, are not as xeric as those preferred by sagebrush voles, nor as mesic as those of montane voles.

Population Data:

Columbia Plateau Ecoregion:

Gitzen et al. (2001) trapped small mammals at 51 locations on and near the Hanford Nuclear Site in south-central Washington. Nine plant associations were sampled, including native and exotic grasslands and a variety of shrubsteppe areas, but in >21,000 trap nights (including 839 pitfall nights) no Merriam's shrews were caught.

Mullican (1996) reported that three Merriam's shrews were caught in 12,392 live-trap nights while studying sagebrush voles inhabiting "sagebrush-grassland habitat" on the Idaho National Engineering and Environmental Laboratory (INEEL). Mullican also reported six additional Merriam's shrews were trapped in 41,875 snap-trap nights in a long-term project investigating INEEL small-mammal populations.

Great Basin Ecoregion:

Ports and McAdoo (1986) caught a total of 23 Merriam's shrews over a four-year period of trapping multiple shrubsteppe and mountain shrub locations in Elko County, Nevada. Total number of trap nights is unknown.

Wyoming Basin Ecoregion:

Brown (1967a) documented the ecological distribution of six shrew species in 14 plant associations of southeastern Wyoming. Merriam's shrews were confined to low elevation, arid sites with shortgrass prairie, shrubsteppe, and mountain mahogany vegetation.

Kirkland et al. (1997) sampled the soricid community of shrubsteppe habitats in southwestern Wyoming. Although Merriam's shrews were the third most frequently trapped species, they comprised only 9% of the total catch. Only 15 Merriam's shrews were caught in 514,060 pit-trap nights.

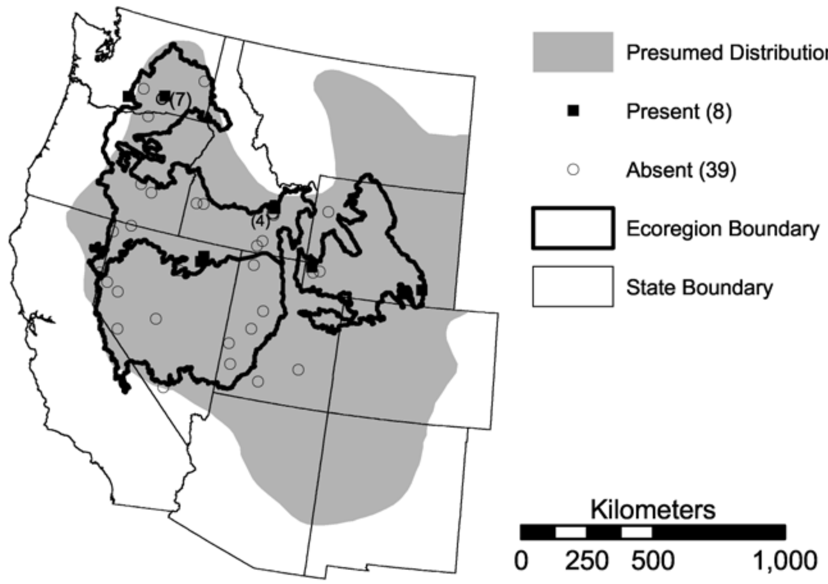


Figure 38.1. Presumed distribution of Merriam's shrew in the western United States (after Hall 1981). Filled squares represent literature sources reporting the species present, unfilled circles represent study localities within the species' range, but where the species was not found. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.

Population Impacts:

Merriam's shrews are rare at most locations. Even in areas where they are known to occur, several hundred trap-nights are required to catch a specimen. Influences on populations are unknown. Durrant and Lee (1955) made the anecdotal observation that the rarity of this species may be exacerbated by overgrazing. While this idea has never been investigated, livestock grazing has been documented to negatively affect other *Sorex* species in a variety of habitats through soil compaction, litter layer reduction, and microhabitat alteration (Whitaker et al. 1983). Other potential impacts to Merriam's shrew populations include agricultural conversion, frequent fire, and exotic plant invasion.

State or Federal Status/Listing:

Washington: species of concern

Map Localities:

Data in Figure 38.1 were compiled from Allred 1973, Brown 1967a, Ports and George 1990, Ports and McAdoo 1986, Wander and Carey 1994, Kirkland et al. 1997, and Gitzen et al. 2001.

References:

Allred, D. M. 1973. Small mammals of the National Reactor Testing Station, Idaho. Great Basin Naturalist 33:246–250.

Armstrong, D. M., and J. K. Jones, Jr. 1971. *Sorex merriami*. Mammalian Species 2:1–2.

Brown, L. N. 1967a. Ecological distribution of mice in the Medicine Bow Mountains of Wyoming. Ecology 48:677-680.

Durrant, S. D., and M. R. Lee. 1955. Rare shrews from Utah and Wyoming. Journal of Mammalogy 36: 560–561.

Gitzen, R. A., S. D. West, and B. E. Trim. 2001. Additional information in the distributions of small mammals at the Hanford Site, Washington. Northwest Science 75:350–362.

Hall, E. 1981. The mammals of North America. John Wiley and Sons, New York.

Kirkland, G. L. J., R. P. Parmenter, and R. E. Skoog. 1997. A five-species assemblage of shrews from the sagebrush-steppe of Wyoming. Journal of Mammalogy 78:83–89.

Mullican, T. R. 1986. Additional records of *Sorex merriami* for Idaho. Murrelet 67:19–20.

Ports, M. A., and S. B. George. 1990. *Sorex preblei* in the northern Great Basin. Great Basin Naturalist 50: 93–95.

Ports, M. A., and J. K. McAdoo. 1986. *Sorex merriami* (Insectivora: Soricidae) in eastern Nevada. Southwestern Naturalist 31:415–416.

Verts, B., and L. Carraway. 1998. Land mammals of Oregon. University of California, Berkeley, CA.

Wander, L., and A. B. Carey. 1994. Merriam's shrew and small mammal communities in the Yakima Training Center, Washington. Northwest Science 68:159.

Whitaker, J. O., S. P. Cross, and C. Maser. 1983. Food of vagrant shrews (*Sorex vagrans*) from Grant County, Oregon, as related to livestock grazing pressure. Northwest Science 57:107–111.

Preble's Shrew
(*Sorex preblei*)

Current and Historical Distribution:

The current distribution of Preble's shrew is assumed generally similar to historical, but there are few contemporary distribution data. In a review of the available scientific literature, Preble's shrews were reported at 12 locations. Based on known natural history traits and presumed distribution, 36 additional locations could have had Preble's shrews, but did not (Fig. 39.1).

Habitat Requirements and Associations:

Preble's shrew is one of the least known small mammal species in the western U.S. Most distribution records come from arid and semiarid shrubsteppe habitats. However, this species does not seem to be restricted to these habitats, since it has been found in coniferous and deciduous woodlands, marshes, and wooded riparian areas. Habitat characteristics that influence presence and abundance are not known.

Population Data:

Specimens of Preble's shrews are rare; as of 1989, only 35 were recorded in the literature. Although a few more records have accumulated in recent years, they support the conclusion that Preble's shrews are rare throughout their range.

Columbia Plateau Ecoregion:

No data reported

Great Basin Ecoregion:

No data reported.

Wyoming Basin Ecoregion

Kirkland et al. (1997) sampled the soricid community of shrubsteppe habitats of southwest Wyoming and found Preble's shrews to be the rarest species present. Seven individuals were trapped in 514,060 pit-trap nights; these composed 4% of the total number of shrews caught.

Brown (1967b) documented the ecological distribution of six shrew species in 14 plant associations of southeast Wyoming. However, in over 30,000 pit-trap nights, not a single Preble's shrew was caught.

Population Impacts:

Almost nothing is known about the natural history and population dynamics of Preble's shrew. Shrews in general are typically associated with moist areas and deep litter layers that provide dependable sources of soil- and ground-dwelling invertebrates. Soil compaction, litter layer reduction, and microhabitat alteration are all potential adverse influences of populations through mechanisms such as livestock grazing, fire, exotic plant invasion, and habitat conversion.

State or Federal Status/Listing:

Federal: species of concern (USDI Bureau of Land Management: Nevada)

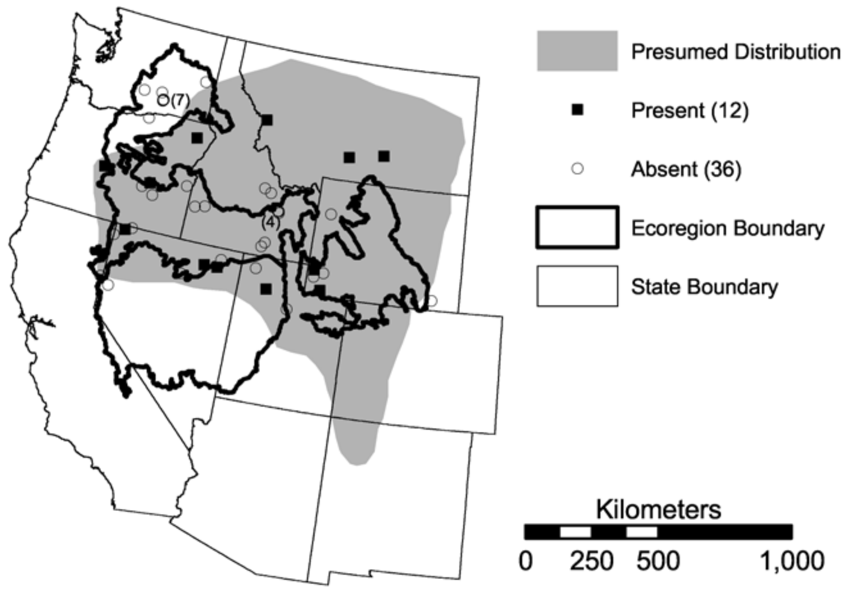


Figure 39.1. Presumed distribution of Preble's shrews in the western United States (after Verts and Carraway 1998). Filled squares represent literature sources reporting the species present, unfilled circles represent study localities within the species' range, but where the species was not found. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.

Nevada: species of concern
Wyoming: species of concern

Map Localities:

Data in Figure 39.1 were compiled from Verts 1975, Hoffman and Fisher 1978, Tomasi and Hoffman 1984, Ports and George 1990, and Kirkland et al. 1997.

References:

Brown, L. N. 1967b. Ecological distribution of six species of shrews and comparison of sampling methods in the Central Rocky Mountains. Journal of Mammalogy 48:617–623.

Cornely, J. E., L. Carraway, and B. Verts. 1992. *Sorex preblei*. Mammalian Species 416:1–3.

Hoffman, R. S., and R. D. Fisher. 1978. Additional distributional records of Preble's shrew (*Sorex preblei*). Journal of Mammalogy 59:883–884.

Kirkland, G. L. J., R. P. Parmenter, and R. E. Skoog. 1997. A five-species assemblage of shrews from the sagebrush-steppe of Wyoming. Journal of Mammalogy 78:83–89.

Ports, M. A., and S. B. George. 1990. *Sorex preblei* in the northern Great Basin. Great Basin Naturalist 50: 93–95.

Tomasi, T. E., and R. S. Hoffman. 1984. *Sorex preblei* in Utah and Wyoming. Journal of Mammalogy 65:708.

Verts, B. 1975. New records for three uncommon mammals in Oregon. Murrelet 56:22–23.

Verts, B., and L. Carraway. 1998. Land mammals of Oregon. University of California, Berkeley, CA.

Spotted Bat
(*Euderma maculatum*)

Current and Historical Distribution:

The current distribution of spotted bats is poorly known and is assumed generally similar to historical. The presumed distribution spans much of the interior West (Fig. 40.1). However, two studies (Fenton et al. 1987, Pierson and Rainey 1998) demonstrated that distribution is both more extensive and more fragmented than previously presumed.

In a review of the available scientific literature, spotted bats were reported at 17 locations (excluding data from Pierson and Rainey 1998, all of which are outside the ecoregions of interest). Based on known natural history traits and presumed distribution, up to 71 additional locations could have had spotted bats but did not (Fig. 40.1).

Habitat Requirements and Associations:

The spotted bat is a patchily distributed, rare species, found in a wide variety of habitats and elevations. Spotted bats have been found in shrubsteppe, riparian and montane meadows, and coniferous forests (particularly ponderosa pine). Elevations where the species occurs extend from –57 m to nearly 3000 m. Proper environmental conditions for roosts, maternity colonies, and hibernacula are potential controlling factors that regulate presence in a habitat or location. However, details about these microhabitat requirements are largely unknown.

Population Data:

Columbia Plateau Ecoregion:

Fenton et al. (1987) sampled 77 areas across the western U.S. where spotted bats "had been reported to or might occur." Spotted bats were absent from 50 areas with no historical presence, absent from 17 areas where historically present, and found in eight areas where historically present and in two additional areas representing modest range extensions (Fig. 40.1).

Great Basin Ecoregion:

Oliver (2000) summarized the available data for spotted bats in Utah and concluded that the species was very infrequently captured and considered rare. In only one of 11 studies did spotted bats account for >2% of all bats captured.

Ports and Bradley (1996) trapped bats at 33 locations across eastern Nevada but failed to capture a single spotted bat in 144 trap nights.

Alcorn (1944) examined 85 mine tunnels and eight caves in central and west-central Nevada and failed to find any hibernating spotted bats.

Kuenzli et al. (1999) trapped spotted bats at five of 18 sites (28%) surveyed in southwest Nevada; however they accounted for only 1% of all bats captured. Locations occupied by spotted bats were characterized by desert shrub and juniper habitats that surrounded water sources. No spotted bats were found near streams surrounded by deciduous trees. No hibernating spotted bats were found in a survey of 70 mines.

Szewczak et al. (1998) surveyed two natural

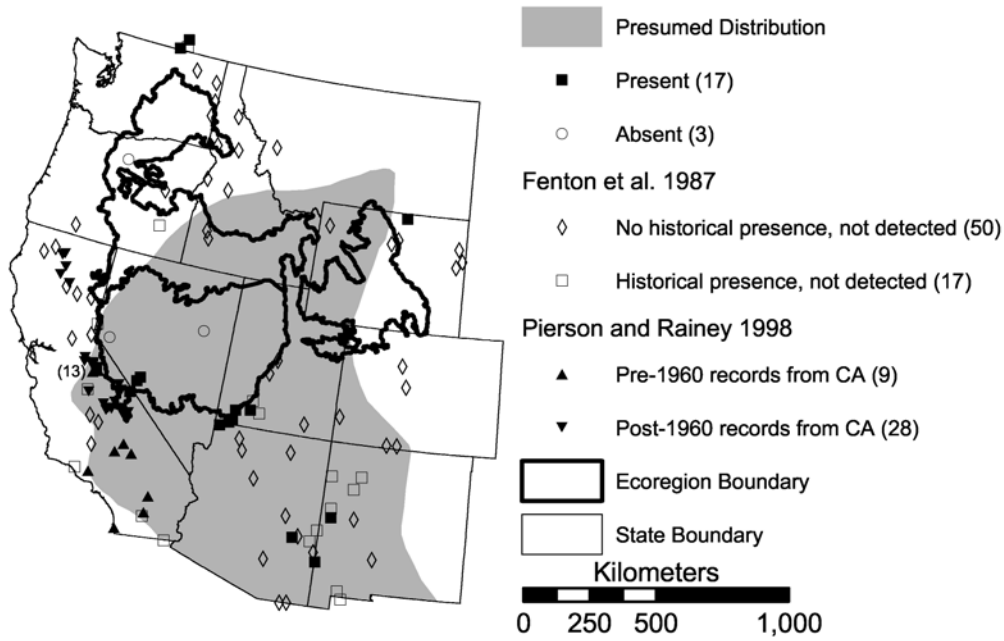


Figure 40.1. Presumed distribution of spotted bats in the western United States (after Hall 1981; distribution continues south through much of Mexico). Filled symbols represent literature sources reporting the species present; unfilled symbols represent study locations within the species' range, but where the species was not found. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.

caves and 260 mines in the White-Inyo Mountains of southwest Nevada and California but failed to detect any hibernating spotted bats. However, spotted bats were detected in Mojave mixed desert shrub, Great Basin desert shrub, and pinyon-juniper woodland, particularly near riparian areas. They were not found in bristlecone-limber pine forest or alpine areas. Spotted bats composed 4% of the total bats observed.

Wyoming Basin Ecoregion:

No data reported

Population Impacts:

It is generally assumed that spotted bats always have been rare. However, because spotted bats forage high above the ground, making them hard to detect or to catch in mist nets, populations could be larger than expected.

Population trends and impacts to spotted bats are virtually unknown. It is hypothesized that spotted bats are cliff-roosting obligates and that populations may be limited by suitable roost sites. However, the microclimate conditions necessary for occupation are not known. Prey availability and habitat degradation have also been suggested as potential population impacts. Anecdotal evidence suggests that spotted bats are highly sensitive to disturbance by people. The migration and wintering ecology of this species are unknown, but probably play an important role in population dynamics.

State or Federal Status/Listing:

Federal: species of concern (USDA Forest Service: Intermountain Region, Pacific Region, Rocky Mountain Region; USDI Bureau of Land Management: Idaho, Nevada, Utah, Wyoming)

California: species of concern
Idaho: species of concern
Nevada: species of concern
Utah: species of concern
Wyoming: species of concern

Map Localities:

Data in Figure 40.1 were compiled from Poché and Bailie 1974, Ruffner et al. 1979, Fenton et al. 1987, Navo et al. 1992, Storz 1995, Pierson and Rainey 1998, Szewczak et al. 1998, and Kuenzli et al. 1999.

References:

Alcorn, J. 1944. Notes on the winter occurrence of bats in Nevada. Journal of Mammalogy 25:308–310.

Fenton, M., D. Tennant, and J. Wyszecki. 1987. Using echolocation calls to measure the distribution of bats: the case of *Euderma maculatum*. Journal of Mammalogy 68:142–144.

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Kuenzli, A. J., G. T. Downard, and M. L. Morrison. 1999. Bat distribution and hibernacula use in west central Nevada. Great Basin Naturalist 59:213–220.

Leonard, M., and M. Fenton. 1983. Habitat use by spotted bats (*Euderma maculatum*, Chiroptera: Verspertilionidae): roosting and foraging behaviour. Canadian Journal of Zoology 61:1487–1491.

Navo, K. W., J. A. Gore, and G. T. Skiba. 1992. Observations on the spotted bat, *Euderma maculatum*, in northwestern Colorado. Journal of Mammalogy 73: 547–551.

Oliver, G. V. 2000. The bats of Utah: a literature review. Utah Division of Wildlife Resources Publication No. 00-14, Salt Lake City, UT.

Pierson, E. D., and W. E. Rainey. 1998. Distribution of the spotted bat, *Euderma maculatum*, in California. Journal of Mammalogy 79:1296–1305.

Poché, R., and G. Bailie. 1974. Notes on the spotted bat (*Euderma maculatum*) from southwest Utah. Great Basin Naturalist 34:254–256.

Ports, M., A., and P. V. Bradley. 1996. Habitat affinities of bats from northeastern Nevada. Great Basin Naturalist 56:48–53.

Ruffner, G., R. Poché, M. Meierkord, and J. Neal. 1979. Winter bat activity over a desert wash in southwestern Utah. Southwestern Naturalist 24:447–453.

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Szewczak, J. M., S. M. Szewczak, M. L. Morrison, and L. S. Hall. 1998. Bats of the White and Inyo Mountains of California-Nevada. Great Basin Naturalist 58: 66–75.

Wai-Ping, V., and M. B. Fenton. 1989. Ecology of spotted bat (*Euderma maculatum*) roosting and foraging behavior. Journal of Mammalogy 70:617–622.

Watkins, L. C. 1977. *Euderma maculatum*. Mammalian Species 77:1–4.

Pallid Bat
(*Antrozous pallidus*)

Current and Historical Distribution:

The current distribution of pallid pats is poorly known but it is assumed generally similar to historical (Fig. 41.1). Documented breeding in south-central Idaho and records from Montana suggest that the species may be more widespread than thought previously (Genter and Jurist 1995). In a review of the available scientific literature, pallid bats were reported at eight locations. Based on known natural history traits and presumed distribution, five additional locations could have had pallid bats but did not (Fig. 41.1).

Habitat Requirements and Associations:

Pallid bats most commonly occur in rocky, arid habitats, such as shrubsteppe and pinyon-juniper (Hermanson and O'Shea 1983, Verts and Carraway 1998). However, they also have been documented in coniferous and mixed

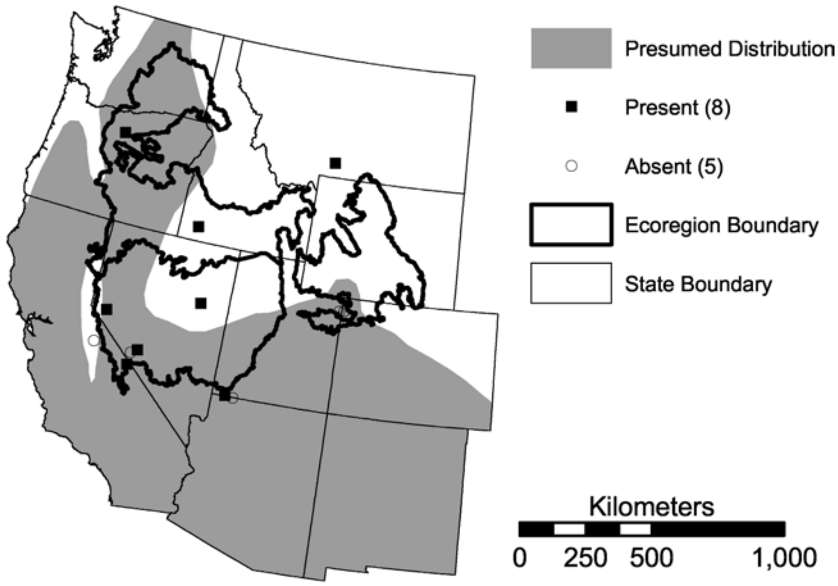

Figure 41.1. Presumed distribution of pallid bats in the western United States (after Hall 1981, distribution continues south through much of Mexico and western Texas). Filled squares represent literature sources reporting the species present, unfilled circles represent study localities within the species' range, but where the species was not found. See text (Map Localities) for data sources.

coniferous–deciduous forests, lowland riparian habitat, and mountain meadows. Although pallid bats primarily roost in rock crevices, they may readily use caves, mines, and human-built structures. Specific habitat and roost microclimate characteristics that influence presence and abundance are not known, but microclimatic conditions affect parturition dates and decrease body mass of lactating females (Lewis 1993). Climatic characteristics likely play an important role in distribution and population regulation.

Population Data:

Columbia Plateau Ecoregion:

No data reported.

Great Basin Ecoregion:

Oliver (2000) summarized the available data for pallid bats in Utah and concluded that the species was "fairly common," regularly numbering among the three most common species at low elevations, but rarer at higher elevations. Pallid bats accounted for ≤5% of all bats captured in five of the10 studies reviewed, and composed a maximum of 15% of bats captured in any one study.

Ports and Bradley (1996) trapped pallid bats at four of 33 locations in northeastern Nevada. They caught the species in river canyons lined with riparian areas and at valley and foothill springs surrounded by desert shrubs. Pallid bats were not abundant, and accounted for only 3% of all bats caught. Pallid bats also were found roosting in caves and cliff crevices.

Alcorn (1944) located only one hibernaculum of pallid bats in a survey of 85 old mines and eight natural caves in central and west-central Nevada.

Kuenzli et al. (1999) trapped pallid bats at six of 18 sites (33%) surveyed in southwestern Nevada; however, they accounted for only 5% of all bats captured. Pallid bats occupied desert shrub and juniper habitats that surrounded water sources. No pallid bats were found near streams surrounded by deciduous trees. No hibernating pallid bats were found in a survey of 70 mines.

Szewczak et al. (1998) surveyed two natural caves and 260 mines in the White-Inyo Mountains of southwestern Nevada and California but failed to find any hibernating pallid bats. However, during the summer, pallid bats were found at multiple locations. Pallid bats were found in Mojave mixed desert scrub and Great Basin desert scrub areas, but not in pinyon-juniper woodland, bristlecone-limber pine forest, or alpine areas. They composed only 2% of all bats observed.

Wyoming Basin Ecoregion:

No data reported

Population Impacts:

Pallid bat population trends and impacts are poorly known. Roosting, maternity, and hibernacula locations are focal points of bat activity, and loss or disturbance of these areas can impact populations. Other potential population impacts include habitat destruction or degradation, loss of water sources, and changes in prey abundance. The migration and wintering ecology of this species are unknown; both probably play a large role in population dynamics.

State or Federal Status/Listing:

Federal: species of concern (USDI Bureau of Land Management: Nevada)

California: species of concern

Oregon: species of concern

Wyoming: species of concern

Map Localities:

Data in Figure 41.1 were compiled from Alcorn 1944, Ruffner et al. 1979, Lewis 1993, Ports and Bradley 1996, Szewczak et al. 1998, and Kuenzli et al. 1999.

References:

Alcorn, J. 1944. Notes on the winter occurrence of bats in Nevada. Journal of Mammalogy 25:308–310.

Genter, D. L., and K. A. Jurist. 1995. Bats of Montana. Montana Natural Heritage Program, Helena, MT.

Hall, E. 1981. The mammals of North America. John Wiley and Sons, New York.

Hermanson, J. W., and T. J. O'Shea. 1983. *Antrozous pallidus*. Mammalian Species 213:1–8.

Kuenzli, A. J., G. T. Downard, and M. L. Morrison. 1999. Bat distribution and hibernacula use in west central Nevada. Great Basin Naturalist 59:213–220.

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Oliver, G. V. 2000. The bats of Utah: a literature review. Utah Division of Wildlife Resources Publication No. 00-14. Salt Lake City, UT.

Ports, M., A., and P. V. Bradley. 1996. Habitat affinities of bats from northeastern Nevada. Great Basin Naturalist 56:48–53.

Ruffner, G., R. Poché, M. Meierkord, and J. Neal. 1979. Winter bat activity over a desert wash in southwestern Utah. Southwestern Naturalist 24:447–453.

Szewczak, J. M., S. M. Szewczak, M. L. Morrison, and L. S. Hall. 1998. Bats of the White and Inyo Mountains of California-Nevada. Great Basin Naturalist 58: 66–75.

Verts, B., and L. Carraway. 1998. Land mammals of Oregon. University of California, Berkeley, CA.

Pygmy Rabbit
(*Brachylagus idahoensis*)

TAXONOMIC EQUIVALENTS:

Lepus idahoensis, *Sylvilagus idahoensis*

CURRENT AND HISTORICAL DISTRIBUTION:

The pygmy rabbit is endemic to shrubsteppe habitats of the Intermountain West (Fig. 42.1). Its historical distribution is poorly known, but is generally assumed to have matched the distribution of big sagebrush. However, even in sagebrush areas, pygmy rabbit distribution was (and is) very patchy.

The current distribution of pygmy rabbits is poorly known, but appears to be considerably reduced, especially in Washington. In a review of the available scientific literature, pygmy rabbits were reported at nine locations (Fig. 42.1).

HABITAT REQUIREMENTS AND ASSOCIATIONS:

Pygmy rabbits are found primarily in habitats dominated by big sagebrush where plants occur in tall, dense clumps (Green and Flinders 1980a). However, pygmy rabbits also have been found in mixed shrub communities that contained (in addition to big sagebrush) black greasewood, rubber rabbitbrush, and other shrubs. Big sagebrush cover in areas used by pygmy rabbits commonly exceeds what is normally found throughout most of the plant's distribution (Gahr 1993). Even in areas with extensive shrub cover, pygmy rabbits prefer the densest cover available (Katzner and Parker 1997). Presence also appears to be associated closely with deep soils and native grass and forb abundance.

POPULATION DATA:

Columbia Plateau Ecoregion:

Gabler et al. (2000, 2001) used a GIS to predict suitable habitat for pygmy rabbits on the relatively undisturbed native shrubsteppe landscape of the Idaho National Engineering and Environmental Laboratory (INEEL). Of the 2,300 km^2 available on the INEEL, only 320 km^2 (14%) had a "good likelihood" of being occupied by pygmy rabbits. Slope, aspect, substrate, and vegetation type were important characteristics in identifying suitable habitat. Using their model, 57% of locations that were predicted to contain pygmy rabbits actually did; nonuse areas were predicted with 100% accuracy (n = 30 for each category).

Weiss and Verts (1984) identified 211 sites likely to be occupied by pygmy rabbits in eastern Oregon using remotely sensed imagery and soil characteristics. Evidence of occupation was found at 51 of 211 sites. Vegetation characteristics were compared at occupied and adjacent unoccupied sites. Sagebrush cover, sagebrush height, and soil depth were significantly greater at the occupied sites; only two of the 51 occupied sites had cheatgrass present in the herbaceous understory. The following year, when the 51 occupied sites were resurveyed, only 19 showed evidence of pygmy rabbits.

Green and Flinders (1980b) examined pygmy rabbit diets in southeastern Idaho. During the winter, sagebrush composed almost 100% of the vegetation consumed. During the summer, 51% was sagebrush, 39% was grasses,

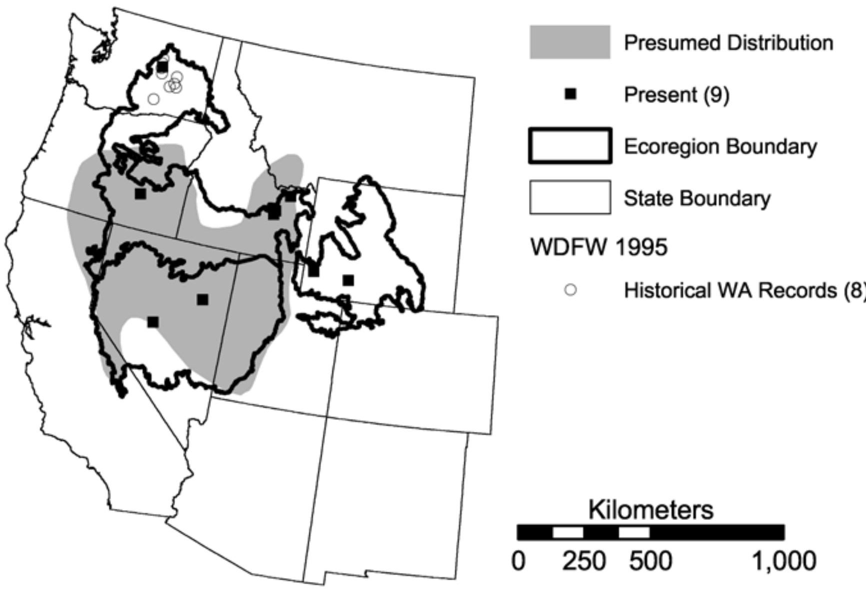

Figure 42.1. Presumed distribution of pygmy rabbits in the western United States (after Hall 1981). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. See text (Map Localities) for data sources.

and 10% was forbs. Native wheatgrasses and Nevada bluegrass were highly preferred; other grasses and various forbs were consumed in smaller proportions.

Great Basin Ecoregion:

No data reported.

Wyoming Basin Ecoregion:

No data reported.

Population Impacts:

Population dynamics of pygmy rabbits are poorly understood, and it is not clear whether populations are cyclic (Wilde 1978). Pygmy rabbits can disappear from known locations very rapidly, for unknown reasons (WDFW 2001). The primary threats to pygmy rabbit populations are habitat destruction, degradation, and fragmentation (Dobler and Dixon 1990). Dispersal ability of pygmy rabbits is extraordinarily limited, and they will not (or cannot) cross significant areas of open ground. Even roads are suspected to be significant barriers to dispersal. Although pygmy rabbits may avoid livestock-grazed areas, they may use areas that were once overgrazed and subsequently are characterized by increased shrub cover. This species appears to avoid areas with significant cheatgrass infestations, but response to exotic herbaceous plants has not been studied specifically.

State or Federal Status/Listing:

Federal: endangered (Washington population), proposed (remaining population)
California: species of concern
Idaho: species of concern
Oregon: species of concern
Washington: endangered species
Wyoming: species of concern

Map Localities:

Data in Figure 42.1 were compiled from Linsdale 1938, Halford and Millard 1978, Green and Flinders 1980b, Weiss and Verts 1984, Ports and Ports 1989, WDFW 1995, Katzner and Parker 1997, Katzner et al. 1997, and Gabler et al. 2001.

References:

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Gabler, K. I., L. T. Heady, and J. W. Laundre. 2001. A habitat suitability model for pygmy rabbits (*Brachylagus idahoensis*) in southeastern Idaho. Western North American Naturalist 61:480–489.

Gahr, M. L. 1993. Natural history, burrow habitat and use, and home range of the pygmy rabbit (*Brachylagus idahoensis*) of Sagebrush Flat, Washington. M.Sc. thesis. University of Washington, Seattle, WA.

Green, J. S., and J. T. Flinders. 1980a. *Brachylagus idahoensis*. Mammalian Species 125:1–4.

Green, J. S., and J. T. Flinders. 1980b. Habitat and dietary relationships of the pygmy rabbit. Journal of Range Management 33:136–142.

Halford, D., and J. Millard. 1978. Vertebrate fauna of a radioactive leaching pond complex in southeastern Idaho. Great Basin Naturalist 38:64–70.

Hall, E. 1981. The mammals of North America. John Wiley and Sons, New York.

Katzner, T. E., and K. L. Parker. 1997. Vegetative characteristics and size of home ranges used by pygmy rabbits (*Brachylagus idahoensis*) during winter. Journal of Mammalogy 78:1063–1072.

Katzner, T. E., K. L. Parker, and H. H. Harlow. 1997. Metabolism and thermal response in winter-acclimatized pygmy rabbits (*Brachylagus idahoensis*). Journal of Mammalogy 78:1053–1062.

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Ports, M. A., and L. K. Ports. 1989. Associations of small mammals occurring in a pluvial lake basin, Ruby Lake, Nevada. Great Basin Naturalist 49:123–130.

WDFW. 1995. Washington state recovery plan for the pygmy rabbit. Washington Department of Fish and Wildlife, Washington Management Program, Olympia, WA.

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Wilde, D. B. 1978. A population analysis of the pygmy rabbit (*Sylvilagus idahoensis*) in the INEL site. Ph.D. dissertation. Idaho State University, Pocatello, ID.

Idaho Ground Squirrel (*Spermophilus brunneus*)

Taxonomic Equivalents:

Recent research indicates that the two subspecies (*S. b. endemicus* and *S. b. brunneus*) probably warrant full species status, and should be split into *S. endemicus* (the southern Idaho ground squirrel) and *S. brunneus* (the northern Idaho ground squirrel).

Current and Historical Distribution:

The historical distribution of the Idaho ground squirrel is estimated to be approximately 11,000 km^2 in southwest Idaho, bounded by the Payette River to the south, the Snake River to the west, and lava flows to the northeast. At present, only approximately 2,300 km^2 appear to be occupied by Idaho ground squirrels (Fig. 43.1).

Habitat Requirements and Associations:

The southern subspecies of the Idaho ground squirrel is found in lower elevation shrubsteppe of Gem, Payette, Washington, and Adams

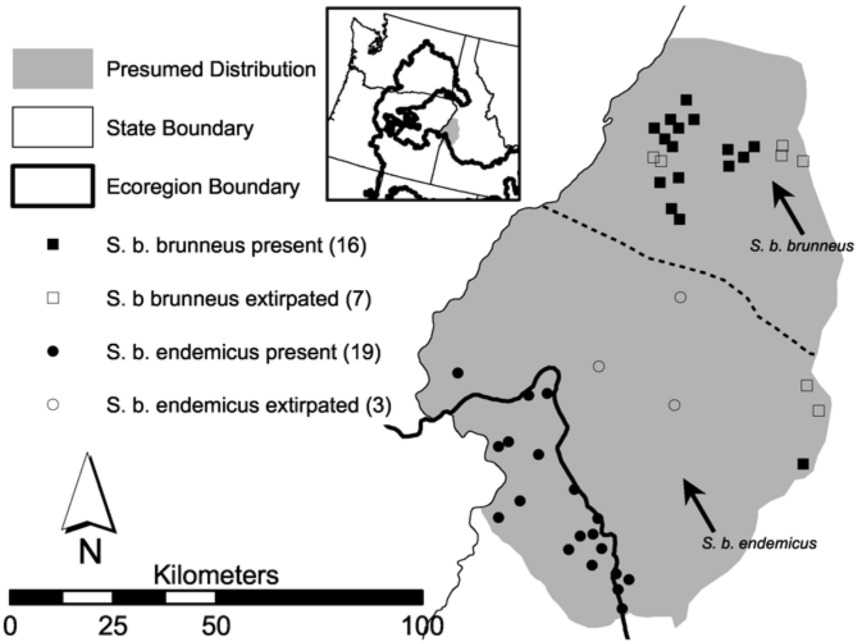


Figure 43.1. Presumed distribution of Idaho ground squirrels in the western United States (after Yensen 1991). Filled symbols represent locations where the species was recently present; unfilled symbols represent localities where the species has been extirpated.

Counties, Idaho (Yensen and Sherman 1997). The northern subspecies is found in xeric montane meadows surrounded by coniferous forests in Adams and Valley Counties, Idaho. Habitat characteristics that influence presence and absence are poorly known, but both subspecies appear to prefer areas with a high percentage of native cover types, particularly grasses and forbs with scattered sagebrush (Yensen and Sherman 2003).

Population Data:

Columbia Plateau Ecoregion:

In 1985, the entire population of the southern subspecies of Idaho ground squirrel was estimated to be about 40,000 individuals. Increased knowledge of the species' natural history, however, indicated that this estimate was too large by 2–10 fold (Yensen 2001). Of 180 sites known to be occupied in 1985, 54 showed evidence of use in 1999–2000 (USFWS 2001), but 53 of the 54 occupied sites were characterized as showing "remarkably low levels of activity." Extensive surveys conducted across the species' entire range in 1999–2001 produced an estimate of only 2,000 to 4,500 individuals. In 1997 and 1998, surveys were conducted for the northern subspecies, which resulted in an estimate for the entire population of fewer than 1000 individuals (USFWS 2000).

Great Basin Ecoregion:

Not present.

Wyoming Basin Ecoregion:

Not present.

Population Impacts:

The leading cause of population decline is thought to be habitat degradation, with the invasion of exotic annuals (specifically cheatgrass and medusahead) being a principal cause. Other potential sources of population decline include recreational shooting, disease, livestock grazing, predation, and competition with Columbia ground squirrels (*Spermophilus columbianus*).

State or Federal Status/Listing

Federal: threatened (*S. b. brunneus*), proposed (*S. b. endemicus*)

Idaho: species of concern (both subspecies)

Map Localities:

Data in Figure 43.1 were compiled from Yensen 1991.

References:

Sherman, P. W., and M. C. Runge. 2002. Demography of a population collapse: the northern Idaho ground squirrel (*Spermophilus brunneus brunneus*). Ecology 83:2816–2831.

USFWS. 2000. Endangered and threatened wildlife and plants: determination of threatened status for the northern Idaho ground squirrel. Federal Register 65: 17779–17786.

USFWS. 2001. Candidate and listing priority assignment form: *Spermophilus brunneus endemicus*. United States Fish and Wildlife Service. Region 1, Portland OR.

Yensen, E. A. 1991. Taxonomy and distribution of the Idaho ground squirrel, *Spermophilus brunneus*. Journal of Mammalogy 72:583–600.

Yensen, E. 2001. Population estimate for the southern Idaho ground squirrel (*Spermophilus brunneus endemicus*). Unpublished report to U.S. Fish and Wildlife Service, Boise, ID. Department of Biology, Albertson College, Caldwell, ID.

Yensen, E., and P. W. Sherman. 1997. *Spermophilus brunneus*. Mammalian Species 560.

Yensen, E., and P. W. Sherman. 2003. Ground-dwelling squirrels of the Pacific Northwest. U.S. Department of the Interior, Fish and Wildlife Service/Bureau of Land Management, Boise, ID.

Merriam's Ground Squirrel (*Spermophilus canus*)

Taxonomic Equivalents:

Based on genetic analysis, the seven subspecies of *S. townsendii* described by Rickart (1987) were resolved and split into three species (Hoffman et al. 1993): *S. canus*, *S. mollis* (the Piute ground squirrel), and *S. townsendii* (Townsend's ground squirrel).

Current and Historical Distribution:

The current distribution of Merriam's ground squirrel is assumed to be generally similar to historical, but contemporary distribution data are virtually nonexistent (Fig. 44.1). Readers should note that because of recent taxonomic revision (see above), much of the scientific literature available for this species is lumped with the Townsend's and Piute ground squirrels under *S. townsendii*.

Habitat Requirements and Associations:

Merriam's ground squirrel occurs in a variety of shrubsteppe communities. Specimens have been collected from big sagebrush, black greasewood, grassland, and agricultural areas. Little information is available concerning the specific habitat preferences of this species, primarily due to its recent elevation to full species status. Habitat preferences, however, likely are similar to those of sympatric congeners (*S. townsendii*, *S. mollis*, *S. washingtoni*).

Population Data:

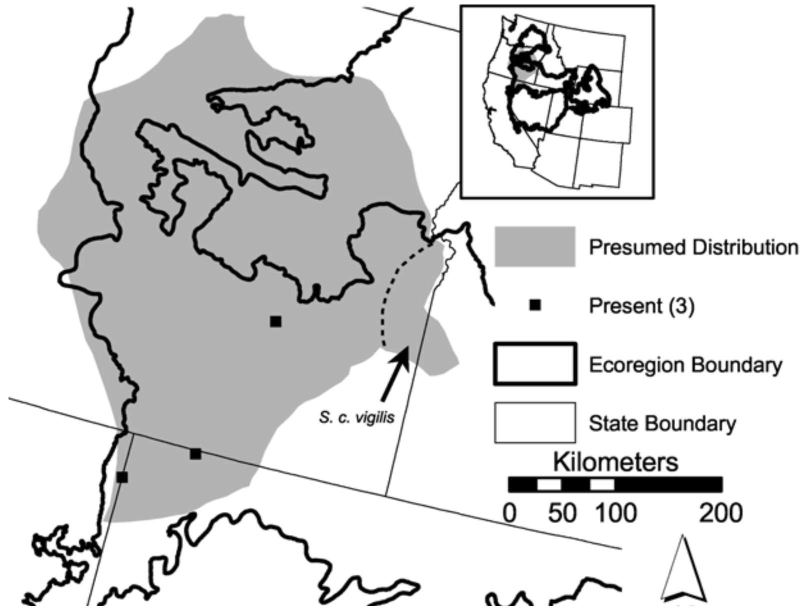
Columbia Plateau Ecoregion:

No studies have specifically examined Merriam's ground squirrel populations. The data below are from small-mammal studies that reported the capture of Merriam's ground squirrels. However, we have not reported trap rates since suboptimal trapping methodology (e.g., nocturnal trapping and inappropriate trap size) likely skewed the data.

Feldhamer (1979b) sampled the small-mammal communities of four major plant associations on Malheur National Wildlife Refuge and caught Merriam's ground squirrels in both black greasewood/cheatgrass and big sagebrush/cheatgrass. They were not caught in Sandberg's bluegrass/saltgrass/bluestem wheatgrass or marsh areas.

Hanley and Page (1981) trapped small mammals at a variety of shrubsteppe sites, both

Figure 44.1. Presumed distribution of Merriam's ground squirrels in the western United States (after Hall 1981). Filled squares represent literature sources reporting the species present. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.



grazed and ungrazed by livestock, in northeastern California. Merriam's ground squirrels were caught in grazed but not ungrazed Nevada bluegrass/sedge. The species was not caught in either grazed or ungrazed shadscale/Indian ricegrass, black greasewood/Great Basin wildrye, dwarf sagebrush/Idaho fescue, big sagebrush/bluebunch wheatgrass/Thurber's needlegrass, or big sagebrush/Idaho fescue.

Oldemeyer and Allen-Johnson (1988) sampled the small-mammal communities of shrubsteppe and mountain mahogany areas in northwestern Nevada that were grazed and ungrazed by livestock. The shrubsteppe areas were composed of big sagebrush and bitterbrush with an Idaho fescue understory. Curl-leaf mountain mahogany and western needlegrass with significant areas of exposed rock characterized the other community. Exclosure plots had been rested from livestock grazing for three years, while allotment plots, historically grazed under an April–September, season-long system, were grazed by livestock using a deferred-rotation system for ≥4 years. Merriam's ground squirrels were caught in both of the livestock-grazed habitats but not in the ungrazed areas.

Great Basin Ecoregion:
Not present.
Wyoming Basin Ecoregion:
Not present.

Population Impacts:

Although very little is known about Merriam's ground squirrels, it is very likely that populations have been impacted by the destruction, degradation, and fragmentation of shrubsteppe habitats.

State or Federal Status/Listing:

Federal: species of concern (*S. c. vigilis* only; USDI Bureau of Land Management: Idaho)

Map Localities:

Data in Figure 44.1 were compiled from Feldhamer 1979b, Hanley and Page 1981, and Oldemeyer and Allen-Johnson 1988.

References:

Feldhamer, G. A. 1979b. Vegetative and edaphic factors affecting abundance and distribution of small mammals in southeast Oregon. Great Basin Naturalist 39: 207–218.

Hall, E. 1981. The mammals of North America. John Wiley and Sons, New York.
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Hoffman, R. S., C. G. Anderson, R. W. Thorington Jr., and L. R. Heaney. 1993. Family Sciuridae, p. 419–465. *In* D. E. Wilson and D. M. Reeder [eds.], Mammal species of the world: a taxonomic and geographic reference. Smithsonian Institution Press, Washington, DC.
Oldemeyer, J., and L. Allen-Johnson. 1988. Cattle grazing and small mammals on the Sheldon Wildlife Refuge, Nevada, p. 391–398. *In* R. Szaro, K. Severson and D. Patton [eds.], Management of amphibians, reptiles, and small mammals in North America. USDA Forest Service General Technical Report RM-GTR-166.
Rickart, E. A. 1987. *Spermophilus townsendii*. Mammalian Species 268:1–6.
Yensen, E., and P. W. Sherman. 2003. Ground-dwelling squirrels of the Pacific Northwest. U.S. Department of the Interior Fish and Wildlife Service/Bureau of Land Management, Boise, ID.
Verts, B., and L. Carraway. 1998. Land mammals of Oregon. University of California, Berkeley, CA.

Piute Ground Squirrel (*Spermophilus mollis*)

TAXONOMIC EQUIVALENTS:

Based on genetic analysis, the seven subspecies of *S. townsendii* described by Rickart (1987) were resolved and split into three species (Hoffman et al. 1993): *S. mollis*, *S. townsendii* (Townsend's ground squirrel), and *S. canus* (Merriam's ground squirrel). Of these three species, the natural history of *S. mollis* is the best known.

CURRENT AND HISTORICAL DISTRIBUTION:

The current distribution of the Piute ground squirrel is assumed to be generally similar to historical, but contemporary distribution data are sparse (Fig. 45.1). Readers should note that because of recent taxonomic revision (see above), much of the scientific literature available for *S. townsendii* actually refers to present-day *S. mollis.*

HABITAT REQUIREMENTS AND ASSOCIATIONS:

Piute ground squirrels occur in various shrubsteppe communities, particularly big sagebrush, shadscale, black greasewood, and winterfat associations. Abundant forb and perennial grass cover with moderate or low shrub cover are probably preferred habitat characteristics, but specific requirements are poorly known.

POPULATION DATA:

Columbia Plateau Ecoregion:

Smith and Johnson (1985) examined Piute ground squirrel population trends on the Snake River Birds of Prey Area (SRBPA) in southwestern Idaho for seven years. Mean ground squirrel densities (per ha) were similar in the four habitats studied: big sagebrush/Sandberg's bluegrass (11.7), cheatgrass/Russian thistle (13.7), winterfat/Sandberg's bluegrass (13.0), winterfat/big sagebrush/spiny hopsage (15.9). Mean densities ranged from 10.0 to 18.6 per ha over six years with normal precipitation. During the summer following a fall/winter drought, mean density fell to 7.6 per ha due to extremely low reproduction.

Yensen et al. (1992) also examined Piute ground squirrel densities on the SRBPA in southwestern Idaho. Ground squirrel abundances were similar to populations studied by Smith and Johnson (1985) in nearby areas (6.1 to 17.4 per ha). Densities were consis-

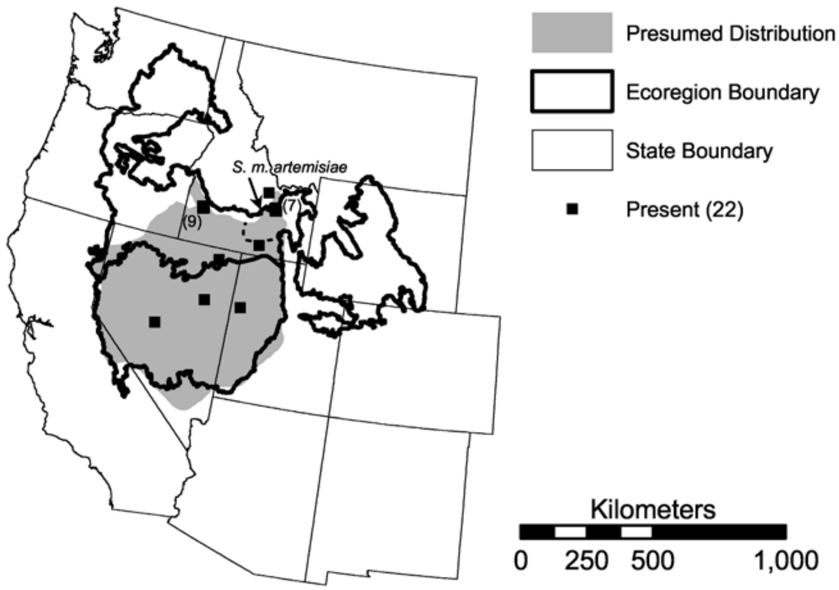

Figure 45.1. Presumed distribution of Piute ground squirrels in the western United States (after Hall 1981). Filled squares represent literature sources reporting the species present. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.

tently the highest in winterfat/Sandberg's bluegrass, followed by winterfat/cheatgrass/bottlebrush squirreltail/Sandberg's bluegrass, big sagebrush/cheatgrass/Sandberg's bluegrass, and cheatgrass/tumblemustard/tansymustard/shadscale.

Van Horne et al. (1997) investigated the effects of drought on Piute ground squirrel populations on the SRPBA in southwestern Idaho. Piute ground squirrel densities were the greatest in grassland areas dominated by Sandberg's bluegrass/cheatgrass/Russian thistle/tumblemustard that had burned 7–10 years previously, followed by big sagebrush/Sandberg's bluegrass, big sagebrush/winterfat/Sandberg' bluegrass matrix, and winterfat/Sandberg's bluegrass. The effects of the drought (i.e., decline in adult body mass, reduced juvenile survival) were seen in all habitats but were significant only in the grassland areas.

Allred (1973) sampled 12 shrubsteppe plots in southeastern Idaho that had varying abundances of sagebrush, rabbitbrush, grasses, forbs, and some junipers. Piute ground squirrels occupied a diverse range of habitat conditions but were consistently absent from areas with junipers, extremely dense shrubs, or no shrubs at all.

Groves and Keller (1983) trapped small mammals in big sagebrush/bluebunch wheatgrass, big sagebrush–bluebunch wheatgrass–crested wheatgrass ecotone, crested wheatgrass, and Russian thistle habitats on the Idaho National Engineering and Environmental Laboratory (INEEL). Piute ground squirrels were distinctly more abundant in the big sagebrush/bluebunch wheatgrass area (1.5 caught per 100 trap nights) than in the other areas (0.6, 0.5, 0.07, respectively). The traps used in this study were not ideal for catching ground squirrels (too small), so caution is warranted when comparing their results with studies that specifically targeted ground squirrels and used larger traps.

Mullican and Keller (1986) trapped specifically for sagebrush voles (*Lemmiscus curtatus*) on the INEEL in Idaho, but Piute ground squirrels were incidentally caught in habitat primarily composed of big sagebrush (29% cover) and bluebunch wheatgrass (11% cover); green rabbitbrush and various herbaceous plants were also common.

Koehler and Anderson (1991) trapped Piute ground squirrels on the INEEL in southeastern Idaho. They were "either absent or uncommon" in areas dominated by big sagebrush/bluebunch wheatgrass. However, in areas of planted crested wheatgrass they were more abundant. Crested wheatgrass was the most heavily used food item of Piute ground squirrels collected in June.

Great Basin Ecoregion:

Ports and Ports (1989) trapped and observed small mammals in six plant associations surrounding a perennial lake in northeastern Nevada. Piute ground squirrels were observed in two habitats. One habitat was a rush/sedge meadow, with abundant springs and "many mesic shrubs" (i.e. Scouler's willow, Wood's rose, golden currant). The other habitat was composed of big sagebrush/bitterbrush/western serviceberry/green rabbitbrush, with an understory of cheatgrass/bottlebrush squirreltail and a "diverse forb component." Piute ground squirrels were not observed in black greasewood/big sagebrush/rubber rabbitbrush with a "sparse" understory of Sandberg's bluegrass/long-leaved phlox, nor in black greasewood/shadscale/alkali rabbitbrush with a "dense" understory of saltgrass/Great Basin wildrye/alkali bulrush/western seepweed. They were not observed in spiny hopsage/dwarf sagebrush with abundant bare ground and a "scarce" grass understory of bottlebrush squirreltail/peppergrass or in a wet rush/sedge meadow with many grass species and extremely dense vegetation.

Wyoming Basin Ecoregion:

Not present.

Population Impacts:

Habitat degradation and fragmentation are the most serious threats to Piute ground squirrel populations. Habitat quality significantly influences the survivorship of Piute ground squirrels, which must store sufficient fat reserves during their ~4 month active period to survive ~8 months of hibernation (Van Horne et al. 1997). Livestock grazing significantly influences the abundances of forbs and perennial grasses, which compose the majority of ground squirrel diets. Although Piute ground squirrels readily use grasslands composed of mixed native and exotic grasses, populations in these areas are more susceptible to the influences of drought, due to lower abundances of alternate food sources (Van Horne et al. 1998). Poor dispersal abilities exacerbate the effects of habitat fragmentation, creating genetically isolated populations that are prone to extinction (Olson and Van Horne 1998).

State or Federal Status/Listing:

Federal: species of concern (*S. m. artemisae* only; USDI Bureau of Land Management: Idaho)

Map Localities:

Data in Figure 45.1 were compiled from Linsdale 1938, Johnson 1961, Egoscue 1962, Allred 1973, Reynolds and Trost 1980, Halford 1981, Groves and Keller 1983, Johnson and Keller 1983, Smith and Johnson 1985, Mullican and Keller 1986, Groves and Steenhof 1988, Medin and Clary 1989, Ports and Ports 1989, Koehler and Anderson 1991, Yensen et al. 1992, Clary and Medin 1993, Schooley et al. 1996, Van Horne et al. 1997, Olson and Van Horne 1998, Sharpe and Van Horne 1998, Van Horne et al. 1998, and Antolin et al. 2001.

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Verts, B., and L. Carraway. 1998. Land mammals of Oregon. University of California, Berkeley, CA.

Townsend's Ground Squirrel (*Spermophilus townsendii*)

Taxonomic Equivalents:

Based on genetic analysis, the seven subspecies of *S. townsendii* described by Rickart (1987) were resolved and split into three species (Hoffman et al. 1993): *S. townsendii*, *S. mollis* (the Piute ground squirrel), and *S. canus* (Merriam's ground squirrel).

Current and Historical Distribution:

Presumably, the distribution of Townsend's ground squirrels is limited to suitable habitats on those lands north of the Columbia River, west of the Yakima River, and east of the Cascade Mountains in Washington (Fig. 46.1). However, both the historical and current ranges are poorly described. Readers should note that because of recent taxonomic revision (see above), much of the scientific literature on *S. townsendii* (pre-1993) actually refers to *S. canus* or *S. mollis*.

Habitat Requirements and Associations:

Townsend's ground squirrels occur mainly in shrubsteppe (Rickart 1987). Little information is available concerning the specific habitat preferences of this species. Habitat preferences, however, likely are similar to those of sympatric congeners (*S. canus, S. mollis, S. washingtoni*).

Population Data:

Columbia Plateau Ecoregion:

Studies that specifically examine Townsend's ground squirrel populations are few. The data reported below are from small-mammal studies that incidentally captured Townsend's ground squirrels. We do not report capture rates, since suboptimal trapping methods (e.g., night trapping, improper trap size) were not appropriate for ground squirrels and likely skewed the data.

O'Farrell (1975) trapped small mammals along a shrubsteppe elevation gradient (~150–1060 m) in south-central Washington. Townsend's ground squirrels were present at all four sampling locations. At low elevations, the vegetation was predominately big sagebrush with a Sandberg's bluegrass understory. From ~300 m to 1060 m, the vegetation transitioned to big sagebrush and bluebunch wheatgrass with rubber rabbitbrush prevalent in spots.

Rogers and Gano (1980) examined the diet of Townsend's ground squirrels in areas of shrubsteppe grazed and ungrazed by livestock in south-central Washington. Diets did not vary significantly between the grazed and ungrazed areas. However, lupine and assorted bluegrasses were consumed substantially more often than would be expected by chance alone in both areas, and bluebunch wheatgrass was consumed substantially less. Cheatgrass was present though not abundant in the area; it was not consumed.

Gano and Rickard (1982) evaluated the impact of fire on small-mammal populations in a bitterbrush/big sagebrush/cheatgrass community of south-central Washington. Townsend's ground squirrels were present in the unburned area. However, four years postfire, they were not trapped in the burned area, which was com-

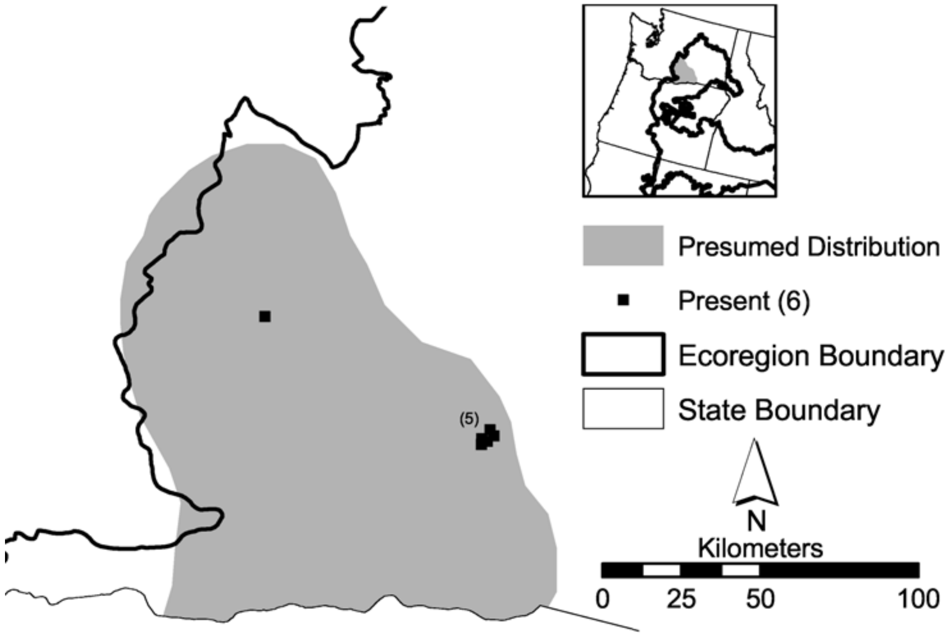

Figure 46.1. Presumed distribution of Townsend's ground squirrels in the western United States (after Hall 1981). Filled squares represent literature sources reporting the species present. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.

posed primarily of cheatgrass.

Gitzen et al. (2001) surveyed for Townsend's ground squirrels in various shrubsteppe communities in south-central Washington. Twenty-two 1-km walking transects were conducted in various sagebrush/bunchgrass areas where Townsend's ground squirrels were likely to be present; however, none were found.

Great Basin Ecoregion:

Not present.

Wyoming Basin Ecoregion:

Not present.

Population Impacts:

Based on its restricted distribution and association with shrubsteppe habitats, it is very likely that populations have been impacted significantly by habitat destruction, degradation, and fragmentation. Very little is known about Townsend's ground squirrels.

State or Federal Status/Listing:

Not listed by any federal or state agencies within the region of interest.

Map Localities:

Data in Figure 1 were compiled from Gray 1942, O'Farrell 1975, Rogers and Gano 1980, Hedlund and Rickard 1981, Gano and Rickard 1982, and Gitzen et al. 2001.

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Washington Ground Squirrel (*Spermophilus washingtoni*)

Current and Historical Distribution:

Historically, Washington ground squirrels were distributed widely in shrubsteppe habitats in eastern Washington. In north-central Oregon, the species occurred along the Columbia River. Recent surveys indicate that Washington ground squirrels have been extirpated from many sites, suggesting a range contraction toward the center of their distribution (Fig. 47.1).

Habitat Requirements and Associations:

The Washington ground squirrel is a shrubsteppe obligate that prefers locations with big sagebrush and bunchgrasses (Rickart and Yensen 1991). Deep soils with reduced clay content are the foremost characteristic associated with Washington ground squirrel habitat (Morgan and Nugent 1999). In a comparison of occupied and unoccupied sites with similar plant communities and soils, Washington ground squirrel presence was correlated significantly with greater native grass and forb cover (Greene 1999).

Population Data:

Columbia Plateau Ecoregion:

Historical reports considered Washington ground squirrels to be extremely abundant and a serious agricultural pest. However, in 1988 a survey of 179 historically occupied sites confirmed the presence of only 87 colonies (51 in Washington, 36 in Oregon, Betts 1990; Fig. 47.1). In 1998, 47 of 51 sites in Washington and all 36 sites in Oregon were resurveyed. Of these sites, only 37 and 9 were still occupied in Washington and Oregon, respectively (Betts 1999; localities not specified).

Great Basin Ecoregion:

Not present.

Wyoming Basin Ecoregion:

Not present.

Population Impacts:

Washington ground squirrel population declines are primarily attributed to habitat loss and fragmentation (ODFW 1999, Yensen and Sherman 2003). Agricultural conversion, livestock grazing, and frequent fire have removed, altered, and fragmented much of the appropriate habitat within this species' historical distribution. Washington ground squirrels occupying locations grazed by livestock have been documented to enter estivation 2–4 weeks earlier than ground squirrels in undisturbed habitats. Other factors, such as predation and recreation-

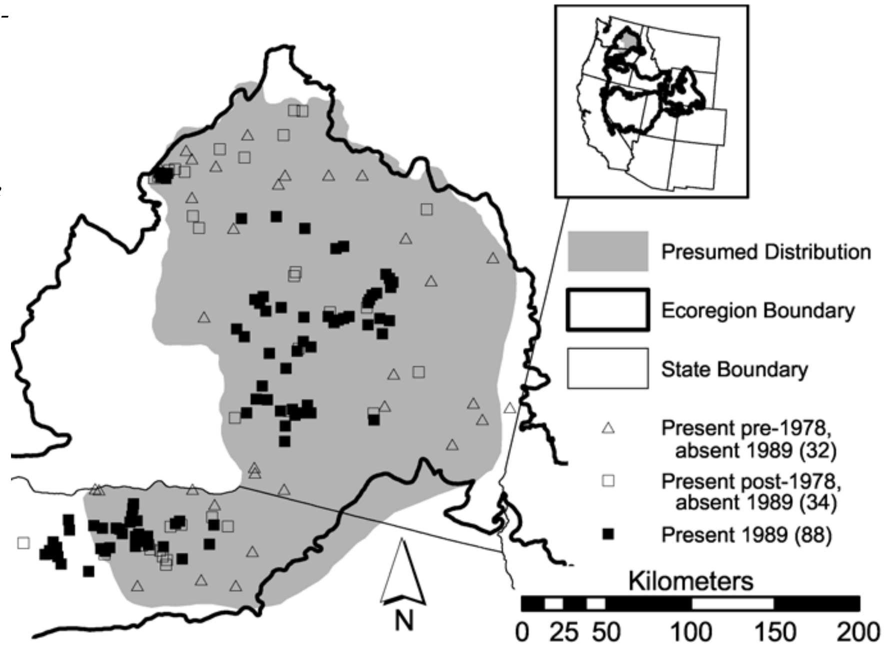

Figure 47.1. Presumed distribution of Washington ground squirrels in the western United States (after Hall 1981). Filled symbols represent locations where the species was recently present; unfilled symbols represent localities where the species has been extirpated (after Betts 1990).

al shooting, probably have played a role in local population declines as well.

State or Federal Status/Listing:

Federal: proposed for listing by the U.S. Fish and Wildlife Service

Oregon: endangered species

Washington: species of concern

Map Localities:

Data in Figure 47.1 were compiled from Betts 1990.

References:

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Little Pocket Mouse
(*Perognathus longimembris*)

Current and Historical Distribution:

The current distribution of little pocket mice is assumed to be generally similar to historical. In a review of the available scientific literature, the little pocket mice were reported at 21 locations. Based on known natural history traits and presumed distribution, 18 additional locations could have had little pocket mice but did not (Fig. 48.1).

Habitat Requirements and Associations:

The little pocket mouse is associated with the arid scrub habitats of the Great Basin and Mojave Deserts. It can be found in a wide range of vegetation types, including shadscale, horsebrush, winterfat, black greasewood, semistabilized dunes, grasslands, and big sagebrush. It is frequently found on sandy or finely textured soils, but it also will use rocky and gravelly soils. Home ranges of little pocket mice are typically small and the species is thought to be quite sedentary (O'Farrell 1978).

Population Data:

Columbia Plateau Ecoregion:

Hanley and Page (1981) trapped small mammals at a variety of shrubsteppe sites in northeastern California that were grazed or ungrazed by livestock. Little pocket mice were caught in ungrazed shadscale/Indian ricegrass and black greasewood/Great Basin wildrye at rates of 0.2 and 0.9 per 100 trap nights. They were not caught in grazed plots of these habitats, nor in grazed or ungrazed low sage/Idaho fescue, big sagebrush/bluebunch wheatgrass/Thurber's needlegrass, big sage/Idaho fescue, Nevada bluegrass/sedge, or aspen.

Great Basin Ecoregion:

Bowers (1986) trapped small mammals at three sites that formed a gradient of Great Basin, Great Basin/Mojave Desert ecotone and Mojave desert habitats. The vegetation at these sites was composed of four-wing saltbush/winterfat/Mormon tea, shadscale/Mormon tea/pale wolfberry, and desert ragweed/creosote bush/spiny hopsage. Capture rates (per 100 trap nights) of little pocket mice were 3.1, 1.9, and 0.4, respectively.

Brown (1973) trapped small mammals at semistabilized dune communities across the western United States. Little pocket mice were caught at 10 of the 18 sites trapped; capture rates ranged from 0.2 to 7.5 per 100 trap nights.

Fautin (1946) trapped small mammals in seven shrub communities in western Utah and estimated densities (per ha) of little pocket mice as 1.3 in shadscale, 1.3 in horsebrush, and 0.5 in winterfat. No little pocket mice were trapped in big sagebrush, shadscale/black greasewood ecotone, black greasewood, or black sagebrush habitats.

Germano and Lawhead (1986) trapped small mammals in the Escalante Desert of west-central Utah. Little pocket mice were caught in mixed shrub, grassland, and sagebrush communities at densities estimated to be 2.8, 1.2 and 0.01 per hectare, respectively. Little pocket mice were not caught in pinyon/juniper or greasewood/shadscale communities.

Ports and Ports (1989) trapped small mam-

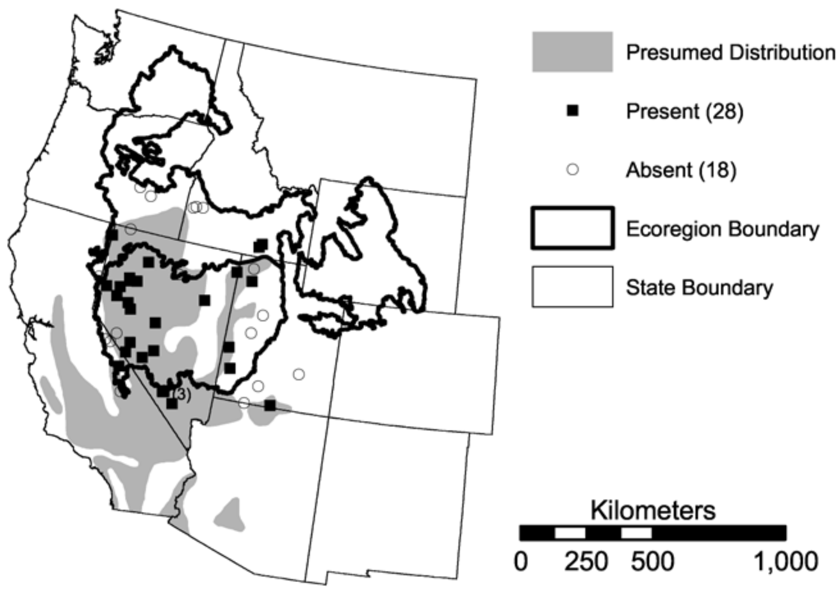

Figure 48.1. Presumed distribution of little pocket mice in the western United States (after Hall 1981; distribution continues south into Baja California). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.

mals in six plant associations surrounding a perennial lake in northeastern Nevada. Little pocket mice were caught at a rate of 3.3 per 100 trap nights in spiny hopsage/dwarf sagebrush with a "scarce" grass understory of bottlebrush squirreltail/peppergrass and abundant bare ground. Little pocket mice were not trapped in black greasewood/shadscale, black greasewood/big sagebrush, big sagebrush/cheatgrass, or two mesic meadows.

Bich et al. (1995) trapped an Indian ricegrass/galleta grass community in south-central Utah and caught significantly more little pocket mice in ungrazed and lightly grazed areas than in heavily grazed areas (6.6, 6.5, and 3.3 captures per 100 trap nights, respectively).

Lemen and Freeman (1987) trapped small mammals in a livestock-grazed mixed desert shrub community in southwest Nevada. Shadscale was the dominant shrub in the area, while sparse grasses and forbs composed the understory. Little pocket mice were caught at a rate of 6.9 per 100 trap nights.

Thompson (1982a) trapped small mammals in creosote bush/desert ragweed/big galleta grass of southeast California. Little pocket mice were caught at a mean rate of 15.3 per 100 trap nights.

Allred and Beck (1963) trapped small mammals on the Nevada Atomic Test Site and caught little pocket mice in the following communities (captures per 100 trap nights): shadscale/kochia (0.9), blackbrush (4.3), spiny hopsage/box thorn (7.4), box thorn (6.4), and creosote bush (2.6).

Wyoming Basin Ecoregion:

Out of range.

Population Impacts:

In general, most *Perognathus* species tend to inhabit areas with moderate to dense vegetation cover, and avoid foraging in open areas. Loss of shrub cover commonly reduces abundance; thus, actions such as agricultural conversion, livestock grazing, and frequent fire are most likely negative influences on little pocket mouse populations. However, data concerning these potential impacts, specific to this species, are sparse.

State or Federal Status/Listing:

Federal: species of concern (USDI Bureau of Land Management: Idaho). *Perognathus l. pacificus,* which occurs only outside the ecoregions of interest, is a federal endangered species.

California: Six subspecies, all of which occur outside the ecoregions of interest, are species of concern: *P. l. bangsi, P. l. brevinasus, P. l. internationalis, P. l. pacificus, P. l. salinensis, P. l. tularensis*.

Idaho: species of concern

Map Localities:

Data in Figure 48.1 were compiled from Linsdale 1938, Johnson 1961, Allred and Beck 1963, Beatley 1969, Brown 1973, Kenagy 1973, Larrison and Johnson 1973, Beatley 1976, Jorgensen et al. 1980, O'Farrell 1980, Hanley and Page 1981, Bowers 1986, Germano and Lawhead 1986, Lemen and Freeman 1987, Ports and Ports 1989, Cramer and Chapman 1990, Bich et al. 1995, Longland and Bateman 1998, and Jones and Longland 1999.

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Ports, M. A., and L. K. Ports. 1989. Associations of small mammals occurring in a pluvial lake basin, Ruby Lake, Nevada. Great Basin Naturalist 49:123–130.

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Thompson, S. D. 1982a. Microhabitat utilization and foraging behavior of bipedal and quadrupedal heteromyid rodents. Ecology 63:1303–1312.

Great Basin Pocket Mouse
(*Perognathus parvus*)

Taxonomic Equivalents:

Verts and Carraway (1998) cited research documenting karyotype variability and divergent mitochondrial DNA lineages in this species. They hypothesized that *P. parvus* is composed of at least two genetically distinct species.

Current and Historical Distribution:

The current distribution of Great Basin pocket mice is assumed generally similar to historical. In a review of the available scientific literature, Great Basin pocket mice were reported at 51 locations. Based on known natural history traits and presumed distribution, 13 additional locations could have had Great Basin pocket mice but did not (Fig. 49.1).

Habitat Requirements and Associations:

The Great Basin pocket mouse is endemic to arid regions of the Intermountain West (Verts and Carraway 1998). It is associated with sandy, deep soils that permit excavation of burrows in which it spends considerable amounts of time (Kritzman 1974, Hedlund et al. 1975). Great Basin pocket mice can be found sporadically in many plant communities, including shadscale, black greasewood, rabbitbrush, winterfat, and spiny hopsage, However, it can be found in abundance most consistently in big sagebrush and native grass areas. Abundance is significantly correlated with increased shrub cover and with soil sand content (Munger et al.1983).

Population Data:

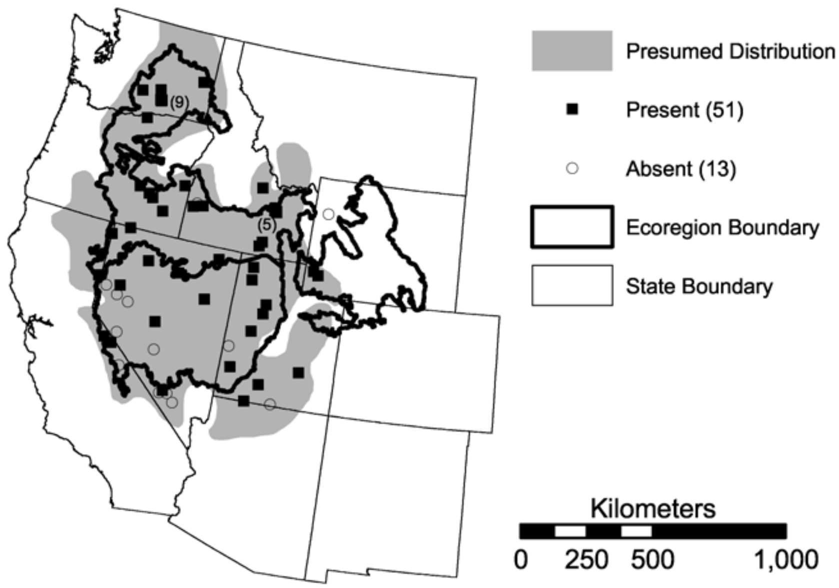
Columbia Plateau Ecoregion:

Rickard (1960) trapped small mammals in seven plant zones of northeastern Washington. Great Basin pocket mice frequently occurred in areas with big or rigid sagebrush and Sandberg's bluegrass or bluebunch wheatgrass (capture rates ranged from 0.7 to 4.7 per 100 trap nights). Great Basin pocket mice were usually absent from grassland areas dominated by bluebunch wheatgrass or Idaho fescue.

Schreibner (1979) caught Great Basin pocket mice at a maximum rate of 33.2 per 100 trap nights in a big sagebrush/cheatgrass area of south-central Washington. Great Basin pocket mice composed 84% of the total small-mammal catch.

O'Farrell (1975) trapped small mammals along a shrubsteppe elevation gradient in south-central Washington. Great Basin pocket mouse abundance was the greatest at the lowest site (150 m) where the vegetation was big sagebrush/Sandberg's bluegrass/cheatgrass. Over three years, the average number of individuals trapped at this site was 32 per 100 trap nights. At the other three sites, where the elevations were 450, 760, and 1060 m, the average numbers of individuals trapped were 19, 18, and 14 per 100 trap nights, respectively. At all three of these sites, the vegetation was composed of big sagebrush/bluebunch wheatgrass with rubber rabbitbrush prevalent in some areas. The authors hypothesized that increased seed availability at low-elevation sites, as well

Figure 49.1. Presumed distribution of Great Basin pocket mice in the western United States (after Hall 1981; distribution continues north into British Columbia). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.



as earlier spring warming, were responsible for higher abundances of Great Basin pocket mice.

O'Farrell et al. (1975) conducted extensive trapping over a six-year period in a big sagebrush/Sandberg's bluegrass/cheatgrass habitat of south-central Washington. Overall trapping success was 34.1 Great Basin pocket mice captured per 100 trap nights, with seasonal success ranging from 10.7 to 47.8. Over the course of the study, minimum and maximum densities were estimated to be 20 and 110 per ha. October to April precipitation levels, which dramatically influence the productivity of cheatgrass and other grasses, were correlated significantly with estimates of summer population sizes. The authors believe that the introduction of cheatgrass has provided an important new food source for Great Basin pocket mice that has facilitated population increases and altered the amplitude of population fluctuations.

Gano and Rickard (1982) evaluated the impact of fire on Great Basin pocket mouse populations in a bitterbrush/big sagebrush/cheatgrass community in south-central Washington. In undisturbed habitat, 5.9 Great Basin pocket mice were caught per 100 trap nights. In the burned area composed mostly of cheatgrass, 1.8 Great Basin pocket mice were caught per 100 trap nights four years after the fire.

Heldlund and Rodgers (1980) estimated annual peak Great Basin pocket mouse densities to be ~40 per ha in a big sagebrush/cheatgrass/Sandberg's bluegrass habitat of south-central Washington. The maximum rate at which Great Basin pocket mice were trapped was 26 per 100 trap nights.

Gitzen et al. (2001) trapped small mammals at 51 locations in nine shrubsteppe plant associations on and near the Hanford Nuclear Site in south-central Washington in 1997. Though Great Basin pocket mice were caught in all associations, they were most common in bitterbrush/Indian ricegrass (5.9 per 100 trap nights) and needle-and-thread/sand dropseed/bluebunch wheatgrass (4.2). In 1998, trapping efforts focused on areas of big sagebrush/bluebunch wheatgrass/needle-and-thread grass. Great Basin pocket mice capture rates ranged from 0.5 to 10.6 and averaged 6.0 per 100 trap nights.

Feldhamer (1979b) caught Great Basin pocket mice at rates of 2.5 and 0.9 per 100 trap nights in big sagebrush/cheatgrass and black greasewood/cheatgrass on the Malheur National Wildlife Refuge. This species was rarely trapped in a marsh and never in a grassland composed of Sandberg's bluegrass/saltgrass/ bluestem wheatgrass.

Boula and Sharp (1985) trapped small mammals in three plant communities: big sagebrush/bluebunch wheatgrass/Idaho fescue, big sagebrush/rabbitbrush/cheatgrass, and crested wheatgrass. Using traditional methods of range condition evaluation, the communities were estimated to be in fair/good, poor, and good condition, respectively. All the communities were grazed by livestock at the maximum allowable level on a spring/rest rotation system. Great Basin pocket mice were caught at mean rates of 2.2, 0.6, and 0.2 per 100 trap nights, respectively. Great Basin pocket mouse densities on the two sagebrush sites were estimated to be 6.6 and 2.1 per ha, respectively.

Rogers and Hedlund (1980) trapped three distinct plant communities in north-central Oregon: cheatgrass, needle-and-thread grass, and sagebrush/juniper. Great Basin pocket mice were caught at rates of 11.2, 11.5, and 3.5 per 100 trap nights, respectively. In the two grassland communities, Great Basin pocket mice composed >90% of the small mammals caught, but <25% in the sagebrush/juniper.

Allred (1973) sampled 12 shrubsteppe plots in southeastern Idaho that had varying abundances of sagebrush, rabbitbrush, grasses, forbs, and sparse junipers. Great Basin pocket mice abundances were associated with heavy sagebrush cover and moderate grass and forb cover. Abundances were the lowest in areas dominated by grasses or with junipers.

Reynolds and Trost (1980) examined the effect of livestock grazing on small-mammal populations in big sagebrush and crested wheatgrass habitats of southeastern Idaho. The ungrazed areas had not been grazed for >25 years, in contrast to the grazed area, which was grazed by sheep every spring. The crested wheatgrass areas had been planted >20 years earlier. The ungrazed sagebrush was characterized by big sagebrush (17% cover), bluebunch wheatgrass (6%), and Indian ricegrass (5%); 31 plant species were identified in this habitat type. The grazed sagebrush had big sagebrush (25%) and bottlebrush squirreltail (9%); nine plant species were identified in this habitat type. Both the ungrazed and grazed crested wheatgrass areas had primarily crested wheatgrass (52% and 39% cover, respectively). The numbers of plant species identified in each crested wheatgrass association were three and five, respectively. Great Basin pocket mice were caught at rates of 0.06 and 0.04 individuals per 100 trap nights in ungrazed sagebrush and ungrazed crested wheatgrass habitats, respectively. No Great Basin pocket mice were captured in grazed habitats.

Groves and Keller (1983) trapped small mammals in crested wheatgrass, big sagebrush/ bluebunch wheatgrass, big sagebrush/bluebunch wheatgrass/crested wheatgrass ecotone, and Russian thistle habitats on the Idaho National Engineering and Environmental Laboratory. Great Basin pocket mice were caught at rates of: 0.4, 0.5, 0.2, and 0.0 per 100 trap nights, respectively.

Larrison and Johnson (1973) caught Great Basin pocket mice at rates of >5 per 100 trap nights in seeded crested wheatgrass and in big sagebrush/Idaho fescue/bluebunch wheatgrass areas. Great Basin pocket mice were "caught in small numbers" in many other plant communities, including big sagebrush/cheatgrass, saltsage, shadscale, winterfat, halogeton, kochia, black sagebrush, mountain mahogany, and Utah juniper/big sagebrush. Great Basin pocket mouse abundances were significantly reduced in a "heavily grazed" big sagebrush/cheatgrass habitat (0.4 per 100 trap nights), compared to a big sagebrush/cheatgrass/awned wheatgrass/ needle-and-thread grass habitat ungrazed for 25 years (2.4 per 100 trap nights).

Laurance and Cohn (1987) trapped a gradient of xeric big sagebrush/shadscale to mesic rush/saltgrass meadow in southwestern Idaho. Over the course of the summer, Great Basin pocket mice capture locations shifted significantly, from almost exclusively xeric to fairly evenly split between xeric and intermediate (xeric–mesic) moisture sites. Great Basin pocket mice were never caught in mesic areas. The maximum rate at which Great Basin pocket mice were caught was 22.2 per 100 trap nights.

Hanley and Page (1981) trapped small mammals at a variety of shrubsteppe sites in northeast California that were grazed and ungrazed by livestock. Great Basin pocket mice were caught in ungrazed dwarf sagebrush/Idaho fescue and big sagebrush/bluebunch wheatgrass/Thurber's needlegrass at rates (per 100 trap nights) of 2.0 and 0.6, respectively. In grazed plots of these habitats, they were caught at rates of 0.6 and 0.4, respectively. Great Basin pocket mice were caught in ungrazed but not grazed shadscale/Indian ricegrass (0.1). They were caught in grazed but not ungrazed mesic sites composed of Nevada bluegrass/sedge and aspen (0.6 and 0.2, respectively). No Great Basin pocket mice were caught in either grazed or ungrazed black greasewood/Great Basin wildrye or big sage/Idaho fescue.

Great Basin Ecoregion:

Nichols et al. (1975) trapped small mammals in northwestern Utah and caught Great Basin pocket mice in big sagebrush/black greasewood and big sagebrush/lupine/thick-spiked wheatgrass/bottlebrush squirreltail. Densities were estimated to be 1.7 and 9.2 per ha, respectively. Great Basin pocket mice were not caught in big sagebrush/rabbitbrush/saltgrass.

Germano and Lawhead (1986) estimated Great Basin pocket mouse densities to be 0.9 and 0.8 per ha in sagebrush and mixed shrub habitats of southwestern Utah. This species was not trapped in pinyon/juniper, grassland, or greasewood/shadscale habitats.

Ports and Ports (1989) trapped small mammals in six plant associations surrounding a perennial lake in northeastern Nevada. Great Basin pocket mice were trapped in all the plant associations, but capture rates varied dramatically. In habitat 1 (0.3 captures per 100 trap nights), the overstory was composed of black greasewood/big sagebrush/ rubber rabbitbrush, with a "sparse" understory of Sandberg's bluegrass/long-leaved phlox. In habitat 2 (3.8 captures), the overstory was composed of black greasewood/shadscale/alkali rabbitbrush, with a "dense" understory of saltgrass/Great Basin wildrye/alkali bulrush/western seepweed. Habitat 3 (0.2 captures) was a wet rush/sedge meadow with many grass species and extremely dense vegetation. Habitat 4 (0.3 captures) was another rush/sedge meadow, this one with 200 springs and "many mesic shrubs" (i.e., Scouler's willow, Wood's rose, golden currant). Habitat 5 (20 captures) was composed of big sagebrush/bitterbrush/western serviceberry/green rabbitbrush, with an understory of cheatgrass/bottlebrush squirreltail and a "diverse forb component." Habitat 6 (33.0 captures) was composed of spiny hopsage/dwarf sagebrush with abundant bare ground and a "scarce" grass understory of bottlebrush squirreltail/peppergrass.

O'Farrell and Clark (1986) sampled the small-mammal communities of five plant associations in north-central Nevada. Maximum annual densities of Great Basin pocket mice were estimated to be as follows: shadscale/bud sagebrush/spiny hopsage/Nevada bluegrass (10.2 per ha), big sagebrush/Nevada bluegrass/snakeweed (7.0 per ha), big sagebrush/shadscale/Nevada bluegrass (5.3 per ha), black greasewood/shrubby seablite/saltgrass (2.2 per ha). Great Basin pocket mice were not trapped in the marsh-meadow community.

Clements and Young (1996) found Great Basin pocket mouse populations to be very low in bitterbrush/big sagebrush/desert peach that had burned eight years earlier and become dominated by cheatgrass/skeleton weed/buckwheat/

desert peach. Capture rates were 0.2 and 2.5 per 100 trap nights in burned and unburned areas, respectively.

Oldemeyer and Allen-Johnson (1988) sampled the small-mammal communities of shrubsteppe and mountain mahogany areas in northwestern Nevada that were grazed and ungrazed by livestock. The shrubsteppe areas were composed of big sagebrush and bitterbrush with an Idaho fescue understory. Curly-leaf mountain mahogany and western needlegrass with significant areas of exposed rock characterized the other community. Exclosure plots had been rested from livestock grazing for three years, while allotment plots were grazed by livestock on a deferred-rotation system for ≥4 years (historically grazed under an April–September seasonlong system). Great Basin pocket mouse abundances were similar on the ungrazed and grazed areas. At the shrubsteppe site, capture rates ranged from 1.1 to 3.1 per 100 trap nights. At the mountain mahogany site they ranged from 0.3 to 2.9 per 100 trap nights.

Zou et al. (1989) documented the impact of shrub control efforts on small-mammal populations in south-central Utah. The plant community was composed of black sagebrush/fringed sagebrush/rabbitbrush with a western wheatgrass/bottlebrush squirreltail understory. Experimental plots were treated with herbicide (2,4-dichlorophenoxy acetic acid) or mechanical shredding, and some were reseeded with a mix of "grasses, forbs and shrubs." During the growing season following treatment, Great Basin pocket mice densities averaged 2.2 per ha on control plots, 1.5 on experimental plots with reseeding, and 0.3 on experimental plots without reseeding.

Wyoming Basin Ecoregion:

No data reported.

Population Impacts:

Though capture data for Great Basin pocket mice are more common than for most other small mammal species of the Intermountain West, population trends and impacts still are understood poorly. Livestock grazing in arid areas, particularly to the point of changes in shrub structure, negatively impact Great Basin pocket mouse populations. The removal of shrub cover by fire, chaining, or other management techniques has been shown to reduce abundances significantly. Exotic annuals, such as cheatgrass, may provide Great Basin pocket mice with a new food source, but the impact on populations is poorly known (O'Farrell et al. 1975).

State or Federal Status/Listing:

Not listed by federal or state agencies within the regions of interest.

Map Localities:

Data in Figure 49.1 were compiled from Linsdale 1938, Gray 1942, Rickard 1960, Johnson 1961, Black and Frischknecht 1971, Allred 1973, Brown 1973, Larrison and Johnson 1973, Kritzman 1974, Hedlund et al. 1975, Nichols et al. 1975, O'Farrell 1975, O'Farrell et al. 1975, Beatley 1976, Feldhamer 1979a, 1979b, Schreibner 1979, Dunigan et al. 1980, Hedlund and Rogers 1980, Reynolds and Trost 1980, Rogers and Hedlund 1980, Hanley and Page 1981, Hedlund and Rickard 1981, Gano and Rickard 1982, Groves and Keller 1983, Johnson and Keller 1983, Parmenter and MacMahon 1983, Harris 1984, Boula and Sharp 1985, Germano and Lawhead 1986, O'Farrell and Clark 1986, Laurance and Coan 1987, Robey et al. 1987, Broome 1988, Groves and Steenhof 1988, Oldemeyer and Allen-Johnson 1988, Medin and Clary 1989, Ports and Ports 1989, Zou et al 1989, Medin and Clary 1990, Cramer and Chapman 1990, DeStefano 1990, Boone and Keller 1993, Clary et al. 1996, Clements and Young 1996, Rosenstock 1996, Moroge 1998, Jones and Longland 1999, and Gitzen et al. 2001.

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Dark Kangaroo Mouse (*Microdipodops megacephalus*)

Current and Historical Distribution:

The current distribution of dark kangaroo mice is assumed generally similar to historical, but contemporary distribution data are scant. In a review of the available scientific literature, dark kangaroo mice were reported at 19 locations. Based on known natural history traits and presumed distribution, 16 additional locations could have had dark kangaroo mice, but did not (Fig. 50.1).

Habitat Requirements and Associations:

Dark kangaroo mice are endemic to the Great Basin and Columbia Plateau Ecoregions. Presence is commonly associated with gravelly or fine-textured soils. Dark kangaroo mice have been trapped in areas dominated by sagebrush, greasewood, shadscale, horsebrush, and rabbitbrush. However, habitat characteristics that promote presence and abundance are poorly known.

Population Data:

Columbia Plateau Ecoregion:

Feldhamer (1979b) caught 0.04 dark kangaroo mice per 100 trap nights in a big sagebrush/cheatgrass community on the Malheur National Wildlife Refuge in southeast Oregon. This species was not trapped in black greasewood/cheatgrass, Sandberg's bluegrass/saltgrass/bluestem wheatgrass, or marsh communities.

DeStefano (1990) trapped small mammals in a stabilized dune community in southeastern Oregon and caught dark kangaroo mice at a rate of 2.5 per 100 trap nights. No mice were caught in "sagebrush" or "mosaic-sagebrush" habitats.

Hanley and Page (1981) trapped small mammals at a variety of shrubsteppe sites in northeastern California that were grazed or ungrazed by livestock. Dark kangaroo mice were only caught in grazed black greasewood/Great Basin wildrye and Nevada bluegrass/sedge (0.1 per 100 trap nights). They were not caught in ungrazed versions of these habitats, nor in grazed or ungrazed shadscale/Indian ricegrass, dwarf sagebrush/Idaho fescue, big sagebrush/bluebunch wheatgrass/Thurber's needlegrass, big sagebrush/Idaho fescue, or aspens.

Great Basin Ecoregion:

Fautin (1946) trapped small mammals in seven shrubsteppe plant communities in western Utah and estimated the densities of dark kangaroo mice to be as follows: 3.8 per ha in winterfat, 1.0 per ha in shadscale, 0.8 per ha in horsebrush, and 0.2 per ha in greasewood. No mice were trapped in black sagebrush, shadscale/greasewood ecotone, or big sagebrush habitats.

Germano and Lawhead (1986) trapped small mammals in the west-central desert of Utah and caught dark kangaroo mice in sagebrush habitat but not in pinyon-juniper, grassland, mixed shrub, or greasewood-shadscale habitats. The estimated density of dark kangaroo mice in sagebrush habitat was 1.4 per ha.

Ports and Ports (1989) trapped small mammals in northeastern Nevada and caught 0.6 dark kangaroo mice per 100 trap nights in

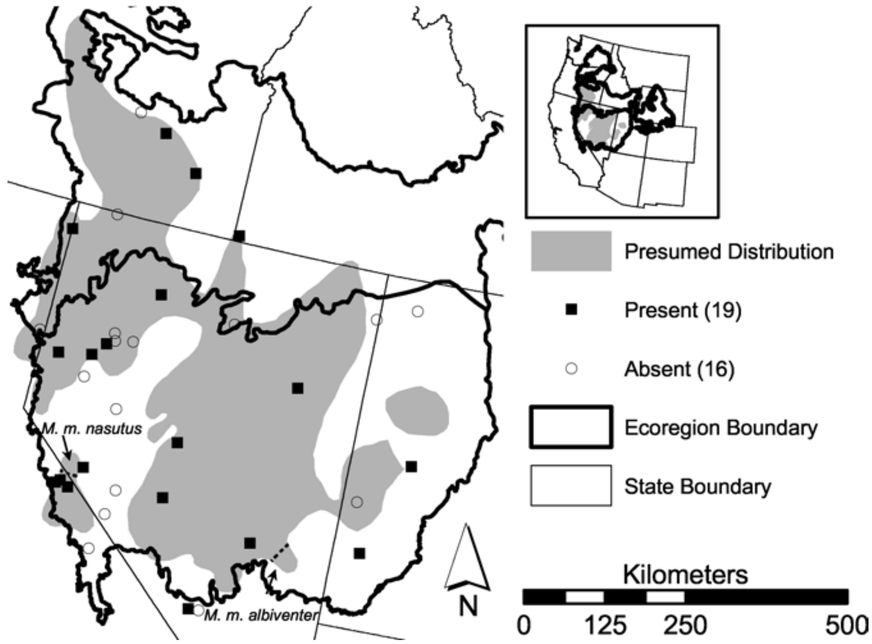

Figure 50.1. Presumed distribution of dark kangaroo mice in the western United States (after Hall 1981). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. See text (Map Localities) for data sources.

black greasewood/big sagebrush/rubber rabbitbrush with a "sparse" understory of Sandberg's bluegrass/long-leaved phlox. This species was not caught in big sagebrush/bitterbrush, spiny hopsage/dwarf sagebrush, or two marsh/meadow communities. Nor were dark kangaroo mice caught in black greasewood/shadscale/alkali rabbitbrush with a "dense" understory of saltgrass/Great Basin wildrye/alkali bulrush/western seepweed.

Brown (1973) trapped small mammals in semistabilized dune sites across the West. Of the 11 sites located near or within the presumed distribution of the dark kangaroo mouse, the species was trapped at only two locations (4.3 and 6.1 captures per 100 trap nights).

Harris (1984) trapped at two dune locations in east-central California and caught dark kangaroo mice at rates of 14.7 and 7.5 captures per 100 trap nights. The first location had stable, low dunes dominated by rabbitbrush with big sagebrush and horsebrush; total cover was approximately 10%. The understory, composed of Indian ricegrass and milk-vetch, was sparse. The second location had tall, unstable dunes with black greasewood, horsebrush, and rabbitbrush of approximately 5% total cover. Harris (1986) presented further data from the first location and reported that abundances of dark kangaroo mice remained "relatively consistent" through a four-year sampling period; capture rates were reported as 15–20 per 100 trap nights.

Wyoming Basin Ecoregion:
Not present.

Population Impacts:

The natural history of the dark kangaroo mouse is very poorly understood. Studies that investigate preferred habitat configurations and impacts to populations are sorely needed. However, factors influencing abundance and distribution are likely similar to those that influence other heteromyid rodents. Destruction and degradation of native habitats (e.g., agricultural conversion, fire, livestock grazing, exotic plant invasion) are potentially important influences on populations.

State or Federal Status/Listing:

Federal: species of concern (USDI Bureau of Land Management: Idaho, Nevada)

Idaho: species of concern

Nevada: species of concern (*M. m. albiven-*

ter and *M. m. nastus* only)

Map Locations:

Data in Figure 50.1 were compiled from Linsdale 1938, Ghiselin 1970, Brown 1973, Beatley 1976, Feldhamer 1979b, O'Farrell 1980, Egoscue 1981, Hanley and Page 1981, Harris 1984, Hafner 1985, Germano and Lawhead 1986, Harris 1986, Robey et al. 1987, Ports and Ports 1989, DeStefano 1990, Jones and Longland 1999.

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Pale Kangaroo Mouse
(*Microdipodops pallidus*)

Current and Historical Distribution:

The current distribution of pale kangaroo mice is assumed generally similar to historical, but contemporary distribution data are sparse. In a review of the available scientific literature, pale kangaroo mice were reported at 12 locations. Based on known natural history traits and presumed distribution, 11 additional locations could have had pale kangaroo mice but did not (Fig. 51.1).

Habitat Requirements and Associations:

The pale kangaroo mouse is endemic to the Great Basin Ecoregion. Habitat preferences are almost entirely unknown, but it has been caught in areas of black greasewood, shadscale, horsebrush, and semistabilized sand dunes. This species is thought to prefer fine-textured soils, but it has also been shown to use gravelly soils as well.

Population Data:

Columbia Plateau Ecoregion:
Not present.

Great Basin Ecoregion:
Few studies report data about pale kangaroo mouse populations. Kotler (1985) trapped pale kangaroo mice at a rate of 2.9 per 100 trap nights in a stabilized dune area of west-central Nevada. Likewise, Brown (1973) trapped small mammals in dune habitats across the West; pale kangaroo mice were trapped at four of the seven sites located near or within their presumed distribution, with capture rates ranging from 2.5 to 10.4 per 100 trap nights.

Wyoming Basin Ecoregion:
Not present.

Population Impacts:

The natural history of the pale kangaroo mouse is very poorly understood. Studies to investigate preferred habitat configurations and impacts to populations are sorely needed. However, factors influencing abundance and distribution are likely similar to those that influence other heteromyid rodents. Destruction and degradation of native habitats (e.g., agricultural conversion, frequent fire, livestock grazing, exotic plant invasion) are potentially important influences on populations.

State or Federal Status/Listing:

Not listed by federal or state agencies within the regions of interest.

Map Localities:

Data in Figure 51.1 were compiled from Brown and Bartholomew 1969, Ghiselin 1970, Brown 1973, Beatley 1976, Hafner 1985, Kotler 1985, and Longland and Bateman 1998.

References:

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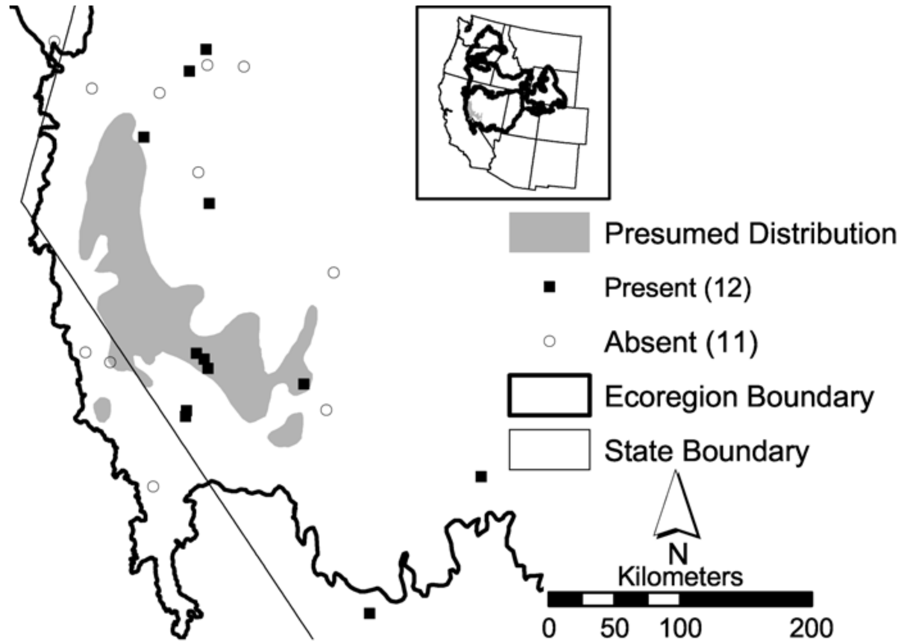

Figure 51.1. Presumed distribution of pale kangaroo mice in the western United States (after Hall 1981). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. See text (Map Localities) for data sources.

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Chisel-toothed Kangaroo Rat
(*Dipodomys microps*)

Current and Historical Distribution:

The current distribution of chisel-toothed kangaroo rats is assumed to be generally similar to historical. In a review of the available scientific literature, chisel-toothed kangaroo rats were reported at 25 locations. Based on known natural history traits and presumed distribution, 20 additional locations could have had chisel-toothed kangaroo rats but did not (Fig. 52.1).

Habitat Requirements and Associations:

The chisel-toothed kangaroo rat is associated with shrub-dominated habitats of the Intermountain West. It is particularly abundant in two plant communities: shadscale and blackbrush. Factors influencing presence and abundance are poorly known, but moderate to heavy shrub cover is thought to be important. Overly rocky areas may be avoided, but this species will use areas with soils ranging from gravelly to silty or sandy.

Population Data:

Columbia Plateau Ecoregion:

Feldhamer (1979b) caught chisel-toothed kangaroo rats in big sagebrush/cheatgrass and black greasewood/cheatgrass (0.1 and 0.03 per 100 trap nights, respectively) on the Malheur National Wildlife Refuge, Oregon. Chisel-toothed kangaroo rats were not caught in marshes or grasslands.

Hanley and Page (1981) trapped small mammals at a variety of shrubsteppe sites in northeast California that were grazed or ungrazed by livestock. Chisel-toothed kangaroo rats were caught in equal numbers in grazed and ungrazed black greasewood/Great Basin wildrye (0.4 per 100 trap nights). In grazed and ungrazed shadscale/Indian ricegrass, they were caught at rates of 0.5 and 0.3 per 100 trap nights, respectively. Chisel-toothed kangaroo rats were not caught in either grazed or ungrazed dwarf sagebrush/Idaho fescue, big sagebrush/bluebunch wheatgrass/Thurber's needlegrass, big sagebrush/Idaho fescue, Nevada bluegrass/sedge, or aspen.

Larrison and Johnson (1973) trapped small mammals in southern Idaho and caught 2–3 times as many chisel-toothed kangaroo rats in healthy shadscale than in shadscale depleted by heavy livestock grazing (5.8 versus 2.3 per 100 trap nights). Chisel-toothed kangaroo rats were also caught in black greasewood (2.7), big sagebrush (1.8), and kochia (0.7). Chisel-toothed kangaroo rats were rare in halogeton and absent in crested wheatgrass.

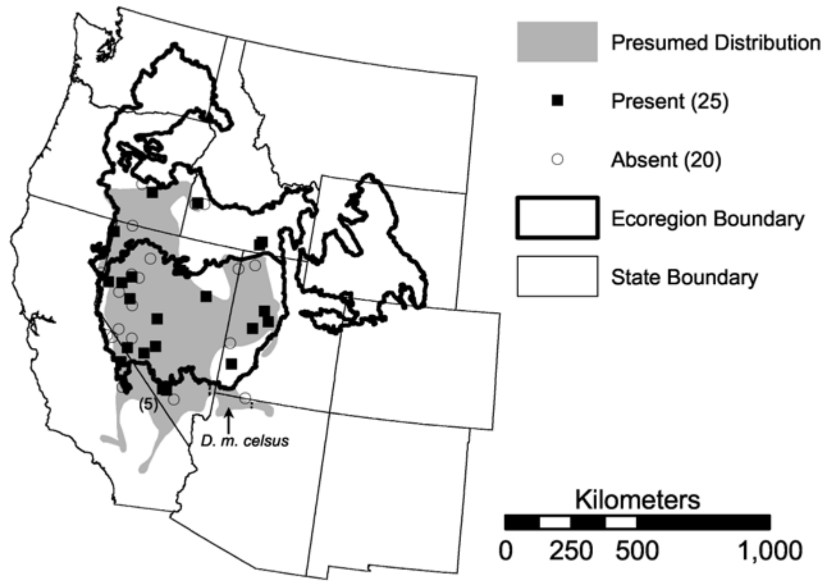
Johnson (1961) found chisel-toothed kangaroo rat abundances in southeastern Idaho to be reduced significantly in shadscale areas depleted by insect defoliation and livestock grazing.

Great Basin Ecoregion:

Black and Frischknecht (1971) caught one chisel-toothed kangaroo rat in 17,280 trap nights in a grassland community of central Utah.

Fautin (1946) trapped small mammals in seven shrub communities in western Utah. Densities of chisel-toothed kangaroo rats were estimated to be as follows (per ha): shadscale (34.0), horsebrush (25.5), winterfat (14.3),

Figure 52.1. Presumed distribution of chisel-toothed kangaroo rats in the western United States (after Hall 1981). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.



shadscale/black greasewood ecotone (13.8), black greasewood (10.2), black sagebrush (8.5). None were trapped in big sagebrush areas.

Brown (1973) trapped small mammals in semistabilized dune communities across the western United States. Chisel-toothed kangaroo rats were caught at only three of the 13 sites that were near or within the presumed distribution of the species. Capture rates were 0.3, 0.6, and 0.4 per 100 trap nights.

O'Farrell and Clark (1986) trapped small mammals in five livestock-grazed plant communities of northeast Nevada and found the annual maximum densities of chisel-toothed kangaroo rats to be 3.8 per ha in big sagebrush/shadscale/Nevada bluegrass; 1.7 per ha in shadscale/bud sagebrush/spiny hopsage/Nevada bluegrass; 1.4 per ha in big sagebrush/Nevada bluegrass/snakeweed; and 0.9 per ha in black greasewood/shrubby seablite/saltgrass. Chisel-toothed kangaroo rats were never caught in wet meadows.

Ports and Ports (1989) trapped small mammals in northeastern Nevada and caught chisel-toothed kangaroo rats in two habitats. They were caught at a rate of 2.5 per 100 trap nights in black greasewood/big sagebrush/rubber rabbitbrush with a "sparse" understory of Sandberg's bluegrass/long-leaved phlox. In spiny hopsage/dwarf sagebrush with abundant bare ground and a "scarce" grass understory of bottlebrush squirreltail/peppergrass, they were caught at a rate of 19.0 per 100 trap nights. Chisel-toothed kangaroo rats were not caught in big sagebrush/bitterbrush/western serviceberry, black greasewood/shadscale/alkali rabbitbrush, or two marshes.

Germano and Lawhead (1986) caught chisel-toothed kangaroo rats in a black greasewood/shadscale community of southeastern Utah, and estimated the density to be 1.0 per ha. No chisel-toothed kangaroo rats were caught in pinyon/juniper, sagebrush, grassland, or mixed-shrub areas.

Allred and Beck (1963) trapped small mammals in five plant communities at the Nevada Atomic Test Site. Chisel-toothed kangaroo rats were caught at the following rates: 22.3 per 100 trap nights in shadscale/kochia/winterfat; 32.6 in blackbrush/spiny hopsage; 30.0 in spiny hopsage/winterfat/desert thorn; 5.3 in pale wolfberry/spiny hopsage; and 0.07 in creosote/desert ragweed (0.07).

Lemen and Freeman (1987) trapped small mammals in a livestock-grazed, mixed desert-shrub community in southwestern Nevada. Chisel-toothed kangaroo rats were caught at a rate of 1.6 per 100 trap nights in an area dominated by shadscale that had a sparse grass and forb understory.

Beatley (1976) trapped small mammals at 58 sites that spanned a transition from Great Basin to Mojave Desert in southern Nevada. Chisel-toothed kangaroo rats were caught at a mean rate of 2.0 per 100 trap nights; abundances were correlated significantly with shrub cover and presence of blackbrush.

Bowers (1986) caught chisel-toothed kangaroo rats at rates of 0.7 and 0.1 per 100 trap nights in four-wing saltbush/winterfat/Mormon tea and shadscale/Mormon tea/pale wolfberry in southern Nevada. Chisel-toothed kangaroo rats were not caught in desert ragweed/creosote/spiny hopsage.

Wyoming Basin Ecoregion:

Not present.

Population Impacts:

Chisel-toothed kangaroo rat population dynamics and factors that influence them are poorly known. However, this species is known to be susceptible to habitat disturbance. Activities that reduce shrub cover (e.g., chaining, burning) will reduce populations and may facilitate invasion by other *Dipodomys* species. Livestock grazing is primarily a negative influence on populations, though magnitude varies by location and grazing regime (Jones and Longland 1999). Some research suggests that this species may avoid areas infested by cheatgrass (Rowland and Turner 1964).

State or Federal Status/Listing:

Federal: species of concern (*D. m. celsus* only; USDI Bureau of Land Management: Utah)

Utah: species of concern (*D. m. celsus* only)

Map Localities:

Data in Figure 52.1 were compiled from Linsdale 1938, Johnson 1961, Allred and Beck 1963, Jorgensen 1963, Rowland and Turner 1964, Beatley 1969, Black and Frischknecht 1971, Brown 1973, Cornaby 1973, Kenagy 1973, Larrison and Johnson 1973, Beatley 1976, Feldhamer 1979b, O'Farrell 1980, Hanley and Page 1981, Bowers 1986, Germano and Lawhead 1986, O'Farrell and Clark 1986, Lemen and Freeman 1987, Robey et al 1987, Ports and Ports 1989, Munger and Slichter 1995, and Jones and Longland 1999.

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Desert Woodrat
(*Neotoma lepida*)

Current and Historical Distribution:

The current distribution of desert woodrats is assumed to be generally similar to historical, but contemporary distribution data are sparse. Presence and abundance of desert woodrats at a location is primarily a function of suitable protective microhabitat (e.g., rock outcrops, junipers, etc.). Thus, trapping data from small-mammal studies that do not specifically target desert woodrats are of questionable use. With this in mind, a review of the available scientific literature reported desert woodrats at 18 locations. Based on known natural history traits and presumed distribution, 20 additional locations could have had desert woodrats but did not (Fig. 53.1).

Habitat Requirements and Associations:

Desert woodrats are found in many types of plant communities, including big sagebrush, black greasewood, shadscale, spiny hopsage, winterfat, kochia, halogeton, curl-leaf mountain mahogany, pinyon/juniper woodland, joshua tree woodland, and creosote bush. However, many of these habitats are occupied only when rock outcrops are available for use as shelter and nest locations (Llewellyn 1981, Thompson 1982b).

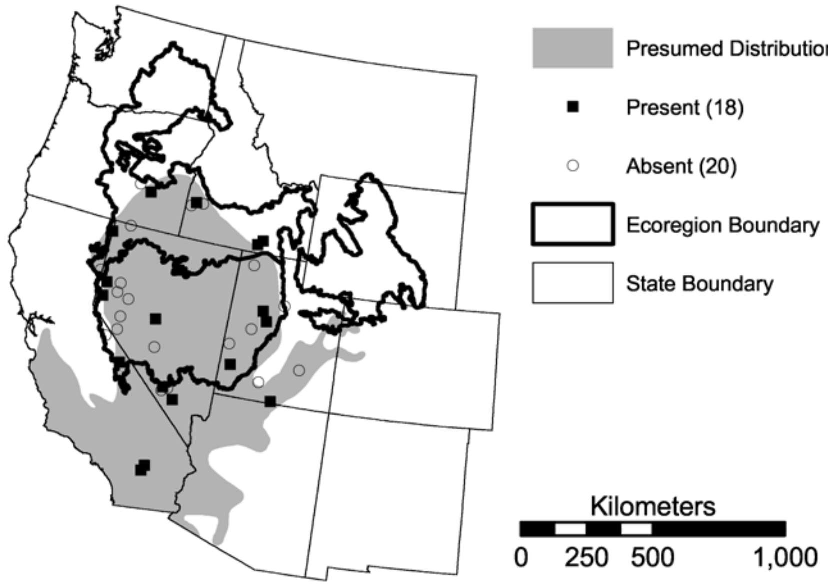

Figure 53.1. Presumed distribution of desert woodrats in the western United States (after Hall 1981; distribution continues south through Baja California). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. See text (Map Localities) for data sources.

Population Data:

Columbia Plateau Ecoregion:

Feldhamer (1979b) caught 0.02 desert woodrats per 100 trap nights in big sagebrush/cheatgrass on the Malheur National Wildlife Refuge, Oregon.

Hanley and Page (1981) caught 0.4 desert woodrats per 100 trap nights in a black greasewood/Great Basin wildrye community of northeastern California.

Great Basin Ecoregion:

Stones and Hayward (1968) used desert woodrat nest densities as an index of abundance in west-central Utah. They estimated adult desert woodrat densities to be 1.3 and 0.7 per ha in moderate and low density juniper forest with big sagebrush understories, respectively.

Bich et al. (1995) caught 0.3 desert woodrats per 100 trap nights in an Indian ricegrass/galleta grass community of south-central Utah.

Germano and Lawhead (1986) estimated the density of desert woodrats to be 0.8 per ha in a pinyon/juniper woodland of southeastern Utah.

O'Farrell and Clark (1986) estimated the density of desert woodrats to be 1.1 per ha in big sagebrush/Nevada bluegrass/snakeweed community of northeastern Nevada.

Bowers (1986) caught 0.2 desert woodrats per 100 trap nights in a desert ragweed/creosote/spiny hopsage community of northwestern Nevada.

Wyoming Basin Ecoregion:

No data reported

Population Impacts:

Many of the usual impacts to small-mammal populations (e.g., frequent fire, habitat conversion, fragmentation, livestock grazing) may be of limited impact to desert woodrats due to their preference for rocky areas and their ability to occupy a diverse range of plant associations. Additionally, desert woodrats readily consume a variety of foods, including plants that contain various phenolic compounds and acids that other mammals often avoid. This contributes to their ability to tolerate diverse habitat conditions.

State or Federal Status/Listing:

Neotoma l. intermedia is a species of concern in California, but this subspecies occurs only outside the ecoregions of interest.

Map Localities:

Data from Figure 53.1 were compiled from Linsdale 1938, Johnson 1961, Stones and Hayward 1968, Beatley 1969, Black and Frischknecht 1971, Cameron and Rainey 1972, Kenagy 1973, Larrison and Johnson 1973, Feldhamer 1979b, O'Farrell 1980, Hanley and Page 1981, Llewellyn 1981, Thompson 1982b, Bowers 1986, Germano and Lawhead 1986, O'Farrell and Clark 1986, Bich et al 1995, and Munger and Slichter 1995.

References:

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Larrison, E. J., and D. R. Johnson. 1973. Density changes and habitat affinities of rodents of shadscale and sagebrush associations. Great Basin Naturalist 33: 255–264.

Linsdale, J. M. 1938. Environmental responses of vertebrates in the Great Basin. American Midland Naturalist 19:1–206.

Llewellyn, J. B. 1981. Habitat selection by desert woodrat (*Neotoma lepida*) inhabiting a pinyon-juniper woodland in western Nevada. Southwestern Naturalist 26:76–78.

Munger, J. A., and T. A. Slichter. 1995. Whipworm (*Trichuris dipodomys*) infection in kangaroo rats (*Dipodomys* spp.): effects on digestive efficiency. Great Basin Naturalist 55:74–77.

O'Farrell, M. J. 1980. Spatial relationships of rodents in a sagebrush community. Journal of Mammalogy 61: 589–605.

O'Farrell, M., and W. A. Clark. 1986. Small mammal community structure in northeastern Nevada. Southwestern Naturalist 31:23–32.

Stones, R., and C. Hayward. 1968. Natural history of the desert woodrat, *Neotoma lepida*. American Midland Naturalist 80:458–476.

Thompson, S. D. 1982b. Spatial utilization and foraging behavior of the desert woodrat, *Neotoma lepida lepida*. Journal of Mammalogy 63:570–581.

Verts, B. J., and L. N. Carraway. 1998. Land mammals of Oregon. University of California Press, Berkeley, CA.

Verts, B. J., and L. N. Carraway. 2002. *Neotoma lepida*. Mammalian Species 699:1–12.

Sagebrush Vole
(*Lemmiscus curtatus*)

Taxonomic Equivalents:

Lagurus curtatus

Current and Historical Distribution:

The current distribution of sagebrush voles is assumed to be generally similar to historical. In a review of the available scientific literature, sagebrush voles were reported at 31 locations. Based on known natural history traits and presumed distribution, 21 additional locations could have had sagebrush voles but did not (Fig. 54.1).

Habitat Requirements and Associations:

Sagebrush voles generally are found in sagebrush and bunchgrass habitats with well-drained soils. This species is also found in areas of rabbitbrush, bitterbrush, and scattered junipers. Although the sagebrush vole can be locally common, habitat characteristics that influence presence and abundance are poorly understood.

Population Data:

Columbia Plateau Ecoregion:

Rickard (1960) trapped small mammals in eight plant associations of northeastern Washington. Sagebrush voles were sporadically caught in stiff sagebrush/Sandberg's bluegrass and big sagebrush/bluebunch wheatgrass/Idaho fescue communities. In both of these habitats, individuals were caught at a rate of 0.2 per 100 trap nights. Sagebrush voles were not caught in bluebunch wheatgrass/Sandberg's bluegrass grassland, mountain shrub, or coniferous forests.

O'Farrell (1972) examined the ecological distribution of sagebrush voles on the Hanford Nuclear Reservation in south-central Washington. At elevations below ~300 m where the vegetation was big sagebrush/Sandberg's bluegrass/cheatgrass, sagebrush voles were rarely trapped. At elevations of 300 to ~1000 m where the vegetation was primarily big sagebrush/bluebunch wheatgrass association, sagebrush voles were distinctly more common.

O'Farrell (1975) trapped small mammals in a shrubsteppe elevation gradient in south-central Washington. At the low-elevation site (~150 m) with big sagebrush/Sandberg's bluegrass/cheatgrass vegetation, no sagebrush voles were trapped. At ~450 m with bluebunch wheatgrass/rubber rabbitbrush, sagebrush voles were caught at a rate of 0.8 per 100 trap nights. At ~760 m, in an ecotone of round-headed buckwheat/Sandberg's bluegrass and big sagebrush/bluebunch wheatgrass, sagebrush vole were caught at a rate of 0.1 per 100 trap nights. At the highest site (~1060 m) with big sagebrush/bluebunch wheatgrass, sagebrush voles were caught at a rate of 4.1 per 100 trap nights.

Hedlund and Rogers (1976) caught one sagebrush vole in 10,000 trap nights in sagebrush-cheatgrass habitat of south-central Washington (elevation ~230 m).

Gitzen et al. (2001) trapped small mammals at 51 locations in nine plant associations

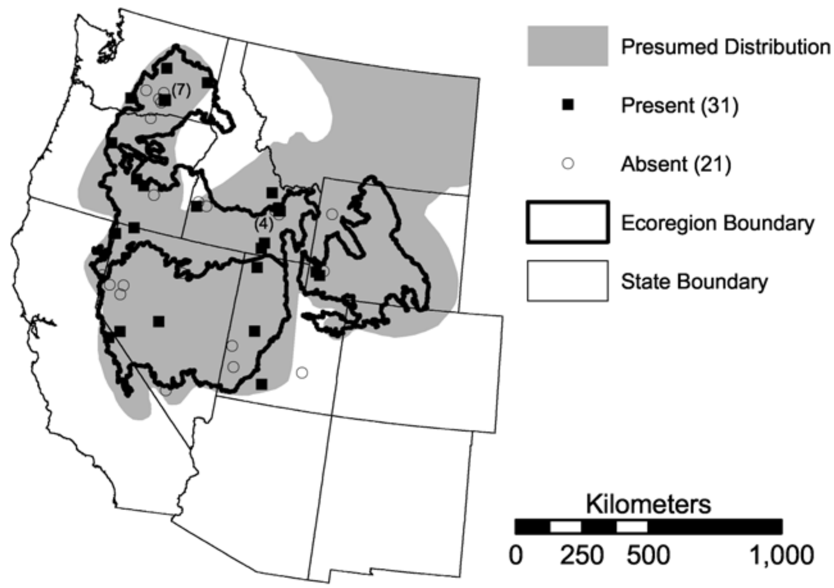

Figure 54.1. Presumed distribution of sagebrush voles in the western United States (after Hall 1981; distribution continues north into southern Alberta and Saskatchewan, east into North Dakota). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.

on and near the Hanford Nuclear Reservation in south-central Washington. Sagebrush voles were caught at a rate of 0.1 per 100 trap nights at three locations with big sagebrush/bluebunch wheatgrass/needle-and-thread grass. At other locations with nearly identical vegetation, no sagebrush voles were trapped.

Johnson and Keller (1983) trapped small mammals in sagebrush-steppe that had been ungrazed for >25 years on the Idaho National Engineering and Environmental Laboratory (INEEL). Big sagebrush dominated the landscape, with an understory composed of native wheatgrasses, bottlebrush squirreltail, and Indian ricegrass. Sagebrush voles were the rarest species trapped (<0.06 per 100 trap nights), comprising <1% of all captures.

Reynolds and Trost (1980) examined the effects of livestock grazing on small-mammal populations in big sagebrush and crested wheatgrass habitats on the INEEL of southeastern Idaho. The ungrazed areas had not been grazed for >25 years, and the grazed area was grazed by sheep every spring. The crested wheatgrass areas had been planted >20 years earlier. The ungrazed sagebrush was characterized by big sagebrush (17% cover), bluebunch wheatgrass (6%), and Indian ricegrass (5%); 31 plant species were identified in this habitat type. The grazed sagebrush had big sagebrush (25%) and bottlebrush squirreltail (9%); nine plant species were identified in this habitat type. Both the ungrazed and grazed crested wheatgrass areas had primarily crested wheatgrass (52% and 39% cover, respectively), with only three and five other plant species identified, respectively. Sagebrush voles were caught at rates of 0.04 and 0.02 individuals per 100 trap nights in ungrazed sagebrush and ungrazed crested wheatgrass habitats, respectively. Sagebrush voles were not trapped in grazed habitats.

Mullican and Keller (1986) trapped specifically for sagebrush voles on the INEEL in southeastern Idaho. The habitat was primarily composed of big sagebrush (29% cover) and bluebunch wheatgrass (11% cover), but green rabbitbrush and various herbaceous plants were also common. Over 2 years, 156 sagebrush voles were caught a total of 617 times in 12,392 trap nights (5.0 per 100 trap nights). Densities were estimated to range from 16 per ha in the summer to 4 per ha in the fall. The examination of the contents of 10 sagebrush vole stomachs (taken in June and August) showed considerable consumption of Indian paintbrush, lupine, and clover.

Groves and Keller (1983) trapped small mammals in big sagebrush/bluebunch wheatgrass, big sagebrush/bluebunch wheatgrass/crested wheatgrass ecotone, crested wheatgrass, and Russian thistle habitats on the INEEL. One sagebrush vole was caught in the sagebrush area in 2,240 trap nights and two in the ecotone area in 9,491 trap nights. Sagebrush voles were not caught in the crested wheatgrass (5,993 trap nights), or in Russian thistle areas (2,965 trap nights).

Boula and Sharp (1985) trapped small mammals in southeast Oregon in three plant communities: big sagebrush/bluebunch wheatgrass/Idaho fescue, big sagebrush/rabbitbrush/cheatgrass, and crested wheatgrass. Using traditional methods of range condition evaluation, these communities were estimated to be in fair/good, poor, and good condition, respectively. All the communities were grazed by livestock at the maximum allowable level on a spring/rest rotation system. Sagebrush voles were caught at rates of 0.6, 0.3, and 0.1 per 100 trap nights, respectively.

Hanley and Page (1981) trapped small mammals at a variety of shrubsteppe sites in northeastern California that were grazed or ungrazed by livestock. Sagebrush voles were caught in ungrazed but not grazed dwarf sagebrush/Idaho fescue and big sagebrush/bluebunch wheatgrass/Thurber's needlegrass (0.5 and 0.4 per 100 trap nights, respectively). They were caught in both grazed and ungrazed big sagebrush/Idaho fescue (0.1 and 0.2, respectively). They were caught in grazed but not ungrazed Nevada bluegrass/sedge (0.1). Sagebrush voles were not caught in either grazed or ungrazed shadscale/Indian ricegrass, black greasewood/Great Basin wildrye, or aspen.

Oldemeyer and Allen-Johnson (1988) sampled the small-mammal communities of shrubsteppe and mountain mahogany areas in northwestern Nevada that were grazed and ungrazed by livestock. The shrubsteppe areas were composed of big sagebrush and bitterbrush with an Idaho fescue understory. Curl-leaf mountain mahogany and western needlegrass with significant areas of exposed rock characterized the other community. Exclosure plots had been rested from livestock grazing for three years, while allotment plots were grazed by livestock using a deferred-rotation system for ≥4 years (historically grazed under an April–September seasonlong system). Sagebrush voles were caught at rates (per 100 trap nights) of 1.9 and 3.8 in ungrazed shrubsteppe, and 0.4 and 1.9 in grazed. Sagebrush voles were not caught in grazed mountain mahogany and were rare in ungrazed (0.2 and 0.4 per 100 trap nights).

Great Basin Ecoregion:

Harris (1984) trapped small mammals at two sand dune sites in east-central California. The first location had stable, low dunes dominated by rabbitbrush with big sagebrush and horsebrush also present; total cover was approximately 10%. The understory, composed of Indian ricegrass and milk-vetch, was sparse. Sagebrush voles were caught at a rate of 0.3 per 100 trap nights at this site. The second location had tall, unstable dunes with black greasewood, horsebrush, and rabbitbrush of approximately 5% total cover; sagebrush voles were not caught at this site.

Zou et al. (1989) documented the impact of shrub control efforts on small-mammal populations in a black sagebrush/fringed sagebrush/rabbitbrush community with a western wheatgrass/bottlebrush squirreltail understory in south-central Utah. Experimental plots were treated with herbicide (2,4-dichlorophenoxy acetic acid) or mechanical shredding, and some were reseeded with a mix of "grasses, forbs and shrubs." During the growing season following treatment, sagebrush voles were absent from herbicide-only plots and from plots with mechanical shredding and reseeding. In herbicide plots with reseeding, sagebrush vole densities averaged 0.1 per ha, while in the control plots they averaged 0.3 per ha.

Wyoming Basin Ecoregion:

No data reported.

Population Impacts:

Sagebrush vole population trends and influences on populations are poorly known. Although the species occasionally occurs in grasslands, abundances are usually highest in shrubsteppe areas with native bunchgrass understories. Activities that reduce sagebrush cover such as agricultural conversion, frequent fire, and range "improvement" projects can cause population declines. The limited information available suggests that livestock grazing is primarily a negative influence on populations, but thorough studies are lacking.

State or Federal Status/Listing:

Not listed by any federal or state agencies within the region of interest.

Map Localities:

Data in Figure 54.1 were compiled from Linsdale 1938, Moore 1942, James and Booth 1954, Rickard 1960, Johnson 1961, O'Farrell 1972, Larrison and Johnson 1973, Kritzman 1974, Maser 1974, O'Farrell 1975, O'Farrell et al. 1975, Hedlund and Rogers 1976, Reynolds and Trost 1980, Egoscue 1981, Hanley and Page 1981, Hedlund and Rickard 1981, Groves and Keller 1983, Johnson and Keller 1983, Harris 1984, Boula and Sharp 1985, Mullican and Keller 1986, Laurance and Coan 1987, Parmenter et al. 1987, Robey et al. 1987, Broome 1988, Oldemeyer and Allen-Johnson 1988, Zou et al. 1989, Clary and Medin 1993, Wander and Carey 1994, Moroge 1998, and Gitzen et al. 2001.

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Kit Fox
(*Vulpes macrotis*)

Taxonomic Equivalents:

The taxonomic status of the kit fox is unclear. Although some research indicates it deserves species status, other research suggests that its proper position is as a subspecies of the swift fox (i.e., *Vulpes velox macrotis*).

Current and Historical Distribution:

The current distribution of kit foxes appears to have declined from its historical extent, but contemporary data are sparse (Fig. 55.1). In a review of the available literature, eight studies have reported kit foxes in the Intermountain West.

Habitat Requirements and Associations:

Kit foxes are closely associated with desert shrub and shrubsteppe habitats; shadscale, black greasewood, and big sagebrush are the most commonly used shrub communities in the

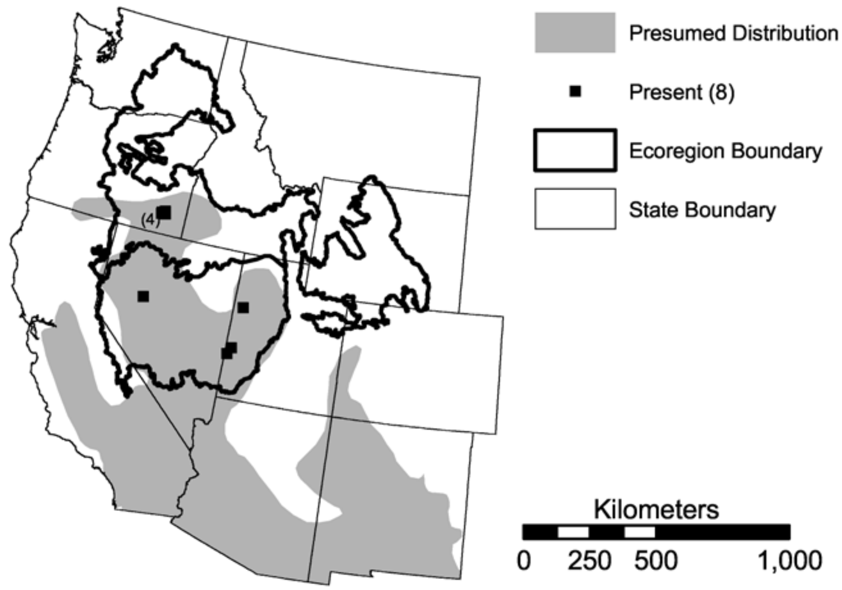

Figure 55.1. Presumed distribution of kit foxes in the western United States (after Hall 1981; distribution continues south into Mexico and Baja California). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.

Intermountain West. Vegetation characteristics that promote presence and abundance are poorly known, but some research indicates that kit foxes may use desert habitats in proportion to their availability (Hardenbrook 1987, Daneke et al. 1984). However, prey abundance can significantly influence presence and abundance of kit foxes.

Population Data:

Columbia Plateau Ecoregion:

Populations in Oregon and Idaho, the northern edge of kit fox range, are thought to be extremely low (Wilson 1985, Keister and Immell 1994). An intensive survey in historically occupied big sagebrush/spiny hopsage habitat in Oregon recorded only three observations (DeStefano 1992).

Great Basin Ecoregion:

Kit fox population data from within the Intermountain West are sparse. Egoscue (1962, 1975) monitored kit fox populations of western Utah for 18 years in a matrix of black greasewood, shadscale, and stabilized dune habitats that was thought to be ideal habitat. Estimated densities ranged between 9.7 and 21.6 per 100 km^2 over the course of the study. In comparison, California populations of kit foxes have been estimated to be as high as 38.5 per 100 km^2 (O'Farrell 1987). Unlike California populations, kit foxes in western Utah subsisted primarily on jackrabbits. A decline in jackrabbit populations was associated with a decline in average kit fox litter size. In spite of a concurrent dramatic increase in Piute ground squirrel (*Spermophilus mollis*) populations, kit foxes did not switch to squirrels as prey.

O'Neal et al. (1987) examined kit fox behavioral ecology in western Utah. Home ranges averaged 3.4 km^2 for adult males and 3.0 km^2 for adult females. Although foxes preferred areas with low shrubs, there was no clear preference for specific shrub types. However, home range size exhibited a strong negative relationship with the length of ravines within an area. The authors hypothesized that this was due to increased prey densities in these areas, but provided no empirical verification. In their study, kit foxes primarily preyed on jackrabbits, kangaroo rats, and Horned Larks (*Eremophila alpestris*).

In the recent past, kit foxes were thought to be common throughout Nevada and western Utah. Trapping data, however, suggest that populations may be in decline: harvest of kit fox pelts in Utah declined steadily from >600 in 1983 to <100 in 1993 (Thacker et al. 1995).

Wyoming Basin Ecoregion:

No data reported.

Population Impacts:

Impacts to kit fox populations are poorly documented. Population cycles of prey species (mainly hares and kangaroo rats) are a natural regulatory mechanism of kit fox abundance. Habitat destruction and degradation have impacted populations, but to an unknown extent. Kit foxes, unlike coyotes (*Canis latrans*), are often not very wary of humans, making them susceptible to a variety of human impacts.

State or Federal Status/Listing:

Federal: *Vulpes m. mutica,* which occurs only outside the ecoregions of interest, is a federal endangered species. *Vulpes macrotis* is a species of concern (USDI Bureau of Land Management: Idaho).

California: *Vulpes m. mutica* (occurs outside ecoregions of interest) is listed as threatened.

Idaho: species of concern

Oregon: threatened species

Washington: species of concern

Map Localities:

Data in Figure 55.1 were compiled from Egoscue 1975, Daneke et al. 1984, Hardenbrook 1987, O'Neal et al. 1987, DeStefano 1990, 1992, Keister 1994, and Keister and Immell 1994.

References:

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Water Shrew
(*Sorex palustris*)

Current and Historical Distribution:

The current distribution of water shrews is assumed generally similar to historical, but contemporary distribution data are virtually nonexistent. In a review of the available scientific literature, water shrews were reported at three locations within the Intermountain West. Based on known natural history traits and presumed distribution, six additional locations could have had water shrews but did not (Fig. 56.1).

Habitat Requirements and Associations:

As the name suggests, water shrews rarely are found far from water. They occur in and around slow and swift-flowing streams, ponds, springs, and other hydrographic features. Vegetation characteristics associated with presence and abundance are poorly understood. Heavy ground cover and well-structured riparian vegetation are considered important, but quantitative specifics are unknown.

Population Data:

Columbia Plateau Ecoregion:

Medin and Clary (1989) compared the small-mammal communities of riparian habitats in northeastern Nevada that were grazed and ungrazed by livestock. Both types of riparian area were characterized by aspens and willows with various grasses and deciduous shrubs. The exclosure was ungrazed for 11 years and occupied >100. Water shrews were absent from both areas.

Medin and Clary (1990) compared the small-mammal communities of riparian habitats in central Idaho that were grazed or ungrazed by livestock. The plots were characterized by various sedges, rushes, and grasses that were invaded by upland shrub and grass species (e.g., big sagebrush, Sandberg's bluegrass). Riparian shrubs were sparse or absent. The 122-ha exclosure was ungrazed for 13 years. Water shrews were caught at rates of 0.2 and 0.3 per 100 trap nights in ungrazed riparian plots and were absent from grazed riparian plots. The following year (Medin and Clary 1991), they again sampled the small-mammal community of the ungrazed exclosure (now ungrazed for 14 years) and caught water shrews at a mean rate of 0.2 per 100 trap nights in both the willow/grass/forb community surrounding a beaver pond and the sedge/rush/Kentucky bluegrass areas surrounding the inlet stream.

Clary and Medin (1993) sampled the small-mammal community in riparian areas with two livestock grazing regimes, light spring grazing and light fall grazing. Both plots were composed of Kentucky bluegrass/redtop/rush/sedge with various forbs, willows and other riparian shrubs. Most vegetation characteristics were similar between the plots, except forb biomass and cover, which were significantly greater on the spring grazed plot. Water shrews were caught at rates of 0.5 and 0.2 per 100 trap nights in the lightly grazed spring and fall plots, respectively.

Great Basin Ecoregion:

No data reported.

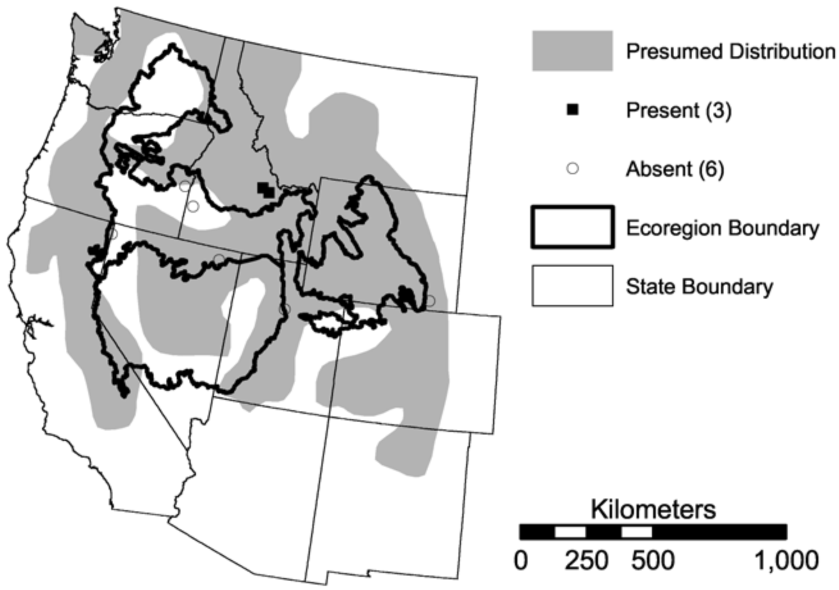

Figure 56.1. Presumed distribution of water shrews in the western United States (after Hall 1981; distribution continues north to Alaska and east through most of Canada into New England). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. See text (Map Localities) for data sources.

Wyoming Basin Ecoregion:
No data reported

POPULATION IMPACTS:

The distribution of water shrew populations within the Intermountain West is poorly known, as are population influences. The association of water shrews with hydric features and mesic areas with substantial cover suggests that this species probably has been severely impacted by the degradation and loss of riparian areas across the West.

STATE OR FEDERAL STATUS/LISTING:

Not listed by any federal or state agencies within the region of interest.

MAP LOCALITIES:

Data in Figure 56.1 were compiled from Brown 1967a, Medin and Clary 1990, and Clary and Medin 1993.

REFERENCES:

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Verts, B., and L. Carraway. 1998. Land mammals of Oregon. University of California, Berkeley, CA.

Townsend's Pocket Gopher
(*Thomomys townsendii*)

CURRENT AND HISTORICAL DISTRIBUTION:

Townsend's pocket gophers appear to have once had a wide distribution in association with expansive Pleistocene lakes. The retreat or disappearance of these lakes has left the current distribution of the species split into several disjunct populations (Fig. 57.1).

HABITAT REQUIREMENTS AND ASSOCIATIONS:

Townsend's pocket gophers are associated with the deep soils of Pleistocene lakebeds. If the proper soils are present, Townsend's pocket gophers can occupy a variety of habitat types, from shrubsteppe to forest-bordered meadows (Thaeler 1968). However, other than soil characteristics, variables that influence presence and abundance are not known.

POPULATION DATA:

With the exception of museum records and specimens collected for taxonomic studies (Rogers 1991a, 1991b), no studies report data on specific habitat associations or abundances.

POPULATION IMPACTS:

Although the current distribution of Townsend's pocket gophers is fairly well documented, even the most basic aspects of its ecol-

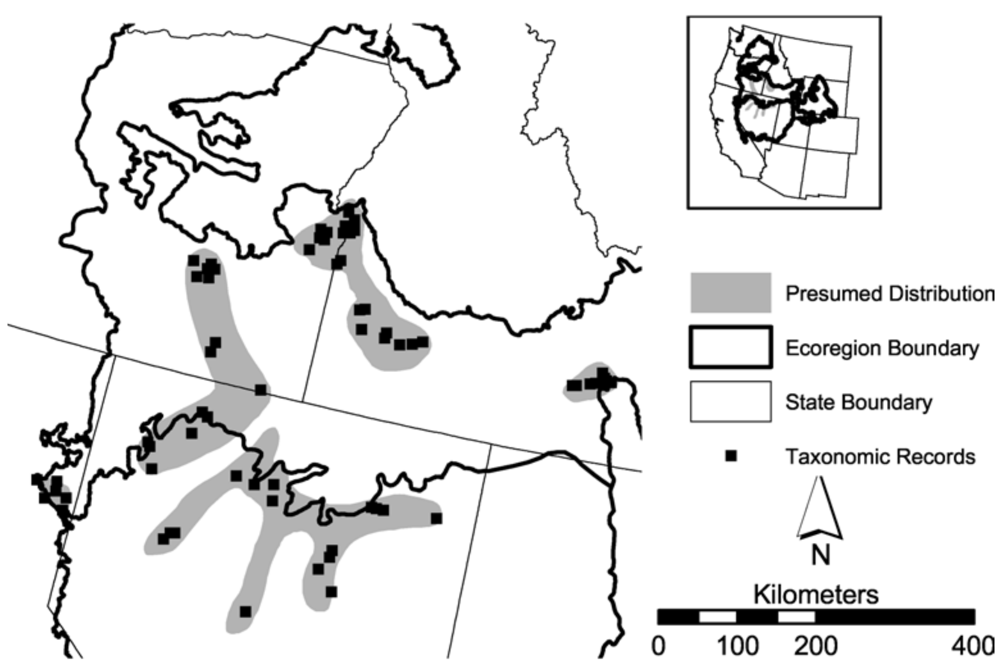

Figure 57.1. Presumed distribution of Townsend's pocket gopher in the western United States (after Rogers 1991a). Filled squares represent literature sources reporting the species present. See text (Map Localities) for data sources.

ogy remain unknown. No information is available regarding population density patterns or impacts. In general, pocket gopher abundances are often correlated positively with plant biomass, particularly the biomass of forbs (Fagerstone and Ramey 1996). Activities that reduce native plant biomass, such as livestock grazing and frequent fires, have the potential to impact pocket gopher populations negatively.

State or Federal Status/Listing:

Not listed by any federal or state agencies within the region of interest.

Map Localities:

Data in Figure 57.1 were compiled from Thaeler 1968 and Rogers 1991a.

References:

Fagerstone, K. A., and C. A. Ramey. 1996. Rodents and lagomorphs, p. 84–132. *In* P. R. Krausman [ed.], Rangeland wildlife. The Society of Range Management, Denver, CO.

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Western Harvest Mouse (*Reithrodontomys megalotis*)

Current and Historical Distribution:

The current distribution of western harvest mice is assumed generally similar to the historical extent. In a review of the available scientific literature, western harvest mice were reported at 34 locations. Based on known natural history traits and presumed distribution, 38 additional locations could have had western harvest mice but did not (Fig. 58.1).

Habitat Requirements and Associations:

Western harvest mice typically inhabit areas of high grass and forb cover such as meadows, abandoned agricultural fields, and riparian areas. They also can be found in big sagebrush, black greasewood, bitterbrush, and rabbitbrush communities. Trap sites where western harvest mice are caught have significantly more shrub, litter, and grass cover than noncapture sites.

Population Data:

Columbia Plateau Ecoregion:

Gray (1942) estimated the density of western harvest mice to be 2.0 per ha in a big sagebrush/black greasewood/rubber rabbitbrush/cheatgrass area of eastern Washington; they comprised 11% of the small mammals trapped.

Schreiber (1979) caught western harvest mice at a rate of 0.3 per 100 trap nights in a big sagebrush/cheatgrass area of south-central Washington; they comprised 3% of total captures.

Gano and Rickard (1982) evaluated the impact of fire on small-mammal populations in a bitterbrush/cheatgrass community in south-central Washington. In undisturbed habitat, 0.1 western harvest mice were caught per 100 trap nights. In the burned area (four years postfire) composed mostly of cheatgrass, 0.03 western

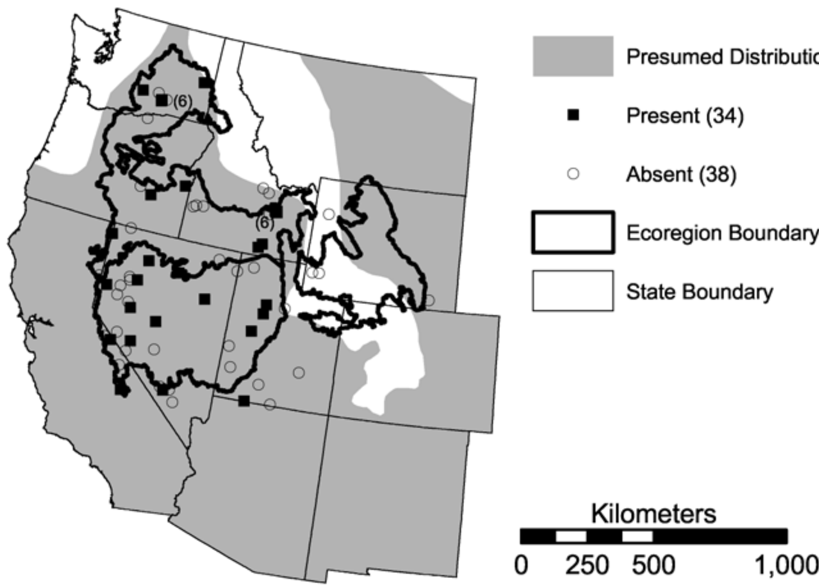

Figure 58.1. Presumed distribution of western harvest mice in the western United States (after Hall 1981, distribution continues south through much of Mexico and east through much of the Midwest). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.

harvest mice were caught per 100 trap nights.

Gitzen et al. (2001) trapped small mammals at 51 locations in nine plant associations on and near the Hanford Nuclear Site in south-central Washington. Western harvest mice were caught most frequently in bitterbrush/Indian ricegrass dunes (0.4 per 100 trap nights) and in dense grass "riverine" areas (0.6 per 100 trap nights). Western harvest mice were absent or rare (≤0.1 per 100 trap nights) in areas dominated by sagebrush, grasses (both exotic annuals and native perennials) and spiny hopsage.

Feldhamer (1979b) sampled the small-mammal communities of four major plant associations on Malheur National Wildlife Refuge, Oregon, and caught western harvest mice in all of them. They caught 0.6 mice per 100 trap nights in hardstem bulrush/common cattail/rush/sedge; 0.4 in Sandberg's bluegrass/saltgrass/bluestem wheatgrass; 0.2 in black greasewood/cheatgrass; and 0.01 big sagebrush/cheatgrass.

Reynolds and Trost (1980) examined the effect of livestock grazing on small-mammal populations in big sagebrush and crested wheatgrass habitats of southeastern Idaho. The ungrazed areas had not been grazed for >25 years, while the grazed area was grazed by sheep every spring. The crested wheatgrass areas had been planted >20 years earlier. The ungrazed sagebrush was characterized by big sagebrush (17% cover), bluebunch wheatgrass (6%), and Indian ricegrass (5%); 31 plant species were identified in this habitat type. The grazed sagebrush had big sagebrush (25%) and bottlebrush squirreltail (9%); nine plant species were identified in this habitat type. Both the ungrazed and grazed crested wheatgrass areas were composed primarily of crested wheatgrass (52% and 39% cover, respectively); the number of plant species identified in each habitat type was three and five, respectively. Western harvest mice were most abundant in the ungrazed crested wheatgrass (1.1 per 100 trap nights), followed by ungrazed sagebrush (0.2), grazed crested wheatgrass (0.2), and grazed sagebrush (0.04).

Larrison and Johnson (1973) caught western harvest mice at rates of >5 per 100 trap nights in seeded crested wheatgrass areas of southeast Idaho. Western harvest mice were captured "in small numbers" in many other plant communities including black greasewood, spiny hopsage, big sagebrush/cheatgrass, sagebrush/native wheatgrass, shadscale, halogeton, kochia, and black sagebrush. Western harvest mice were "rare or absent" in saltsage, winterfat, mountain mahogany, and Utah juniper/big sage. Western harvest mouse abundances were reduced significantly in a "heavily grazed" big sagebrush/cheatgrass habitat (0 were caught in 450 trap nights), compared to a big sagebrush/cheatgrass/awned wheatgrass/needle-and-thread grass habitat ungrazed for 25 years (8 caught in 450 trap nights).

Hanley and Page (1981) trapped small mammals at a variety of shrubsteppe sites in northeastern California that were grazed or ungrazed by livestock. Western harvest mice were caught in both grazed and ungrazed black greasewood/Great Basin wildrye (0.1 and 0.8 per 100 trap nights, respectively). They were caught in grazed but not ungrazed dwarf sagebrush/Idaho fescue (0.1 per 100 trap nights). Western harvest mice were not caught in either grazed or ungrazed shadscale/Indian ricegrass, big sagebrush/bluebunch wheatgrass/Thurber's needlegrass, big sagebrush/Idaho fescue, Nevada bluegrass/sedge, or aspen.

Great Basin Ecoregion:

Nichols et al (1975) caught western harvest mice in a big sagebrush/rabbitbrush/saltgrass habitat of northwestern Utah, and estimated the density to be 3.1 per ha. Western harvest mice were not found at two other sites characterized by big sagebrush/black greasewood and big sagebrush/lupine/thick-spiked wheatgrass/bottlebrush squirreltail.

Fautin (1946) estimated densities of western harvest mice to be 1.3, 9.5, and 4.3 per ha in shadscale/black greasewood, black greasewood, and big sagebrush habitats of western Utah, respectively. Western harvest mice were absent from shadscale, winterfat, horsebrush, and black sagebrush habitats in this study.

O'Farrell and Clark (1986) trapped small mammals in northeastern Nevada and estimated western harvest mice mean annual density to be 1.2 per ha in a marshy meadow of saltgrass, rushes, and sedges with 70% vegetation cover. In a black greasewood/shrubby seablite/saltgrass community with 45% perennial cover, western harvest mice annual mean density was estimated to be 0.3 per ha. Western harvest mice were absent from the following plant associations: big sagebrush/Nevada bluegrass/snakeweed (29% perennial cover); shadscale/bud sagebrush/spiny hopsage/Nevada bluegrass (24% perennial cover); and big sagebrush/shadscale matrix.

Ports and Ports (1989) trapped small mammals in six plant associations surrounding a perennial lake in northeastern Nevada. Western harvest mice were caught only in black greasewood/shadscale/alkali rabbitbrush, with a "dense" understory of saltgrass/Great Basin wildrye/alkali bulrush/western seepweed (1.0 per 100 trap nights). They were not caught in black greasewood/big sagebrush/ rubber rabbitbrush with a "sparse" understory of Sandberg's bluegrass/long-leaved phlox, or in big sagebrush/bitterbrush/western serviceberry/green rabbitbrush, with an understory of cheatgrass/bottlebrush squirreltail and a "diverse forb component," or in spiny hopsage/dwarf sagebrush with abundant bare ground and a "scarce" grass understory of bottlebrush squirreltail/peppergrass. They were not trapped in two mesic meadows either.

Wyoming Basin Ecoregion:

No data reported.

Population Impacts:

Although densities of western harvest mice may go through dramatic interannual fluctuations, most of the available data from within the Intermountain West suggest that where present, western harvest mice densities are commonly low (<5 per ha), as are capture rates (<1 per 100 trap nights). Research suggests that activities that reduce cover (e.g., livestock grazing, frequent fire) can reduce populations significantly (Bock et al. 1984, Longland and Young 1995). Agricultural conversion and fragmentation are also potential negative influences on western harvest mouse populations. Actual controlling factors in shrubsteppe habitats of the Intermountain West are poorly understood.

State or Federal Status/Listing:

Not listed by and federal or state agencies within the region of interest.

Map Localities:

Data in Figure 58.1 were compiled from Linsdale 1938, Gray 1942, Rickard 1960, Johnson 1961, Black and Frischknecht 1971, Allred 1973, Brown 1973, Larrison and Johnson 1973, Nichols et al. 1975, O'Farrell et al. 1975, Beatley 1976, Halford and Millard 1978, Feldhamer 1979b, Schreibner 1979, Hedlund and Rogers 1980, O'Farrell 1980, Reynolds and Trost 1980, Halford 1981, Hanley and Page 1981, Hedlund and Rickard 1981, Gano and Rickard 1982, Johnson and Keller 1983, O'Farrell and Clark 1986, Robey et al. 1987, Ports and Ports 1989, Boone and Keller 1993, Clary et al. 1996, and Gitzen et al. 2001.

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Long-tailed Vole
(*Microtus longicaudus*)

Current and Historical Distribution:

The current distribution of long-tailed voles is assumed generally similar to historical, but contemporary distribution data are sparse. In a review of the available scientific literature, long-tailed voles were reported at 13 locations. Based on known natural history traits and presumed distribution, 40 additional locations could have had long-tailed voles but did not (Fig. 59.1).

Habitat Requirements and Associations:

Long-tailed voles occur in a wide variety of habitats, including coniferous forests, shrubby thickets, forest-meadow ecotones, riparian woodlands, marshes, grasslands, and sagebrush areas. This diverse array precludes simple explanations of presence or absence. Although, long-tailed voles are frequently caught in greater numbers in mesic areas with dense cover, their relationship with water is not fully understood. Populations are cyclic, seemingly on a three-year period, but typically do not reach densities similar to those of the sympatric montane vole (*Microtus montanus*).

Population Data:

Columbia Plateau Ecoregion:

Rickard (1960) trapped the small mammals of seven plant zones in northeastern Washington and found long-tailed voles to be consistently associated with the fescue zone. Long-tailed voles were particularly abundant in snowberry/ Idaho fescue, where capture rates were 1.7 per 100 trap nights. Long-tailed voles were rare in the ponderosa pine zone and absent from the big

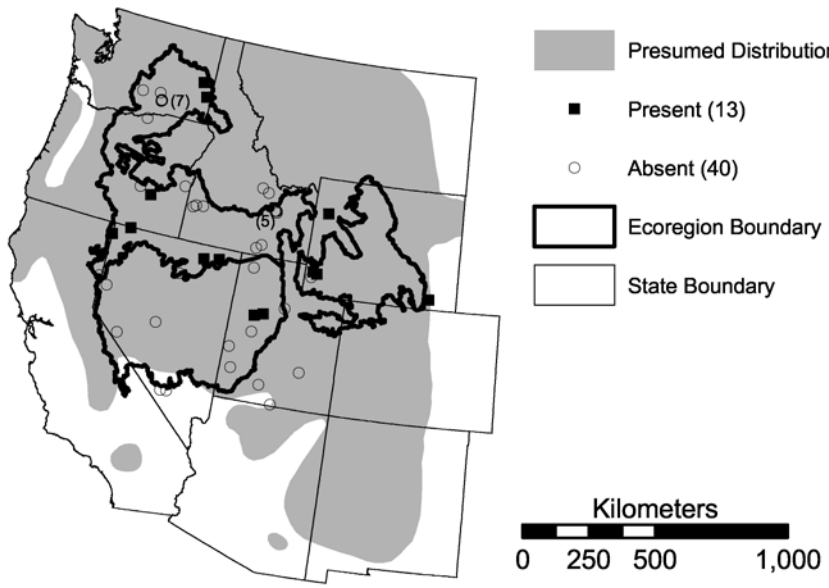

Figure 59.1. Presumed distribution of long-tailed voles in the western United States (after Hall 1981; distribution continues north through British Columbia, the Yukon, and into Alaska). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.

sagebrush, native wheatgrass, Douglas-fir, red cedar/pacific hemlock, and Engelmann spruce/subalpine fir zones.

Randall and Johnson (1979) trapped long-tailed voles in three plant associations for 10 consecutive years to monitor population cycles and habitat occupancy patterns in eastern Washington. In 21,600 trap nights, long-tailed voles were caught once in Idaho fescue/bluebunch wheatgrass, 31 times in common snowberry/rose (0.4 per 100 trap nights), and 47 times in blue bunchgrass/common snowberry/ponderosa pine (0.7 per 100 trap nights).

Feldhamer (1979b) sampled the small-mammal communities of four major plant associations on Malheur National Wildlife Refuge, Oregon. Long-tailed voles were caught at a rate of 0.05 per 100 trap nights in hardstem bulrush/common cattail/rush/sedge. The species was not caught in Sandberg's bluegrass/saltgrass/bluestem wheatgrass, black greasewood/cheatgrass, or big sagebrush/cheatgrass.

Hanley and Page (1981) trapped small mammals at a variety of shrubsteppe sites in northeastern California that were grazed or ungrazed by livestock. Long-tailed voles were caught in ungrazed big sagebrush/bluebunch wheatgrass/Thurber's needlegrass and aspen woodland (0.4 and 1.4 per 100 trap nights, respectively). They were not caught in grazed plots of these habitats. Long-tailed voles were not caught in either grazed or ungrazed shadscale/Indian ricegrass, black greasewood/Great Basin wildrye, dwarf sagebrush/Idaho fescue, big sagebrush/Idaho fescue, or Nevada bluegrass/sedge.

Oldemeyer and Allen-Johnson (1988) sampled the small-mammal communities of shrubsteppe and mountain mahogany areas in northwestern Nevada that were grazed or ungrazed by livestock. The shrubsteppe areas were composed of big sagebrush and bitterbrush with an Idaho fescue understory. Curl-leaf mountain mahogany and western needlegrass with significant areas of exposed rock characterized the other community. Exclosure plots had been rested from livestock grazing for three years, while allotment plots were grazed by livestock using a deferred-rotation system for ≥4 years (historically grazed under an April–September seasonlong system). Capture rates of long-tailed voles in the exclosure and allotment shrubsteppe areas were 0.4 and 0.9 per 100 trap nights, respectively. Long-tailed voles were not trapped in the mountain mahogany areas.

Great Basin Ecoregion:

Medin and Clary (1989) compared small-mammal communities of riparian habitat in northeastern Nevada that were grazed or ungrazed by livestock. The riparian area was characterized by aspens and willows with various grasses and deciduous shrubs. The exclosure was ungrazed for 11 years and >45 ha in size. Long-tailed voles were not caught in grazed riparian, but were caught in ungrazed riparian at a rate of 0.3 per 100 trap nights.

Frischknecht and Baker (1972) caught long-tailed voles at a rate of 14.4 per 100 trap nights during a peak in the population cycle in west-central Utah. Big sagebrush/thick-spiked wheatgrass/bluebunch wheatgrass and locally abundant cheatgrass characterized the study area. The authors concluded that "good herbaceous cover was conducive to buildup of high population of voles."

Wyoming Basin Ecoregion:

Brown (1967b) sampled the small-mammal communities of eight plant associations in southeastern Wyoming. Long-tailed vole capture rates (per 100 trap nights) were highest in willow/alder bog, subalpine meadow, and aspen forest (4.3, 4.5, and 3.3 per 100 trap nights, respectively). The species was rare in lodgepole pine (0.2 per 100 trap nights), Engelmann spruce/subalpine fir (0.4), and alpine tundra (0.3). It was not present in big sagebrush or mountain mahogany communities. Across all habitats, captures rates were distinctly higher at locations near or adjacent to water or with dense or intermediate cover.

Parmenter et al. (1987) trapped small mammals in southeastern Wyoming for three summers, through a long-tailed vole population peak. Annual capture rates ranged from 1.2 to 0.02 per 100 trap nights. Big sagebrush, bitterbrush, and Utah serviceberry composed the shrub layer, with an understory predominantly of grasses (ricegrass, bluegrass, and brome) and various forbs.

Population Impacts:

Although long-tailed voles occur in many habitats, populations are often low. Habitat correlates with presence and abundance are poorly known. The affinity of this species for areas with dense cover suggests that populations are probably sensitive to habitat degradation and simplification. Activities such as agricultural conversion, range "improvements," livestock grazing, and frequent fires all have the potential to impact populations.

State or Federal Status/Listing:

Not listed by any federal or state agencies within the region of interest.

Map Localities:

Data in Figure 59.1 were compiled from Rickard 1960, Brown 1970, Black and Frischknecht 1971, Frischknecht and Baker 1972, Randall 1978, Feldhamer 1979b, Hanley and Page 1981, McGee 1982, Ports and McAdoo 1986, Parmenter et al. 1987, Broome 1988, Oldemeyer and Allen-Johnson 1988, and Medin and Clary 1989.

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Smolen, M. J., and B. L. Keller. 1987. *Microtus longicaudus*. Mammalian Species 271:1–7.

Montane Vole
(*Microtus montanus*)

Current and Historical Distribution:

The current distribution of montane voles is assumed to be generally similar to historical. In a review of the available scientific literature, montane voles were reported at 30 locations. Based on known natural history traits and presumed distribution, 23 additional locations could have had montane voles but did not (Fig. 60.1).

Habitat Requirements and Associations:

Montane voles are associated closely with grassy habitats such as wet and dry grasslands, marshes, alpine meadows, and pastures. They are also found, usually at lower densities, in habitats where woody plants predominate, such as shrubsteppe, mountain shrubland, and riparian areas. The presence and abundance of montane voles are primarily influenced by vegetation cover and moisture. Grass cover ≥50% and mesic conditions are most conducive to higher densities.

Population Data:

Columbia Plateau Ecoregion:

Randall and Johnson (1979) sampled montane vole populations in east-central Washington for 10 years. The three plant associations sampled were Idaho fescue/bluebunch wheatgrass, common snowberry/rose, and blue bunchgrass/common snowberry/ponderosa pine. Mean capture rates (per 100 trap nights) of montane voles were 0.8, 0.5, and 1.0, respectively, in these three associations.

Hodgson (1972) trapped for montane voles in nine plant associations in west-central Montana and caught them at the following rates: 9.0

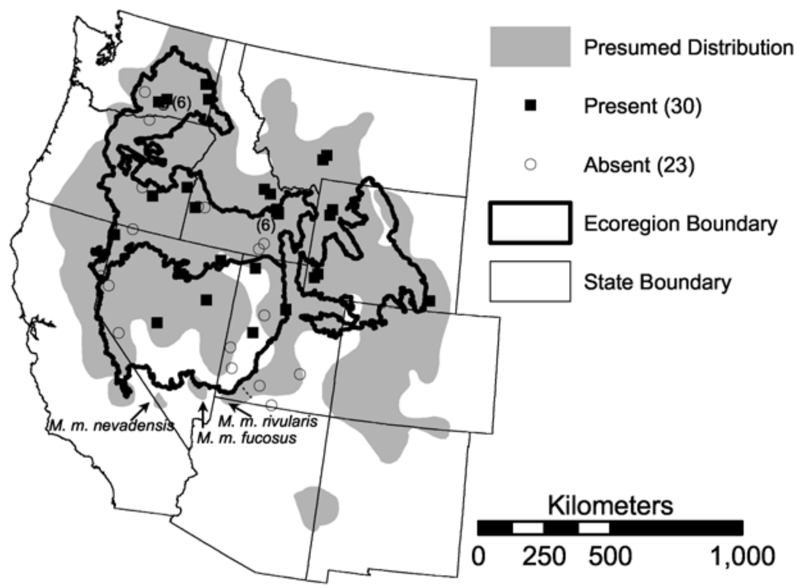

Figure 60.1. Presumed distribution of montane voles in the western United States (after Hall 1981; distribution continues north into British Columbia). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. Numbers in parentheses represent studies whose locations overlap. See text (Map Localities) for data sources.

per 100 trap nights in sagebrush, 6.1 in mesic grassland, 4.9 in grass-forb, 3.9 in dry grassland, 3.2 in mountain park, 0.3 in forb, and 0.2 in grass-sedge associations. Montane voles were not trapped in coniferous or aspen forests.

Feldhamer (1979b) sampled the small-mammal communities of four major plant associations on Malheur National Wildlife Refuge, Oregon. These were hardstem bulrush/common cattail/rush/sedge, Sandberg's bluegrass/saltgrass/bluestem wheatgrass, black greasewood/cheatgrass, and big sagebrush/cheatgrass. Montane voles were caught at the following rates (per 100 trap nights): 5.8, 2.1, 0.1, 0.0, respectively. Montane vole abundances were significantly positively correlated with mean cover on the marsh and grassland plots.

Medin and Clary (1990) compared the small-mammal communities of riparian habitats in central Idaho that were grazed or ungrazed by livestock. All plots were characterized by various sedges, rushes, and mesic grasses that were invaded by upland shrub and grass species (e.g., big sagebrush, Sandberg's bluegrass). Riparian shrubs were sparse or absent. Montane voles were caught at a mean rate of 1.6 per 100 trap nights in ungrazed plots and 0.4 in grazed plots.

Medin and Clary (1991) sampled the small-mammal community surrounding a beaver pond and its inlet stream in central Idaho. Montane voles were caught in the willow/grass/forb community surrounding the beaver pond at rates of 5.7 and 6.7 per 100 trap nights. They were caught in the sedge/rush/Kentucky bluegrass areas surrounding the inlet stream at rates of 1.5 and 1.8 per 100 trap nights. Both plots sampled were in a 55-ha exclosure that had been ungrazed for 14 years.

Koehler and Anderson (1991) sampled the small-mammal communities of three plant associations in central Idaho: big sagebrush/bluebunch wheatgrass, crested wheatgrass, and Russian thistle/cheatgrass/green rabbitbrush. Montane vole capture rates were significantly higher in the crested wheatgrass (2.4 per 100 trap nights) than in the sagebrush or thistle sites (0.1 and 0.6, respectively).

Johnson and Keller (1983) trapped small mammals in sagebrush steppe that had been ungrazed for >25 years on the Idaho National Engineering and Environmental Laboratory (INEEL). Big sagebrush dominated the landscape with an understory of native wheatgrasses, bottlebrush squirreltail, and Indian ricegrass. Montane voles were caught at a rate of 0.09 per 100 trap nights.

Groves and Keller (1983) trapped small mammals in crested wheatgrass, big sagebrush/bluebunch wheatgrass, big sagebrush/bluebunch wheatgrass/crested wheatgrass ecotone, and Russian thistle habitats on the INEEL. Montane voles were caught at rates of 3.0, 0.3, 2.8, and 0.03 per 100 trap nights, respectively.

Hanley and Page (1981) trapped small mammals in a variety of shrubsteppe sites in northeastern California that were grazed or ungrazed by livestock. Montane voles were absent from grazed Nevada bluegrass/sedge, but were caught at a rate of 7.8 per 100 trap nights in ungrazed plots of the same habitat. With the exception of one individual caught in ungrazed big sagebrush/bluebunch wheatgrass/Thurber's needlegrass, no montane voles were caught in the other shrubsteppe sites sampled.

Great Basin Ecoregion:

O'Farrell and Clark (1986) sampled small-mammal community structure in northeastern Nevada. In a marsh meadow area of saltgrass, rushes, and sedges with 70% cover, mean montane vole density was estimated to be 4.1 per ha. Montane voles were absent from the following plant associations: black greasewood/shrubby seablite/saltgrass (45% perennial cover), big sagebrush/Nevada bluegrass/snakeweed (29% perennial cover), shadscale/bud sagebrush/spiny hopsage/Nevada bluegrass (24% perennial cover), and big sagebrush/shadscale matrix.

Ports and Ports (1989) trapped small mammals in six plant associations surrounding a perennial lake in northeastern Nevada. Montane voles were not caught in four upland areas that were composed of various shrubsteppe and salt desert shrubs. In a rush/sedge/grass meadow with seasonal grazing and haying, montane voles were caught at a rate of 7.4 per 100 trap nights. Vegetation cover at this site was "extremely dense" with heights ranging from 10 to 100 cm. In another rush/sedge meadow, this one with 200 springs and "many mesic shrubs" (e.g., Scouler's willow, Wood's rose, golden currant), 1.7 montane voles were caught per 100 trap nights.

Medin and Clary (1989) compared the small-mammal communities of riparian habitats in northeastern Nevada that were grazed and ungrazed by livestock. The riparian vegetation was composed mainly of aspens and willows with various grasses and deciduous shrubs. The exclosure was ungrazed for 11 years and >45 ha in size. Montane voles were only caught at the ungrazed locations. The capture rate was 0.2 per 100 trap nights.

Wyoming Basin Ecoregion:

Brown (1967b) sampled the small-mammal communities of eight plant associations in southeastern Wyoming. Montane voles were caught at the following rates (per 100 trap nights): subalpine meadow (4.3), alpine tundra (3.5), aspen forest (2.8), willow-alder bog (1.7), lodgepole pine forest (1.1), Engelmann spruce/subalpine fir forest (0.8) and big sagebrush (0.2). No montane voles were caught in mountain mahogany.

Pinter (1988) monitored montane vole populations over 19 years in montane meadows of Grand Teton National Park, Wyoming. Capture rates ranged from zero to 8.8 per 100 trap nights. May precipitation levels significantly influenced population densities and population cycles, presumably by altering survival rates and reproductive success.

Population Impacts:

The cyclic nature of montane vole populations complicates interpretation of trapping data; however, the removal of grass cover typically reduces populations. Conversely, the removal of shrubs with a concurrent increase in grass cover can increase abundance. Both agricultural conversion and livestock grazing negatively impact populations. Fire, which temporarily reduces populations, is beneficial over the long-term if appropriate herbaceous vegetation regenerates (McGee 1982).

State or Federal Status/Listing:

Federal: species of concern (USDI Bureau of Land Management: Nevada [*M. m. fucosus* and *M. m. nevadensis*], Utah [*M. m. rivularis*])

Nevada: species of concern (*M. m. fucosus*, *M. m. nevadensis*)

Utah: species of concern (*M. m. rivularis*)

Map Localities:

Data from Figure 60.1 were compiled from Linsdale 1938, Rickard 1960, Brown 1970, Hodgson 1972, Allred 1973, O'Farrell et al. 1975, Douglass 1976, Randall 1978, Feldhamer 1979b, Reynolds and Trost 1980, Hanley and Page 1981, McGee 1982, Groves and Keller 1983, Johnson and Keller 1983, Parmenter and MacMahon 1983, O'Farrell and Clark 1986, Laurance and Coan 1987, Robey et al. 1987, Belk et al. 1988, Broome 1988, Pinter 1988, Medin and Clary 1989, Ports and Ports 1989, Medin and Clary 1990, Koehler and Anderson 1991, Boone and Keller 1993, Clary and Medin 1993, Clary et al. 1996, Moroge 1998, and Gitzen et al. 2001.

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Western Jumping Mouse (*Zapus princeps*)

Current and Historical Distribution:

The current distribution of western jumping mice is assumed generally similar to historical, but contemporary distribution data are sparse. In a review of the available scientific literature, western jumping mice were reported at eight locations. Based on known natural history traits and presumed distribution, five additional locations could have had western jumping mice but did not (Fig. 61.1).

Habitat Requirements and Associations:

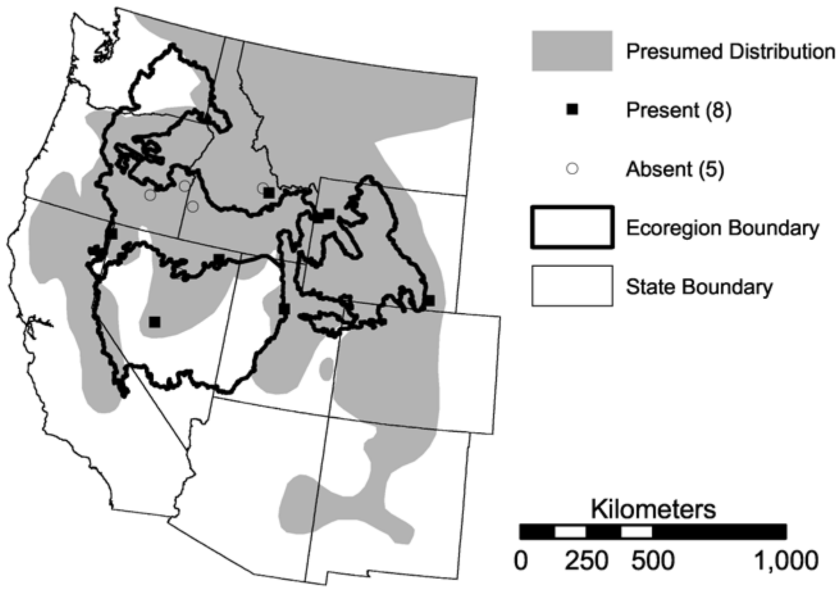
Western jumping mice are closely associated with water and are seldom trapped more than 50 m away from a stream or other hydrographic feature. They are found in riparian areas, mountain meadows, and bogs where the plant communities are characterized by willow, aspen, alder, sedges, and associated forbs and grasses. Prime habitat consists of very dense cover with damp or spongy soils but no standing water.

Population Data:

Columbia Plateau Ecoregion:

Medin and Clary (1989) compared small-

Figure 61.1. Presumed distribution of western jumping mice in the western United States (after Hall 1981; distribution continues north through British Columbia, Alberta, Saskatchewan, and east through North Dakota). Filled squares represent literature sources reporting the species present; unfilled circles represent study localities within the species' range, but where the species was not found. See text (Map Localities) for data sources.



mammal communities of riparian habitats in northeastern Nevada that were grazed or ungrazed by livestock. The riparian area was characterized by aspens and willows with various grasses and deciduous shrubs. The exclosure was >45 ha and had not been grazed for 11 years. Western jumping mice were caught at rates of 2.8 and 2.3 per 100 trap nights in the ungrazed and grazed areas, respectively.

Medin and Clary (1991) sampled the small mammals surrounding a beaver pond and its inlet stream in central Idaho. Western jumping mice were caught only in the willow/grass/forb community surrounding the beaver pond; capture rates were 0.3 and 0.2 per 100 trap nights in 1988 and 1989, respectively. They were not caught in the sedge/rush/Kentucky bluegrass areas surrounding the inlet stream. Both plots sampled were in a 54-ha exclosure ungrazed for 14 years.

In southeastern Idaho, Clary and Medin (1993) sampled the small-mammal community of riparian areas with two livestock grazing regimes: light spring grazing and light fall grazing. Both plots were composed of Kentucky bluegrass/redtop/rush/sedge with various forbs, willows and other riparian shrubs. Most vegetation characteristics were similar between the plots, except forb biomass and cover, which were significantly greater on the spring grazed plot. Western jumping mice were caught at rates of 4.8 and 1.2 per 100 trap nights in the spring and fall plots, respectively.

Hanley and Page (1981) trapped small mammals in aspen stands grazed and ungrazed by livestock in northeastern California. Western jumping mice were caught in ungrazed but not grazed aspen areas (0.2 per 100 trap nights).

Great Basin Ecoregion:

Belk et al. (1988) sampled small mammals in western Utah and caught 0.6 western jumping mice per 100 trap nights in study plots that included areas of aspen, Douglas-fir, and herbaceous meadows with patches of snowberry. Microhabitat characteristics around trap sites where western jumping mice frequently were caught included intermediate herbaceous cover and low tree density.

Wyoming Basin Ecoregion:

Brown (1967b) sampled the small-mammal communities of eight plant associations in southeastern Wyoming. Western jumping mice were caught at rates of 5.0 per 100 trap nights in willow/alder, 4.7 in aspen woodland, 4.6 in subalpine meadows. No western jumping mice were caught in big sagebrush, mountain mahogany, or alpine habitats; they were rare in lodgepole pine and spruce/fir forests. Across all habitats, capture rates were distinctly higher near water or with dense or intermediate cover.

Brown (1970) found western jumping mice densities to be "remarkably stable" in a southeastern Wyoming willow/sedge bog. Densities ranged from 0.4 to 0.8 per ha over the four years of study. Home ranges were narrow and long, parallel to streams. Jumping mice were rarely trapped more than 50 m from the stream, even though the habitat appeared uniformly suitable to twice that distance.

Clark (1971) studied the habitat affinities of western jumping mice in northwestern Wyoming. Abundances were the greatest in areas <50 m from a water source, with dense, waist-deep cover and moderate moisture. Western jumping mice were abundant in willow/sedge/grass savannah and aspen woodlands with "closed canopies, dense shade, and forbs and grasses." Capture rates were 3.1 and 3.7 per 100 trap nights, respectively. Western jumping mice were caught at 1.0 per 100 trap nights in a willow/forb/grass swamp. In big sagebrush, sedge meadow, and sedge/grass meadow, western jumping mice were absent.

McGee (1982) evaluated the impact of spring and fall burning on a mountain shrub community in northwestern Wyoming. Mountain big sagebrush was the dominant shrub, forming "dense homogenous stands" with native grasses and forbs forming a "continuous understory with few open areas." The neighboring habitats were Douglas-fir and aspen forests. In an unburned control area, western jumping mice capture rates averaged 1.6 per 100 trap nights. In spring burn and fall burn areas, capture rates averaged 0.5 and 0.0 per 100 trap nights, respectively, for the two years following the burns.

Schulz and Leininger (1991) trapped small mammals in riparian areas grazed and ungrazed by livestock in north-central Colorado. The ungrazed plots were in enclosures that had been created >30 years earlier because heavy grazing had "practically denuded the entire riparian area." They were vegetated by willow/fowl bluegrass/sedge. The grazed area was composed of Kentucky bluegrass/sedge, annually grazed from June to October (600 AUMs). Significantly more western jumping mice were caught in the ungrazed riparian area (2.3 per 100 trap nights) than in the grazed riparian area (0.01 per 100 trap nights).

Population Impacts:

Western jumping mice typically occur at low densities, and populations are not thought to cycle. The dependence of this species on dense cover and mesic areas makes populations particularly susceptible to riparian habitat destruction and degradation. Livestock grazing has been shown to reduce western jumping mouse abundance, as can fire in the short-term. Other factors, such as watershed degradation and habitat conversion, also negatively impact this species.

State or Federal Status/Listing:

Not listed by any federal or state agencies within the region of interest.

Map Localities:

Data in Figure 61.1 were compiled from Linsdale 1938, Brown 1970, Clark 1971, Hanley and Page 1981, McGee 1982, Belk et al. 1988, Medin and Clary 1989, and Clary and Medin 1993.

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APPENDIX A. Scientific names of plant species mentioned in this report. Nomenclature follows USDA (2004).

Common name	Scientific name	Family
alder	*Alnus* spp.	Betulaceae
aspen	*Populus tremulodies*	Salicaceae
bitterbrush	*Purshia tridentata*	Rosaceae
blackbrush	*Coleogyne ramosissima*	Rosaceae
bluegrass,	*Poa* spp.	Poaceae
fowl	*Poa palustris*	Poaceae
Kentucky	*Poa pratensis*	Poaceae
Nevada	*Poa secunda* (= *nevadensis*)	Poaceae
Sandberg's	*Poa secunda* (= *sandbergii*)	Poaceae
box thorn	*Lycium halimifolium*	Solanaceae
brome	*Bromus* spp.	Poaceae
buckwheat, round-headed	*Eriogonum sphaerocephalum*	Polygonaceae
bulrush, alkali	*Schoenoplectus maritimus* (= *Scirpus paludosus*)	Cyperaceae
hardstem	*Schoenoplectus* (= *Scirpus*) *acutus*	Cyperaceae
cattail, common	*Typha latifolia*	Typhaceae
cheatgrass	*Bromus tectorum*	Poaceae
clover	*Trifolium* spp.	Fabaceae
cottonwood	*Populus* spp.	Salicaceae
creosote	*Larrea divaricata*	Zygophyllaceae
currant, golden	*Ribes aureum*	Grossulariaceae
desert thorn	*Lycium andersonii*	Solanaceae
Douglas fir	*Pseudotsuga menziesii*	Pinaceae
dropseed, sand	*Sporobolus contractus* (= *cryptandrus*)	Poaceae
fescue, Idaho	*Festuca idahoensis*	Poaceae
fir, subalpine	*Abies lasiocarpa*	Pinaceae
galleta grass	*Pleuraphis* (= *Hilaria*) *jamesii*	Poaceae
big	*Pleuraphis* (= *Hilaria*) *rigida*	Poaceae
greasewood, black	*Sarcobatus vermiculatus*	Chenopodiaceae
halogeton	*Halogeton glomeratus*	Chenopodiaceae
hemlock, Pacific	*Tsuga heterophylla*	Pinaceae
hopsage, spiny	*Grayia* (= *Atriplex*) *spinosa*	Chenopodiaceae
horsebrush	*Tetradymia* spp.	Asteraceae
Joshua tree	*Yucca brevifolia*	Liliaceae
juniper, Utah	*Juniperus osteosperma*	Cupressaceae
kochia	*Kochia* spp.	Chenopodiaceae
lupine	*Lupine* spp.	Fabaceae
manzanita	*Arctostaphylos* spp.	Ericaceae
medusahead	*Taeniatherium caput-medusae* (= *asperum*)	Poaceae
milk-vetch	*Astragalus* spp.	Fabaceae
Mormon tea	*Ephedra viridis*	Ephedraceae
mountain mahogany, curl-leaf	*Cercocarpus ledifolius*	Rosaceae
needle and thread	*Hesperostipa* (= *Stipa*) *comata*	Poaceae
needlegrass, Thurber's	*Achnatherum thurberianum* (= *Stipa thurberiana*)	Poaceae
western	*Achnatherum nelsonii* (= *Stipa occidentalis*)	Poaceae

Common name	Scientific name	Family
oak	*Quercus* spp.	Fagaceae
paintbrush, Indian	*Castilleja* spp.	Scrophulariaceae
peach, desert	*Prunus andersonii*	Rosaceae
phlox, long-leaved	*Phlox longifolia*	Polemoniaceae
pine, bristlecone	*Pinus longaeva*	Pinaceae
limber	*Pinus flexilus*	Pinaceae
lodgepole	*Pinus contorta*	Pinaceae
pinyon	*Pinus edulis*	Pinaceae
rabbitbrush	*Chrysothamnus* spp.	Asteraceae
alkali	*Chrysothamnus albidus*	Asteraceae
green	*Chrysothamnus vicidiflorus*	Asteraceae
rubber	*Chrysothamnus nauseosus*	Asteraceae
ragweed, desert	*Ambrosia dumosa*	Asteraceae
redcedar, western	*Thuja plicata*	Cupressaceae
redtop	*Agrostis gigantea* (= *alba*)	Poaceae
ricegrass, Indian	*Achnatherum* (= *Oryzopsis*) *hymenoides*	Poaceae
rose, Wood's	*Rosa woodsii*	Rosaceae
rush	*Juncus* spp.	Juncaceae
sagebrush	*Artemisia* spp.	Asteraceae
big	*Artemisia tridentata*	Asteraceae
black	*Artemisia arbuscula nova*	Asteraceae
bud	*Picrothamnus desertorum* (= *Artemisia spinescens*)	Asteraceae
dwarf	*Artemisia arbuscula*	Asteraceae
fringed	*Artemisia frigida*	Asteraceae
mountain big	*Artemisia tridentata vaseyana*	Asteraceae
stiff	*Artemisia rigida*	Asteraceae
saltbush, four-wing	*Atriplex canescens*	Chenopodiaceae
saltgrass	*Distichlis* spp.	Poaceae
saltsage	*Atriplex nuttallii*	Chenopodiaceae
seablite, shrubby	*Suaeda moquinii* (= *fruticosa*)	Chenopodiaceae
sedge	*Carex* spp.	Cyperaceae
seepweed, western	*Suaeda calceoliformis* (= *occidentalis*)	Chenopodiaceae
serviceberry, western	*Amelanchier alnifolia*	Rosaceae
shadscale	*Atriplex confertifolia*	Chenopodiaceae
snakeweed	*Gutierrezia sarothrae*	Asteraceae
snowberry, common	*Symphoricarpos albus*	Caprifoliaceae
spruce, Engelmann	*Picea engelmannii*	Pinaceae
squirreltail, bottlebrush	*Elymus elymoides* (= *Sitanion hystrix*)	Poaceae
tansymustard	*Descurainia pinnata*	Brassicaceae
thistle, Russian	*Salsola kali*	Chenopodiaceae
tumblemustard	*Sisymbrium altissimum*	Brassicaceae
wheatgrass,	*Agropyron* spp.	Poaceae
awned	*Elymus caninum* (= *Agropyron caninum*)	Poaceae
bearded	*Elymus caninum* (= *Agropyron caninum*)	Poaceae
bluebunch	*Pseudoroegneria spicata* (= *Agropyron spicatum*)	Poaceae
thick-spiked	*Elymus albicans* (= *Agropyron dasystachyum*)	Poaceae
western	*Pascopyrum* (= *Agropyron*) *smithii*	Poaceae
wrested	*Agropyron cristatum*	Poaceae
wildrye, Great Basin	*Leymus* (= *Elymus*) *cinerus*	Poaceae
willow, Scouler's	*Salix scouleriana*	Salicaceae
winterfat	*Krascheninnikovia* (= *Eurotia*) *lanata*	Chenopodiaceae

APPENDIX B. Responses to livestock grazing by small mammals occupying shrubsteppe or riparian habitats of the Intermountain West.

Species Study location	Habitat type	Intensity[a]	Response[b]	Source
Upland species				
Little pocket mouse				
California	shadscale/Indian ricegrass	heavy	–	Hanley and Page 1981
California	black greasewood/Great Basin wildrye	heavy	–	Hanley and Page 1981
Nevada	shadscale/black greasewood	heavy	–	Jones and Longland 1999
Utah	Indian ricegrass/galleta grass	heavy	–*	Bich et al. 1995
Great Basin pocket mouse				
California	shadscale/Indian ricegrass	heavy	–	Hanley and Page 1981
California	dwarf sagebrush/Idaho fescue	heavy	–	Hanley and Page 1981
California	big sagebrush/bluebunch wheatgrass/Thurber's needlegrass	heavy	–	Hanley and Page 1981
California	Nevada bluegrass/sedge	heavy	+[c]	Hanley and Page 1981
California	aspen	heavy	+[c]	Hanley and Page 1981
Idaho	riparian	heavy	+[c]	Medin and Clary 1989
Idaho	riparian	heavy	–	Medin and Clary 1990
Idaho	big sagebrush	heavy	–	Larrison and Johnson 1973
Idaho	big sagebrush/bluebunch wheatgrass/Indian ricegrass	unknown	–	Reynolds and Trost 1980
Idaho	crested wheatgrass	unknown	–	Reynolds and Trost 1980
Nevada	big sagebrush/bitterbrush/Idaho fescue	moderate	0	Oldemeyer and Allen-Johnson 1988
Nevada	curl-leaf mountain mahogany/western needlegrass	moderate	–	Oldemeyer and Allen-Johnson 1988
Utah	native/exotic perennial bunchgrass	heavy	0	Black and Frischknecht 1971
Utah	semiarid shrub-grassland	heavy	–	Rosenstock 1996
Washington	bluebunch wheatgrass/needle and thread	moderate	0	Grant et al. 1982
Dark kangaroo mouse				
California	black greasewood/Great Basin wildrye	heavy	0	Hanley and Page 1981
California	Nevada bluegrass/sedge	heavy	+[c]	Hanley and Page 1981
Chisel-toothed kangaroo rat				
California	shadscale/Indian ricegrass	heavy	+	Hanley and Page 1981
California	black greasewood/Great Basin wildrye	heavy	0	Hanley and Page 1981

APPENDIX B Continued.

Species Study location	Habitat type	Intensity[a]	Response[b]	Source
Idaho	shadscale	heavy	–[*]	Johnson 1961
Idaho	shadscale	heavy	–	Larrison and Johnson 1973
Nevada	shadscale/black greasewood	heavy	–	Jones and Longland 1999
Desert woodrat				
California	black greasewood/Great Basin wildrye	heavy	–	Hanley and Page 1981
Utah	Indian ricegrass/galleta grass	heavy	–	Bich et al. 1995
Sagebrush vole				
California	dwarf sagebrush/Idaho fescue	heavy	–	Hanley and Page 1981
California	big sagebrush/bluebunch wheatgrass/Thurber's needlegrass	heavy	–	Hanley and Page 1981
California	big sagebrush/Idaho fescue	heavy	–	Hanley and Page 1981
California	Nevada bluegrass/sedge	heavy	+[c]	Hanley and Page 1981
Idaho	big sagebrush/bluebunch wheatgrass/Indian ricegrass	unknown	–	Reynolds and Trost 1980
Idaho	crested wheatgrass	unknown	–	Reynolds and Trost 1980
Nevada	big sagebrush/ bitterbrush/Idaho fescue	moderate	–	Oldemeyer and Allen-Johnson 1988
Nevada	curl-leaf mountain mahogany/western needlegrass	moderate	–	Oldemeyer and Allen-Johnson 1988
Washington	bluebunch wheatgrass/ needle and thread	moderate	0	Grant et al. 1982
Riparian species				
Water shrew				
Idaho	riparian	heavy	–	Medin and Clary 1990
Western harvest mouse				
California	black greasewood/Great Basin wildrye	heavy	–	Hanley and Page 1981
California	dwarf sagebrush/Idaho fescue	heavy	+	Hanley and Page 1981
Idaho	big sagebrush	heavy	–[*]	Larrison and Johnson 1973
Idaho	shadscale	heavy	–	Larrison and Johnson 1973
Idaho	big sagebrush/bluebunch wheatgrass/Indian ricegrass	unknown	–	Reynolds and Trost 1980

APPENDIX B. Continued.

Species / Study location	Habitat type	Intensity[a]	Response[b]	Source
Idaho	crested wheatgrass	unknown	–	Reynolds and Trost 1980
Utah	native/exotic perennial bunchgrass	heavy	–	Black and Frischknecht 1971
Long-tailed vole				
California	big sagebrush/bluebunch wheatgrass/Thurber's needlegrass	heavy	–	Hanley and Page 1981
California	aspen	heavy	–	Hanley and Page 1981
Colorado	riparian	heavy	–	Schulz and Leininger 1991
Idaho	riparian	heavy	–	Medin and Clary 1989
Nevada	big sagebrush/bitterbrush/Idaho fescue	moderate	0	Oldemeyer and Allen-Johnson 1988
Montane vole				
California	big sagebrush/bluebunch wheatgrass/Thurber's needlegrass	heavy	–	Hanley and Page 1981
California	Nevada bluegrass/sedge	heavy	–	Hanley and Page 1981
Colorado	riparian	heavy	–	Schulz and Leininger 1991
Idaho	riparian	heavy	–	Medin and Clary 1989
Idaho	riparian	heavy	–	Medin and Clary 1990
Idaho	big sagebrush/bluebunch wheatgrass/Indian ricegrass	unknown	–	Reynolds and Trost 1980
Idaho	crested wheatgrass	unknown	0	Reynolds and Trost 1980
Montana	Idaho fescue/bearded wheatgrass	moderate	–	Grant et al. 1982
Western jumping mouse				
California	aspen	heavy	–	Hanley and Page 1981
Colorado	riparian	heavy	–**	Schulz and Leininger 1991
Idaho	riparian	heavy	0	Medin and Clary 1989
Montana	Idaho fescue/bearded wheatgrass	moderate	–	Grant et al. 1982

[a] Livestock grazing intensity reported by original authors, in comparison with lightly grazed or ungrazed areas.

[b] Effect of livestock grazing on abundance. Responses are listed as positive (+) or negative (–) only when the difference between treatments was ≥ 20%; 0 = no effect. Asterisks denote statistically significant differences reported by original authors, * = $P \leq 0.05$, ** = $P \leq 0.01$.

[c] These positive responses involve species typically associated with dry upland habitats. Their increased abundances were reported in mesic habitats altered by heavy livestock grazing.