

**PETITION TO LIST OREGON VESPER SPARROW
(*Pooecetes gramineus affinis*)
AS ENDANGERED OR THREATENED
UNDER THE U.S. ENDANGERED SPECIES ACT**



Photo: Klamath Bird Observatory

American Bird Conservancy

October, 2017

P.O. Box 249, 4249 Loudoun Avenue • The Plains, VA 20198
Tel: 540-253-5780 • Fax: 540-253-5782 • info@abcbirds.org • abcbirds.org



Bringing back the birds

October 5, 2017

The Honorable Ryan Zinke
Secretary
U.S. Department of the Interior
1849 C Street
Washington, D.C. 20240

Dear Secretary Zinke,

Pursuant to Section 4(b) of the Endangered Species Act (ESA), 16 U.S.C. §1533(b), Section 553(3) of the Administrative Procedures Act, 5 U.S.C. § 553(e), and 50 C.F.R. §424.14(a), the American Bird Conservancy (ABC) hereby petitions the Secretary of the Interior, through the United States Fish and Wildlife Service (USFWS), to list Oregon Vesper Sparrow (*Pooecetes gramineus affinis*) as a threatened or endangered species and designate critical habitat to ensure its recovery.

This petition sets in motion a specific process, placing defined response requirements on the USFWS. Specifically, the USFWS must issue an initial finding as to whether the petition “presents substantial scientific or commercial information indicating that the petitioned action may be warranted.” 16 U.S.C. §1533(b)(3)(A). The USFWS must make this initial finding “to the maximum extent practicable, within 90 days after receiving the petition.” Petitioners need not demonstrate that listing is warranted, rather, petitioners must only present information demonstrating that such listing may be warranted. In this case, petitioners believe that the best available information demonstrates listing the Oregon Vesper Sparrow as threatened or endangered is in fact warranted, and therefore expect USFWS to make a positive initial finding on the petition, to promptly commence a status review as required by 16 U.S.C. § 1533(b)(3)(B), and to list this species as threatened or endangered under the ESA as soon as practicable.

Petitioner

ABC is a 501(c)3 not-for-profit organization dedicated to conserving wild birds and their habitats throughout the Americas (www.abcbirds.org). Founded in 1994, ABC is the only US-based group whose sole focus is the birds of the Americas. We act to safeguard the rarest species, protect and expand bird habitats, and eliminate threats to all birds, while building capacity within the conservation movement.

ABC staff in the Pacific Northwest, Bob Altman, is the leading expert on Oregon Vesper Sparrow. He conducted the initial studies in the Willamette Valley, Oregon in the 1990s, and has been leading the range-wide assessment on abundance, distribution, and habitat relationships over the last four years.

Sincerely,

Michael J. Parr, President

EXECUTIVE SUMMARY

Oregon Vesper Sparrow (*Pooecetes gramineus affinis*) warrants listing as threatened or endangered under the Endangered Species Act because of small population size, significant population declines, breeding and wintering range contractions and many local extirpations, ongoing habitat loss and degradation, negative impacts from a variety of threats, and lack of adequate protection by existing regulatory mechanisms. These factors, and the best available scientific data to support them as presented herein, portray a bird that is highly imperiled and threatened with extinction throughout its range.

Oregon Vesper Sparrow has a restricted breeding range that historically included southwestern British Columbia, western Washington and Oregon, and northwestern California. It is migratory, and overwinters in California west of the Sierra Nevada Mountains and south of San Francisco Bay, and historically into northwestern Baja California, Mexico.

The current estimated population of Oregon Vesper Sparrow is <3,000 birds. Breeding Bird Survey data indicates a statistically significant population decline of 5.48%/year over the last 47 years. Wintering populations have been extirpated from Baja, California and parts of southern California. There have been numerous local breeding population extirpations throughout the range. This includes extirpations and range contractions of approximately 100 miles (160 kilometers) and 75 miles (120 kilometers) from both the northern and southern edges of its range (i.e., British Columbia and California, respectively).

The primary threats to Oregon Vesper Sparrow are: 1) continuing loss and degradation of grassland and savannah habitats (e.g., development and land conversion to non-suitable agricultural cropland habitat; encroachment of invasive shrubs, trees, and tall, dense exotic grasses); 2) negative impacts of land use/management on nesting birds (e.g., type, degree, and timing of activities such as mowing, habitat restoration, overgrazing, military training, recreation); and 3) several factors related to small, isolated, and declining populations (e.g., genetic variability, recruitment/dispersal, stochastic events).

These threats and the following observations suggest a heightened sense of conservation urgency for Oregon Vesper Sparrow: 1) many areas of unoccupied suitable habitat within the context of an existing population, 2) many local extirpations of populations where there were no habitat changes, 3) areas with significant restoration of suitable habitat, but no establishment of populations, and 4) a preponderance of small and isolated populations that are inherently subject to a high degree of potential demographic issues.

Existing regulatory mechanisms are inadequate to provide the protection needed to prevent Oregon Vesper Sparrow from continued population declines and local and regional extirpations on a trajectory towards extinction. There are no Federal or State programs specific to its conservation. Further, opportunities for proactive conservation measures are challenged by the birds limited occurrence on public lands (approximately 20% of the range-wide population), and/or existing mandates and policies that prioritize actions that are either not compatible with or not specific enough to Oregon Vesper Sparrow.

The range-wide small population size of Oregon Vesper Sparrow and the extirpation of several populations without any apparent change in habitat suggests a change from a *declining population paradigm* where populations decline deterministically and proportionately to the threats, to a *small population paradigm* where populations declines are more rapid due to demographic issues and/or random environmental fluctuations beyond the immediate threats. Thus, extinction likelihood is accelerated (i.e., Extinction Vortex) as populations in decline are pushed into greater rate of decline and addressing just the most obvious deterministic factors in the decline is insufficient.

BIOLOGICAL INFORMATION

Status

Oregon Vesper Sparrow (*Pooecetes gramineus affinis*) is one of the most imperiled bird species in North America, and is considered of high conservation concern by all natural resources entities within its range. In British Columbia, it was listed as an Endangered Species in April 2006 (COSEWIC 2006), and has likely been extirpated as a breeding species (S. Beauchesne pers. comm.). It is a Bird of Conservation Concern for the U.S. Fish and Wildlife Service (USFWS 2008), and a Species of Greatest Conservation Need in both the Oregon and Washington State Wildlife Action Plans (Oregon Department of Fish and Wildlife [ODFW] 2016, Washington Department of Fish and Wildlife [WDFW] 2015). It is a candidate for listing as Endangered or Threatened in Washington (wdfw.wa.gov/conservation/endangered/status/SC/), and the process for listing as a State Endangered species has been initiated (H. Anderson pers. comm.). On the ODFW Sensitive Species List, it is considered Sensitive-Critical, a subcategory which indicates “may qualify for threatened or endangered status if conservation actions are not taken” (ODFW 2016b). In California, the wintering population is considered a Bird Species of Special Concern (Erickson 2008). Continentally, Oregon Vesper Sparrow is one of 22 subspecies recognized as a “distinct population of high conservation concern and extremely high vulnerability” in the 2014 State of the Birds Watch List report (Rosenberg et al. 2014).

Taxonomy

The Vesper Sparrow (*Pooecetes gramineus*) is one of 49 species of sparrows of the Family Emberizidae that breed in North America (Sibley 2000). Former scientific names include *Poocaetes gramineus* and *Fringilla graminea* (American Ornithological Union [AOU] 1957). Vesper Sparrow was originally known as Bay-winged Bunting or Grass Finch (Berger 1968).

Subspecies

Four subspecies of Vesper Sparrow are recognized (*P. g. confinis*, *P. g. gramineus*, *P. g. altus*, and *P. g. affinis*) (AOU 1957, Pyle 1997, Jones and Cornely 2002). Oregon Vesper Sparrow was first described by Miller (1888), and is well accepted as a taxonomically distinct unit based on morphological measurements (Ridgeway 1901, AOU 1957, Pyle 1997).

There has not been genetic assessment of subspeciation for any of the Vesper Sparrow subspecies. Jones and Cornely (2002) note in general terms that there is weak to moderately distinct morphological differentiation among subspecies, although they don't specify their categorization between each subspecies. Pyle (1997) considers the subspecies distinctions moderately well-established with some clinal differences where ranges meet. The breeding ranges of Oregon Vesper Sparrow and Great Basin Vesper Sparrow (*P. g. confinis*), its nearest geographical neighbor, are separated by the densely forested unsuitable habitat of the Cascade Mountains. Thus, Oregon Vesper Sparrow has a disjunct breeding population completely separated from all other Vesper Sparrow populations and subspecies (Figure 1). It is accepted by all authorities as the only breeding subspecies of Vesper Sparrow west of the Cascade Mountains (AOU 1957, Pyle 1997, Cannings 1998, Campbell et al. 2001, Jones and Cornely 2002).

Common names for subspecies are not formally recognized by the AOU, but *P. g. affinis* is typically referred to as the Oregon Vesper Sparrow throughout most its range except for British Columbia where it is known as Coastal Vesper Sparrow (COSEWIC 2006). Herein, the name Oregon Vesper Sparrow will be used for consistency, even when discussing the bird in British Columbia.

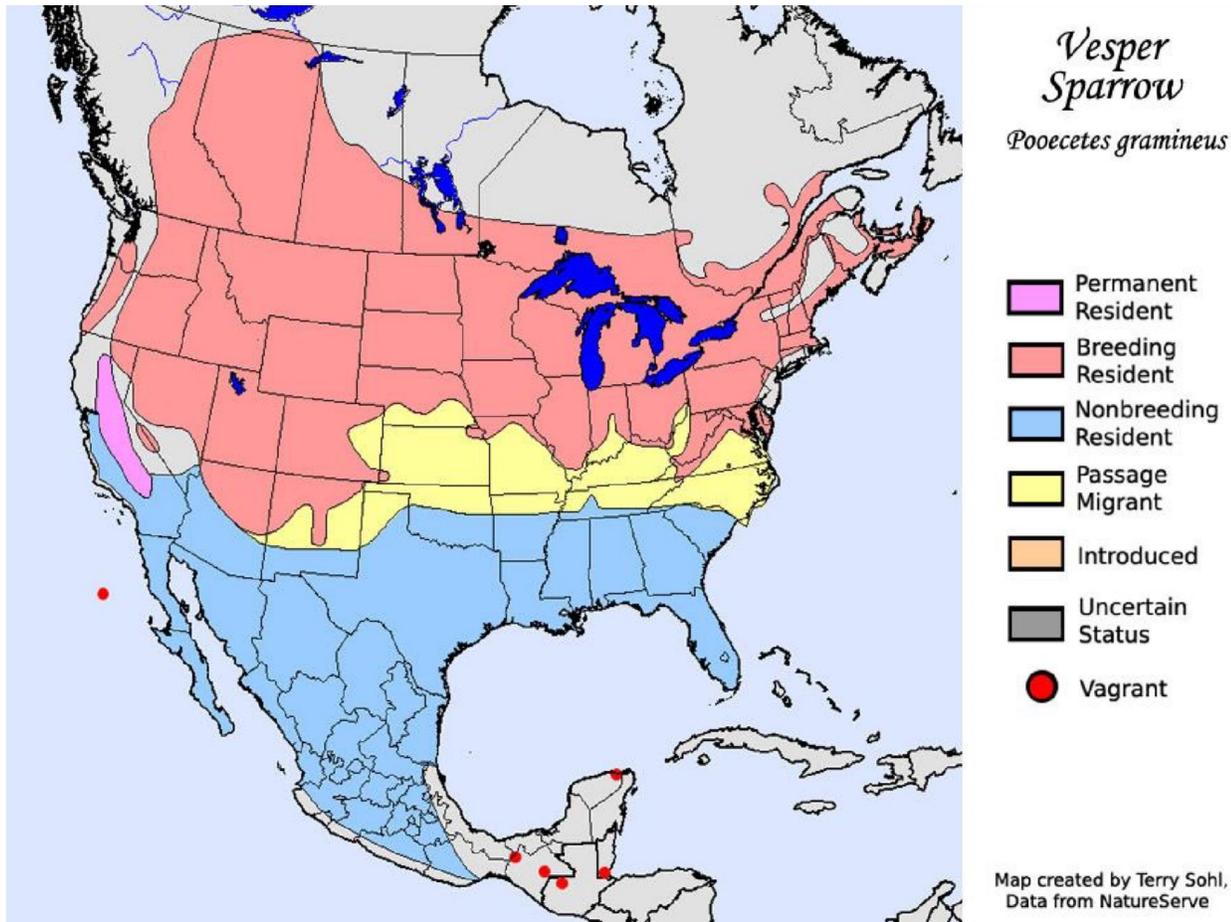


Figure 1. Range of Vesper Sparrow showing geographic separation of Oregon Vesper Sparrow in the Pacific Northwest.

Distinct Population Segment

In addition to the well-recognized taxonomy of Oregon Vesper Sparrow, it also demonstrates several characteristics of a unique Ecological Unit (National Research Council 1995) that would satisfy the definition of a Distinct Population Segment (DPS) (USFWS 1996). These characteristics, as described below and throughout this document, support the requirements for discreteness, significance, and status of a DPS.

Discreteness: The breeding range of Oregon Vesper Sparrow is completely geographically separated from all other breeding populations of Vesper Sparrow by the physical and ecological barrier of the Cascade Mountain Range (Figure 1). Thus, it has complete reproductive isolation from other breeding populations of the taxon, which indicates the likelihood of an independent evolutionary past and genetic divergence from the rest of the species. Further, Vesper Sparrow as a taxon is known to have high breeding site fidelity (Jones and Cornely 2002, B. Altman unpubl. data), and there is little to no likelihood of genetic mixing with other populations through non-breeding season pairing and returns from the wintering grounds where their range overlaps with Great Basin Vesper Sparrow. The geographic isolation of populations of species west of the Cascade Mountains has been shown to result in subspeciation for numerous other bird taxon such as Streaked Horned Lark (Drovetski et al., 2005), Little Willow Flycatcher (Paxton 2000), and Slender-billed White-breasted Nuthatch (Grubb and Pravosudov 2008).

Nearly all of the geographic separation of Oregon Vesper Sparrow with the nearest other subspecies population (i.e., Great Basin Vesper Sparrow) is >100 miles (160 kilometers) and comprised of nonsuitable forested habitat in the Cascade Mountain Range. The only closer distance with breeding populations of Great Basin Vesper Sparrow is approximately 30 miles (48 kilometers) near the southern boundary of the range of Oregon Vesper Sparrow in the Klamath Mountains ecoregion between Howard Prairie and Upper Klamath Lake, Oregon. The closer proximity in this region may be caused in part by the lower height of the mountain range with less high elevation peaks, and the drier forest types with more open grassland pockets embedded in the forested landscape providing potential habitat that is absent in the wetter forests of the Cascade Mountain range to the north.

The physical separation of breeding populations of Oregon Vesper Sparrow from other subspecies of Vesper Sparrow also coincides with some known morphological/ecological differences. It has the smallest linear length of all the subspecies, and is smaller in nearly all the measured morphological characteristics (Jones and Cornely 2002). Additionally, Vesper Sparrows elsewhere in the range are frequently associated with cropland habitats (Jones and Cornely 2002); whereas Oregon Vesper Sparrow avoids croplands in its range (e.g., grass seed fields, hayfields, row crops) except for some Christmas tree farms (Altman 1999).

Significance: The breeding range geographic separation of Oregon Vesper Sparrow from other Vesper Sparrow subspecies is the basis for its significance as an important component of the evolutionary legacy of the taxon. Historically and currently it has persisted in the unique ecological setting of scattered grassland and savannah habitats embedded in the dominant rainforests of the Pacific Northwest. This subspecies is the only occurrence of the taxon that breeds in the context of a rainforest landscape, and in the context of a highly disjunct landscape of suitable habitat where mountain ranges and forests fragment areas of suitable habitat. These unique adaptations not only represent the evolutionary potential of the taxon which would be lost with extinction, but also showcase the potential genetic plasticity of the taxon in a region where climate change projections generally favor expansion of its preferred habitats (Bachelet et al. 2011). Thus, extinction of the subspecies would also result in lost potential climatic opportunities to realize population growth and geographic expansion, and would create a significant gap in the range of the taxon of approximately 600 linear miles (965 kilometers) along the Pacific Coast.

Species Description

Vesper Sparrow is a medium to large-sized sparrow with three distinguishing characteristics - a chestnut or rufous shoulder patch (i.e., lesser coverts), white-edged outer tail feathers, and a white eye-ring (Sibley 2000). It also has a narrowly streaked breast, whitish belly, and notched brown tail. The legs are pinkish and the bill is dusky brown with a pinkish lower mandible (Rising 1996). Sexes are similar in plumage, and juveniles similar to adults but duller, and usually lack the chestnut shoulder patch (Pyle 1997). Compared with other similar looking sparrows, it is relatively larger and longer-tailed (Jones and Cornely 2002).

The four subspecies of Vesper Sparrow cannot reliably be separated in the field (Rising 1996, Jones and Cornely 2002). Differences between the subspecies are limited to slight differences in shading of the plumage and variation in morphological measurements (Pyle 1997). Oregon Vesper Sparrow has medium grayish-brown upperparts and white underparts with a buff tinge. In comparison, Great Basin Vesper Sparrow, the nearest subspecies geographically, has pale grayish-brown upperparts and creamy underparts. Oregon Vesper Sparrow is smaller overall and has a shorter tail than Great Basin Vesper Sparrow (Pyle 1997, Jones and Cornely 2002).

Natural History

Breeding Season Timing

The timing of Oregon Vesper Sparrow occurrence on the breeding grounds is fairly consistent throughout its range. Initial arrivals are typically in early April, and the nesting season is late April through the end of July (Altman 2003, Mlodinow 2005, COSEWIC 2006). Occasional early migrants arrive before April, especially in the more southern parts of the range (Altman 2003). Nesting begins in the first week of May with early dates of nests with eggs May 7-13 throughout its range (Altman 2016). Fledglings have been observed as early as the first week in June (B. Altman unpubl. data). Late date for an active nest is July 27 (B. Altman unpubl. data).

Pair Formation

Vesper Sparrows become sexually mature a year after hatching, and are seasonally monogamous (Jones and Cornely 2002). Males generally arrive a week before females, and begin singing to attract a mate upon arrival at their breeding sites (Best and Rodenhouse 1984).

Territories

Vesper Sparrow territory size is highly variable, and likely related to quality of the habitat with larger sizes usually reflecting poorer food availability (Jones and Cornely 2002). This variability also has been noted for Oregon Vesper Sparrow, based on an extensive territory-mapping effort from 2013-2016 (Altman 2015, B. Altman, unpubl. data). For example, in 2015 when 88 territories were mapped throughout the range, mean territory size was 3.57 acres (1.45 hectares) with a range of 0.46-26.66 acres (0.19-10.79 hectares) (Altman 2016).

Area Requirements

Minimum patch size for Oregon Vesper Sparrow occupancy is unknown, but size of grassland has been noted as an important factor in site selection for Vesper Sparrow (Kershner and Bollinger 1996, Vickery et al. 1994). In Washington, Oregon Vesper Sparrow is currently found in large grasslands, but not in small patches of similar habitat (S. Pearson, pers. comm.). In the Willamette Valley, they have been recorded breeding in relatively small areas of 20 acres (8 hectares), but are also absent from many more of those same-sized areas of suitable habitat (B. Altman pers. obs.). On southeastern Vancouver Island, the last extant population occurred in an area of suitable habitat of approximately 25 acres (10 hectares) (Beauchesne 2002). However, that population has been extirpated despite no habitat change, and limits on population size due to size of the area may have contributed to the demise.

Nests

Vesper Sparrow nests are located on the ground, and females construct the nest alone (Rising 1996). Nests can be bulky and loose or tightly woven of grasses and rootlets often placed in a shallow depression (Berger 1968). Nests are usually located next to a clump of vegetation, crop residue, dirt clod, or at the base of a shrub or tree (Jones and Cornely 2002, Altman 2003).

Nesting Phenology

Clutch size for Vesper Sparrow is 3-5 eggs (range 2-6) (Jones and Cornely 2002), decreasing in later nesting attempts (Berger 1968). Limited records of Oregon Vesper Sparrow clutch size (n=57) include 61% four-egg clutches with a mean clutch size of 3.4 eggs (Altman 2016, B. Altman unpubl. data).

Vesper Sparrow incubation averages 12-13 days (range 11-14) and is performed nearly exclusively by the female (Berger 1968, Jones and Cornely 2002). Young are altricial at hatching and open their eyes by day five (Dawson and Evans 1960). Both parents feed the nestlings, which fledge from the nest after 9-

10 days (range 7-14) (B. Altman unpubl. data), and remain dependent on the parents for another 20-30 days (Perry and Perry 1918, Dawson and Evans 1960).

If the first brood has successfully fledged and the female initiates a second nesting, the primary responsibility for feeding the fledglings from the first brood falls to the male (Berger 1968). If a nest fails, they will re-nest up to two times (Wray et al. 1982). Oregon Vesper Sparrow is known to regularly have a second brood after a successful first nesting (B. Altman unpubl. data).

Nest Success

Apparent nest success (i.e., number of successful nests among nests monitored to outcome) of a limited sample of Oregon Vesper Sparrow nests (n=57) is relatively high (61%) (Altman 2016, B. Altman unpubl. data). However, this includes nests found at all stages which typically overestimates true nest success (Moynahan et al. 2007). Mayfield estimates (Mayfield 1961, 1975), a better measure of nest success that takes into account the number of days of observation that the nest was exposed to potential loss, have been calculated for some nests. Mayfield estimates of nest success in the Willamette Valley from 1996-1997 (n=19) were 30% (apparent nest success was 58%) (Altman 1999), and in 2017 Mayfield estimates were 16% (apparent nest success was 48%) (B. Altman unpubl. data). Fledging rates of Oregon Vesper Sparrow nests (n=54) are 3.2 young/successful nest, and 2.0 young/active nest (Altman 2016, B. Altman unpubl. data).

Nest Parasitism

Nest parasitism by Brown-headed Cowbird (*Molothrus ater*) has not been reported for Oregon Vesper Sparrow (Campbell et al. 2001, S. Pearson, pers. comm., B. Altman unpubl. data), although there is a limited sample size of nests monitored (n=57). Nest parasitism of Vesper Sparrow is variable (0-61%) where cowbirds were present in the midwestern United States and Canada (Jones and Cornely 2002).

Vital Rates

The Monitoring Avian Productivity and Survivorship Program does not have a sample size large enough to provide any vital rates for Vesper Sparrow (vitalratesofnorthamericanlandbirds.org). The average lifespan is unknown, but a maximum of 7.1 years has been recorded for a banded individual in the wild (www.pwrc.usgs.gov/BBL/longevity_main.cfm).

Site Fidelity

Color-banding results from several studies of Vesper Sparrow in the midwestern United States have shown that breeding site fidelity is high for adults, with an average return rate of approximately 50% to the same site the following year (Best and Rodenhouse 1984). However, there were no returns of 45 banded nestlings at their natal site or elsewhere (Berger 1968). This could indicate low site fidelity, but also may reflect typical low survivorship of first year passerine birds (Weatherhead and Forbes 1994).

Vesper Sparrow winter site fidelity is low (Pulliam and Mills 1977). For example, there was only a 3% (n=420) return rate to wintering sites in southeast Arizona (Gordon 2000).

Prior to 2016, there were 79 Vesper Sparrows banded within the range of Oregon Vesper Sparrow since 1931, with 54 of those during the breeding season (D. Bystrak, pers. comm.). There has never been a reported return or a recovery of any of those birds. However, return rates of color-banded birds in 2016 at Bald Hill Farm, near Corvallis, Oregon were 52% for adults (n=15; 57% for males and 50% for females), and 36% for hatch-year birds (n=6; 9% for nestlings and 83% for fledglings). Further, the repeated and only use of a single site on Vancouver Island (i.e., Nanaimo Airport) for at least an approximately 15-year period suggests high site fidelity for Oregon Vesper Sparrow (Beauchesne 2002).

Diet and Foraging

Oregon Vesper Sparrow diet has not been studied. Vesper Sparrow diet includes a wide-variety of available insects (especially grasshoppers, beetles, and caterpillars) and other arthropods during the breeding season, supplemented with grass and forb seeds year-round, including crop waste grains in winter (Berger 1968, Rotenberry 1980, Zeiner et al. 1990, Adams et al. 1994). Adults provide nestlings with invertebrates, rarely seeds (Jones and Cornely 2002). Adults also eat grit, and have low free-water requirements (Jones and Cornely 2002).

Most foraging occurs while walking on the ground, but birds also will hop and hover to glean invertebrates from vegetation (Rodenhouse and Best 1994). In the breeding season, both sexes forage almost exclusively within the territory (Rodenhouse and Best 1994, B. Altman pers. obs.).

Genetics and Hybridization

No genetic work has been done to assess issues of geographic variation or genetic depression for Oregon Vesper Sparrow. There have been no observed manifestations of genetic issues such as physical deformities. The only hybridization that has been reported for Vesper Sparrow is with Field Sparrow (Pyle 1997), a species that does not occur within the range of Oregon Vesper Sparrow.

Population Viability Analysis

No known population viability analyses have ever been conducted for Vesper Sparrow or Oregon Vesper Sparrow. There are limited data on productivity and survivorship for Oregon Vesper Sparrow to allow for analyses of sources and sinks or metapopulation dynamics (DeSante et al. 2015).

Post-breeding Dispersal and Migration

The only data on Oregon Vesper Sparrow post-breeding behavior is from one site near Corvallis, Oregon. There was 70% survivorship of color-banded nestlings (n=20) from fledging to migration (B. Altman, unpubl. data).

Shortly after fledging, adults bring dependent and semi-dependent young to shrubby areas for cover (B. Altman pers. obs.). Once fully dependent, Vesper Sparrows typically gather in small groups until fall migration (Bailey and Niedrach 1965). Oregon Vesper Sparrow fall migration is primarily from mid-August to late September, with fewer records extending into early October (Gilligan et al. 1994, Campbell et al. 2001). The late date in British Columbia is October 18 (Campbell et al. 2001).

Oregon Vesper Sparrow migrates completely out of its breeding range, but there is no information on movement patterns. Vesper Sparrow migration is known to occur primarily at night (Jones and Cornely 2002). They generally move in small flocks of up to 10 birds (Berger 1968). During migration they often frequent roadsides, field borders, fencerows, and hedgerows (Ligon 1961).

Wintering

In California, Oregon Vesper Sparrow occurs on the wintering grounds from September to April (Willett 1933) or October to early April (Grinnell and Miller 1944). There is no information on intra-seasonal movements on the wintering grounds. There have been a number of wintering records of Vesper Sparrow in Oregon, although almost exclusively before the mid-1980s (Altman 2003). These records occurred mostly on Christmas Bird Counts, and they lack documentation, but the frequency and number of records, and the variety of qualified observers suggests that most of the records are likely to be valid. However, there is the uncertainty of the subspecies, with the potential wintering of the interior subspecies Great Basin Vesper Sparrow.

Habitat

Habitat Types and Geographic Variability

In southwestern British Columbia, it is assumed that prior to European settlement, sparsely vegetated open oak and related ecosystems or burnt areas would have been the primary habitats (Chatwin 2004). Post-settlement, they bred in pastures, agricultural lands, and airport fields with patches of grasses and weeds (Campbell et al. 2001). The last remaining territories were in grasslands at an airport next to hayfields (COSEWIC 2006).

In the Puget Lowlands of Washington in the early 1900s, they were a bird of “cultivated land and open pastures” (Jewett et al. 1953). By the 1990s, they had become mostly restricted to the edges of open prairies and airports (Rogers 2000, Mlodinow 2005), with occasional birds in pastureland and Christmas tree farms (Rogers 2000).

On Columbia River Islands, they have been reported mostly on dredged-material sites dominated by sandy soils with scattered vegetation and much bare ground (S. Pearson pers. comm.).

In the Willamette Valley of Oregon, in the early 1900s they were widespread in “open meadow and farm lands where it frequents the fence rows and pasture lands” (Gabrielson and Jewett 1940). Currently, most detections are in light to moderately grazed pastures, often with scattered shrubs and variable grass heights, but mostly <2 feet (61 centimeters) high; and to a lesser extent young Christmas tree farms (i.e., 2-5 years after planting) with a mix of bare ground, grass, and weedy forb cover (Altman 1999). Pastureland and Christmas tree farm habitats mostly occur in the foothills, and the bird is rare on the valley floor, which was historically dominated by floodplain riparian forest, wetlands, and wet prairies, except for the upland grasslands of remnant volcanic buttes, which is the primary place they still occur on the valley floor. Occurrence at airports in the Willamette Valley is also rare, unlike the Puget Lowlands, likely because airports are on the valley floor and in historic wetland or wet prairie habitat.

In the Klamath Mountains of Oregon, breeding habitat is almost exclusively light to moderate grazed pastureland and to a lesser extent fallow fields in the Umpqua Valley, and montane meadows in the Rogue Basin, some of which are grazed (Altman 2016). They are absent as a breeding species in the Rogue Valley pastureland and low foothills, which are similar in habitat conditions to occupied sites in the Umpqua and Willamette Valleys.

Along the south coast of Oregon, habitat for the only known breeding population is primarily steep-sloped pastureland within 3-4 miles (4.8-6.4 kilometers) of the ocean (T. Rodenkirk, pers. comm., B. Altman pers. obs.). This type of habitat is limited to a few locations amid the otherwise forest-dominated landscape along the coast. They occasionally are reported in flat sandy coastal floodplains where development has not occurred, and in coastal balds and headlands, especially when those areas are used as pastureland (e.g. Cape Blanco) (T. Rodenkirk pers. comm.).

In northwestern California, breeding habitat was the coastal dune system dominated by sandy soils, wet meadows, and low-statured herbaceous vegetation and bare ground mixed with some shrubland (native and invasive) (B. Altman pers. obs.). Exotic, taller European beach grass patches dominate in some places.

The current dominance of pastureland among habitat types is noteworthy, although there is some ecoregional uniqueness with mostly restoration prairie in the Puget Lowlands and montane meadows in the Rogue Basin. Even within the montane meadows, some are publicly grazed Bureau of Land

Management (BLM) lands, and others are grazed private lands. There is a near absence of pastureland use in the Puget Lowlands, even in locations adjacent to or in close proximity to JBLM, where 90-95% of the ecoregional population occurs. This may reflect habitat conditions (e.g., overgrazed due to shallow soils and less productivity), but also may in part be due to the small population and issues with recruitment off JBLM.

Oregon Vesper Sparrows frequently inhabit the edges of grasslands in the transition area with forests or shrublands (B. Altman pers. obs., G. Slater pers. comm.). In several instances, they occur in lower densities or are even absent from the more central part of the grassland relative to the edge. These edges provide more perches and cover opportunities, and in some cases are more upland habitat than the center of the fields which can be more mesic habitats (e.g., wet prairie or wetland).

Habitat Conditions

Oregon Vesper Sparrow desired breeding habitat conditions can be generally characterized as moderately short and patchy grass and forb cover with low to moderate bare ground, low to moderate shrub or tall forb cover, and low tree cover (Altman 2016). They typically avoid mesic areas or sites with tall, dense herbaceous vegetation (Dobkin and Sauder 2004, B. Altman pers. obs.). Structural diversity of herbaceous vegetation appears to be an important factor in site selection, with bare ground and shorter vegetation chosen for foraging, moderate structured vegetation for nesting, and scattered taller vegetation used for cover and singing perches (Davis and Duncan 1999, Rogers 2000, COSEWIC 2006). Fence posts, fences, and other man-made structures are often used for singing perches (Altman 1999, Beauchesne 2002).

Winter habitat in California has been characterized as “open ground with little vegetation or else areas grown to short grass and low annuals,” including stubble fields, meadows, and road edges (Grinnell and Miller 1944). Grinnell (1898) and Willett (1933) reported Oregon Vesper Sparrow wintering with Great Basin Vesper Sparrow, but was more numerous on “damp meadows of the lowlands,” whereas the Great Basin Vesper Sparrow was more typical of “stubble fields, washes, and especially dry mesas.” Vesper Sparrows in the Cuyama Valley winter in semidesert scrub as well as grasslands, weedy agricultural fields, and alfalfa (Lehman 2017). Garrett and Dunn (1981) reported that wintering Vesper Sparrows often occur in areas with sandy substrates.

Habitat use during migration is poorly described, although anecdotal observations suggest similar use as breeding and especially wintering seasons. Migrating individuals of Oregon Vesper Sparrow have been observed in a variety of grassy habitats in western Washington (Mlodinow 2005).

Habitat Selection

Oregon Vesper Sparrow habitat selection studies have been conducted in the Willamette Valley (Altman 1999), Puget Lowlands (Rogers 2000), and range-wide (Altman 2015). In the Willamette Valley in 1996-1997, most detections were in pastures (49%), despite a relatively low percent sampling of that land use type (9.5%) (Altman 1999). Christmas tree farms were the other high-use habitat type (44% of detections and 5% of land use type sampled). Habitat types generally avoided include cultivated grass fields, highly manicured Christmas tree farms, and fields with grass heights exceeding 2 feet (60 centimeters) high.

Within pastures, most detections (48%) were in pastures with <10% shrub cover, although 31% were in entirely herbaceous pastures, and 17% in pastures with 10-25% shrub cover (Altman 1999). Most detections (79%) occurred in relatively short grass herbaceous structure (i.e., <12 inches [30 centimeters] in height).

Nests were built in areas with relatively reduced grass cover (mean 49%), and high amounts of bare ground (mean 24%) and litter/ residue (mean 21%) compared to other locations within territories (Altman 1999).

In prairies in the Puget Lowlands in 1998, Rogers (2000) reported reduced vegetation heights (average = 6.1-7.8 inches [15.5-19.8 centimeters]) and densities at foraging locations compared to random sites (10.5-13.6 inches [26.6 – 34.5 centimeters]). Foraging birds used sites with a mean cover of 32% bare ground, with the remainder grasses and forbs.

In a range-wide survey in 2013, detections by habitat type were variable among ecoregions, although pasture was the dominant habitat type in the Coast Range (91%), Umpqua Valley (88%), and Willamette Valley (71%) (Altman 2015). Use of pastures in the Rogue Basin and Puget Lowlands was negligible, and habitat type use in these ecoregions was dominated by montane meadows (79%) and restoration prairie/savannah (79%), respectively. The only other habitat type of noteworthy use was Christmas tree farms in the Willamette Valley (16%).

Confidence in the Knowledge of Habitat Associations

Knowledge of the habitat associations of Oregon Vesper Sparrow is high, with significant enough data to allow for some specificity of habitat associations across its range (Altman 2016). This confidence is based on Willamette Valley surveys and habitat selection data collection conducted in 1996-1997 (Altman 1999) and 2008 (Myers and Kreager 2010), a foraging and habitat selection study in the Puget Lowlands in 1998 (Rogers 2000), a range-wide inventory with significant habitat association data collected in 2013 (Altman 2015), extensive territory-mapping and habitat data collection conducted range-wide from 2013-2016 (Altman 2015, B. Altman unpubl. data), and intensive nest site and random plot data collected at one site from 2014-2016 (B. Altman unpubl. data).

Range, Distribution, and Abundance

Breeding Range and Distribution

Oregon Vesper Sparrow has a restricted breeding range that historically included southwestern British Columbia, western Washington, western Oregon, and the northwestern corner of California (Campbell et al. 2001, Jones and Cornely 2002, Altman 2003, Erickson 2008) (Figure 2). Within that breeding range, it is further restricted to grassland and savannah habitats in lowland valleys and foothills, except for the Klamath Mountains where it occurs in montane meadows. These areas are all embedded within a landscape dominated by forests, thus the overall distribution is patchy and disjunct.

In British Columbia, the historic distribution of Oregon Vesper Sparrow was restricted to the lower Fraser River valley and southeastern Vancouver Island, with breeding season records from 1890 (COSEWIC 2006). More specifically, they were reported during the breeding season on Vancouver Island from the Englishman River estuary in the north, to Cobble Meadows and Mill Bay in the south, and locally in the Fraser Lowland on the southwest mainland coast (Campbell et al. 2001).

Currently in British Columbia, Oregon Vesper Sparrow has been extirpated as a breeding species from the mainland Fraser Lowlands since 1968 (Campbell et al. 2001). The only recently known breeding population since the 1970s, located at the Nanaimo Airport on Vancouver Island, is probably extirpated (S. Beauchesne pers. comm.).

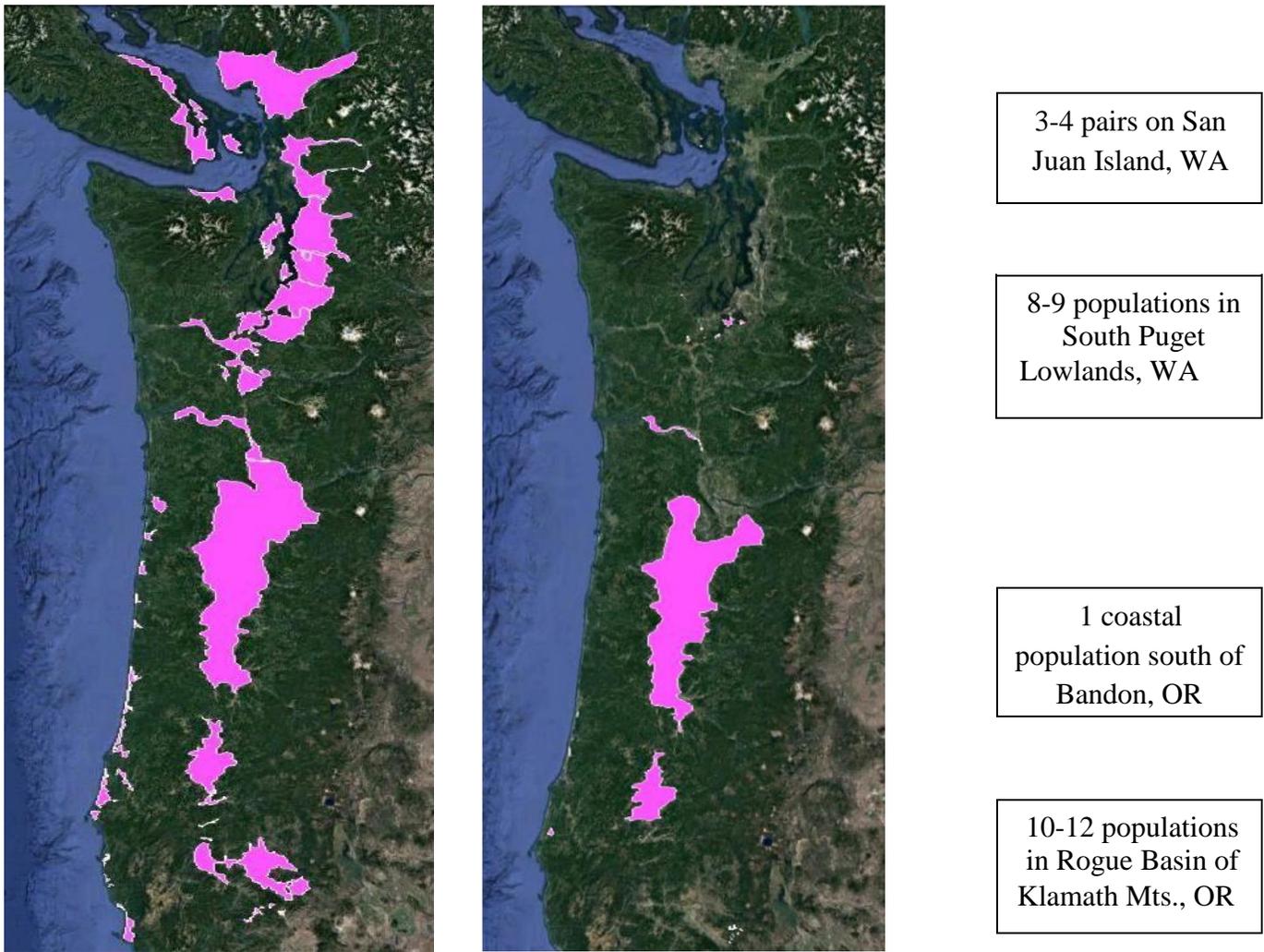


Figure 2. Historic (left) and current (right) breeding range of Oregon Vesper Sparrow.

In Washington, the historical breeding range of Oregon Vesper Sparrow is believed to have extended from northern Skagit County, the San Juan Islands, and Clallam County (Dungeness and Sol Duc), south through the southern Puget Lowlands and into Clark County (Camas and Vancouver) (Washington Department of Fish and Wildlife 2013). The vicinity of Yelm in the south Puget Lowlands was once considered a prime area for the subspecies (Jewett et al. 1953), but is no longer occupied (Rogers 2000).

The current breeding population in Washington is predominantly on airports and remnant prairies in the south Puget Lowlands, especially on JBLM. A few birds remain on San Juan Island (K. Foley and R. Milner, pers. comm.), on islands in the lower Columbia River (S. Pearson, pers. comm.), and near Shelton in Mason County (Mlodinow 2005, Altman 2015).

In the interior valleys of western Oregon, the historical breeding range of Oregon Vesper Sparrow was the Willamette and Umpqua Valleys (Gabrielson and Jewett 1940), and the Rogue Valley (Gabrielson 1931, Gabrielson and Jewett 1940). Currently, the breeding range has not changed in the Umpqua Valley, but they are nearly extirpated from the valley floor and parts of the northern Willamette Valley. In the Rogue Valley, since the early 1970s it has not been reported as a breeding species, but only breeds in montane meadows in the higher elevations of the Rogue Basin (Browning 1975) [Note: historically there could have been broader interpretation of the term Rogue Valley to include the mountains].

Along the Oregon Coast, historically Oregon Vesper Sparrow was not documented as a nesting species, although it likely breed at a few locations (e.g., Tillamook, Jewett 1916; Coos Bay, King 1968) based on breeding season records (Gabrielson and Jewett 1940). Currently, they are a rare breeding bird along the southern Oregon Coast primarily south of Bandon in an approximately 6 mile (9.7 kilometers) strip between Bethel Mountain and Langolis Mountain, and a few birds near Agness at the confluence of the Rogue and Illinois Rivers, and on a large ranch on Cape Blanco (T. Rodenkirk pers. comm.).

In California, breeding birds were first discovered in 1976 in northwestern California north of Crescent City (McCaskie et al. 1979) from Pt. Saint George to the Smith River mouth (G. S. Lester pers. comm. in Erickson 2008). A survey in 2016 of most of that area did not detect any birds (B. Altman unpubl. data).

Winter Range and Distribution

Oregon Vesper Sparrow is migratory, and overwinters almost entirely in California (AOU 1957, King 1968). Grinnell and Miller (1944) described the winter range as the lowlands west of the Sierra Nevada mountains from the San Francisco Bay area through the San Joaquin Valley to coastal southern California and into northwestern Baja California, Mexico. Migrants are found occasionally as far east as western Utah (Behle and Selander 1952). The wintering range is mainly intact from early 1900s, except for contraction from the south northward with no recent records from Baja California (Patten et al. 2003), and in parts of the southern coast (Figure 3) (Erickson 2008).

Oregon Vesper Sparrow winter range overlaps with that of Great Basin Vesper Sparrow. It is generally found in the lower valleys and plains west of the Sierra Nevada mountains from central California south to northwestern Baja California (AOU 1957, King 1968). Great Basin Vesper Sparrow is considered to winter in the deserts and in coastal areas north to Santa Barbara County, and “more sparingly in San Joaquin Valley and coastal valleys north at least to Fresno and San Benito County” (Grinnell and Miller 1944). Based on a recent review of 251 specimens from six museums, in the early 1900s when most of the specimens were taken, Oregon Vesper Sparrow was the predominate subspecies north of Kern County, with the reverse true to the south (Erickson 2008).

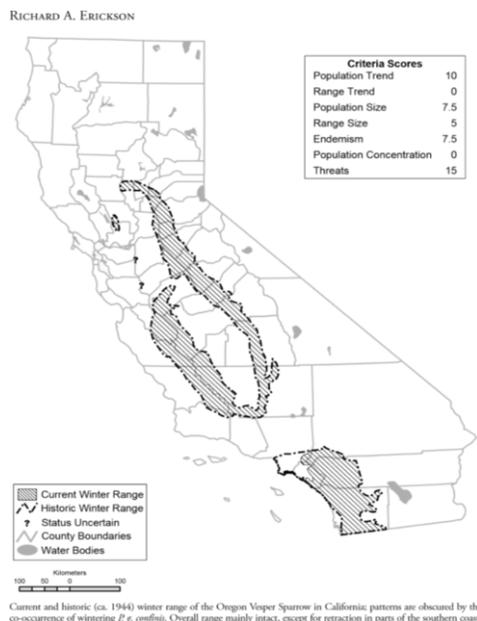


Figure 3. Wintering range of Oregon Vesper Sparrow.

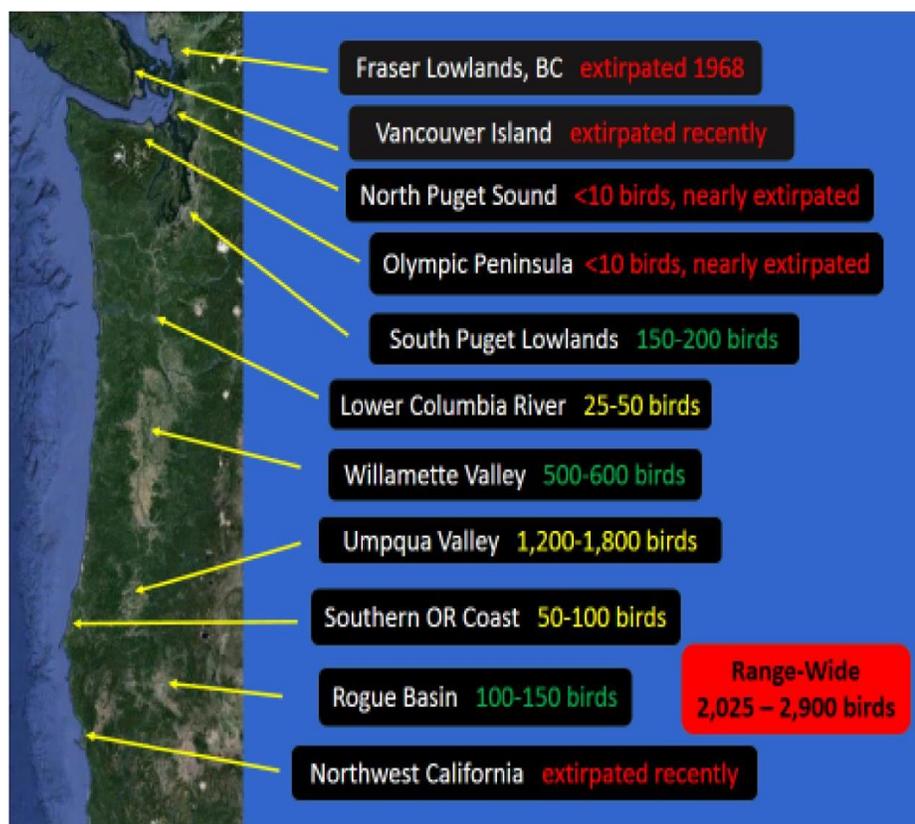
Confidence in the Knowledge of Range and Distribution

Confidence in the knowledge of Oregon Vesper Sparrow range and distribution is high. This is based primarily on a range-wide inventory in 2013 that targeted known populations and all accessible suitable habitat (Altman 2015). Additional sources of information included Avian Knowledge Northwest (www.avianknowledgeinorthwest.net), North American Breeding Bird Survey (www.mbr-pwrc.usgs.gov/bbs/bbs.html), and eBird (ebird.org/ebird/map/); detections on State birding list-serves (e.g., OBOL in Oregon and TWEETERS in Washington); and detections by the author over several years making a concerted effort to find birds throughout the known range, including securing permission to access many private properties. The confidence also is enhanced by the fact that it is recognized as a rare species throughout its range, and thus is both sought after and regularly reported to external audiences.

Populations

Breeding Abundance

Historically, Oregon Vesper Sparrow was considered a relatively common species except for the northern part of its range in northwestern Washington and southwestern British Columbia (Altman 2011). A 2011 preliminary population estimate from a variety of sources indicated that the population of Oregon Vesper Sparrow was <3,000 birds (i.e., 1,540-2,770) (Altman 2011). A recent range-wide inventory in 2013 (Altman 2015), in conjunction with additional surveys and extensive anecdotal information, suggests the population is similar to the original estimate (i.e., 2,025-2,900 birds) (Figure 4).



Red Population Estimates = Extirpated or nearly extirpated.

Green Population Estimates = High confidence in the population estimate based on extensive effort and good access to most potential habitat with limited need for extrapolation of numbers to inaccessible potential habitat.

Yellow Population Estimates = Low to moderate confidence in the estimate based on reduced coverage due to no access to much potential habitat and more need for extrapolation of numbers to inaccessible potential habitat.

Figure 4. Population estimates for Oregon Vesper Sparrow by regions, 2016.

Wintering Abundance

Wintering Oregon Vesper Sparrows were considered “common” in southwestern California in the late 1800s and early 1900s (Grinnell 1898, Willett 1933). Up to the mid 1900s, winter abundance has been described variously as ‘rare,’ ‘fairly common,’ or even ‘common,’ but total numbers were evidently small, especially to “northward in winter” (Grinnell and Miller 1944). Highest densities apparently occurred in central and southwestern California (Willett 1933, Grinnell and Miller 1944). More recently, wintering numbers appear to have declined moderately (Erickson 2008).

Confidence in the Knowledge of Abundance

Confidence in the knowledge of Oregon Vesper Sparrow breeding abundance is moderate to high. This is based primarily on the range-wide inventory in 2013 (Altman 2015), and numerous other sources used to compile detection records. The only reason for not having completely high confidence in the abundance of Oregon Vesper Sparrow is the unknown degree of occurrence of birds on a few inaccessible large ranches in the southeastern Willamette Valley foothills, but especially on ranches throughout the Umpqua Valley. Permission was granted to survey several ranches in these areas which provided a sense of the populations that could exist on inaccessible ranches, and this information was used to subjectively extrapolate for a population estimate, especially in the Umpqua Valley.

The emphasis of effort during the 2013 range-wide breeding season inventory was complete geographic coverage of known occurrences within the breeding range, extensive remote identification (i.e., satellite imagery) of potential habitat followed up by field reconnaissance to establish habitat suitability, extensive roadside and accessible off-road inventories at known locations and in suitable habitat, and documentation of reports by others from many sources. The overall effort likely reflects a high degree of coverage of known occurrences and potential habitat relative to potential habitat not covered through inaccessibility.

It is noteworthy that during the inventory, Oregon Vesper Sparrows were detected on only 13% of the roadside point count stations despite effort targeted at known locations and suitable habitat. More specifically, the 2013 range-wide breeding season inventory and additional surveying since then included the following efforts:

- 665 roadside point count stations visited twice during the breeding season covering approximately 11,611 acres and 124 miles
- 41 off-road point count stations at nine sites visited three times during the breeding season covering approximately 716 acres
- 12 off-road transects visited once or twice during the breeding season covering approximately 1,046 acres and 9.15 miles
- 26 off-road area searches at 28 sites visited once during the breeding season covering approximately 4,423 acres
- Territory-mapping at five sites visited numerous times during the breeding season delineating 20 territories in 2013, 20 more territories repeating one site in 2014, 88 territories at 12 sites in three ecoregions in 2015, and 23 territories at one site in 2016

Trends

The Breeding Bird Survey is the only systematic range-wide source of population trend data for landbirds (Robbins et al. 1986). Long-term data (1968-2015) indicates a range-wide statistically significant declining trend of 5.48%/year (n= 18 routes) for Oregon Vesper Sparrow (Table 1) (Sauer et al. 2017). The range-wide population trend over the most recent 10 year period (2005-2015) is a

statistically significant declining trend of 2.92%/year. Within the states of Oregon and Washington, there are long-term statistically significant declines of 3.86%/year in Oregon and 24.45%/year in Washington. Over the most recent 10-year period the State-level trend in Washington is a statistically significant decline of 24.30%/year, and in Oregon a non-significant decline of 2.91%/year.

Table 1. Breeding Bird Survey population trends for Oregon Vesper Sparrow.

	1968-2015	2005-2015
Range-wide	-5.48 (n=18)*	-2.92*
Washington	-24.45	-24.30
Oregon	-3.86	-2.91
California	no data	no data

Source = Sauer et al. (2017)

Bold indicates statistically significant declining population trends; regular font indicates non-significant declining population trends.

*Credibility measure that indicates data with a deficiency such as low abundance of birds and/or small sample size of routes.

In California, numbers of wintering birds appear to have declined moderately (Erickson 2008). The source/method for that conclusion is not described, although it is likely based on anecdotal observations.

There have been some indications of population trends at smaller scales. In British Columbia, over the last 50 years Oregon Vesper Sparrow disappeared from some historic breeding locations (e.g., Cobble Meadows, Iona Island and the Fraser River valley) including the last population at the Nanaimo Airport, suggesting population declines that ended in extirpation.

On islands in the Columbia River, Oregon Vesper Sparrow was detected in varying numbers on seven islands during Streaked Horned Lark (*Eremophila alpestris strigata*) surveys from 2006-2010 (S. Pearson, pers. comm.). However, repeated surveys at the same locations from 2010-2016 have resulted in only one detection on one island during 2015 (H. Anderson, A. Martin, and G. Slater, pers. comm.).

A recent study at 544 roadside point count stations throughout the Willamette Valley reported a 79% decline in Oregon Vesper Sparrow detections between surveys conducted in 1996 and repeated in 2008 (Myers and Kreager 2010). This included a drop from 65 to 14 detections, and a reduction in region occurrence from 16 regions to 8 regions.

Discontinuities and Isolation of Populations

Within the historic and current breeding range of Oregon Vesper Sparrow there are significant and increasing discontinuities in the distribution and isolation of populations, both at the range-wide scale and at smaller scales within ecoregions. Some of the discontinuities are based on the natural fragmentation of grassland and savannah habitat embedded within a Pacific Northwest landscape dominated by coniferous forests and other natural barriers of unsuitable habitat (e.g., large bodies of water such as the Puget Sound or Columbia River). However, even within historically naturally contiguous habitat, populations have been fragmented and isolated due to 1) expansion of the developed human footprint (e.g., cities, towns, unsuitable agricultural habitat), and 2) increases in forest and shrubland patches from fire suppression and vegetative succession, beginning with early Euroamerican settlement and continuing into the present. Thus, over time there has been an increase in isolated populations, reduced connectivity between sites, and greater distances between populations as suitable habitat has been reduced and fragmented.

The example of the greatest isolation of a population is the only known coastal population south of Bandon, Oregon (Figure 1). Other noteworthy examples of fragmentation of populations are in the Puget Lowlands, and the Rogue Basin of the Klamath Mountains (Figure 1). In the former, the isolation of populations is mostly due to human development and vegetative succession in what was historically mostly several large grasslands and savannahs. The remaining patches, outside of the Artillery Impact Area on JBLM, are mostly restored prairies. In the latter example, the isolation of populations is mostly due to the natural occurrence of montane meadows in a forested landscape. However, some forest encroachment from the edges of the meadows has reduced the area of suitable habitat.

Extirpations and Range Contractions

There have been significant historic and recent local extirpations or near-extirpations (i.e., sites with <5 pairs down from a much higher population) and range contractions of Oregon Vesper Sparrow populations (Altman 2016). The causes have included permanent loss of habitat and loss of habitat from degradation or succession. However, there also are several examples of sites with no apparent change in habitat, and potentially the demographic consequences of a small, isolated population.

At the range-wide scale, there have been recent breeding population extirpations from both the northern and southern edge of the range, and in both cases with no apparent change in habitat (Altman 2016). In the north, the last known population in British Columbia at Nanaimo Airport on Vancouver Island was apparently extirpated by 2014-2015 (S. Beauchesne pers. comm.), and a small population on San Juan Island, Washington was nearly extirpated by 2016 (R. Milner and K. Foley, pers. comm.). With no known breeding populations elsewhere in the north Puget Lowlands of Washington, outside of the 2-3 pairs on San Juan Island, the range will have contracted southward approximately 100 miles (160 kilometers) to the south Puget Lowlands, where the population is predominantly associated with one site, JBLM. The spatial extent and intervening unsuitable habitat of this range contraction, combined with a likely declining population at JBLM, make it unlikely that there will be a source of dispersing birds to repopulate the northern extirpated regions.

At the southern end of the range, Oregon Vesper Sparrow is likely extirpated as breeding bird from the only known population in California near Crescent City (B. Altman unpubl. data). This population was discovered in 1976, and anecdotal accounts indicated a population of 10-15 to 25 pairs into the early 2000s (Erickson 2008). A recent survey in June, 2016 over approximately 80% of the area did not detect a bird (B. Altman, unpubl. data). Thus, the range has likely contracted approximately 75 miles (121 kilometers) to the north to a population south of Bandon, Oregon (a population near Gold Beach at approximately 40 miles [64 kilometers] north of Crescent City has been extirpated, T. Rodenkirk pers. comm.). The spatial extent and mostly intervening unsuitable habitat between these populations make it unlikely that there will be a source of dispersing birds to repopulate the northwestern California site.

These types of edge of range contractions are one of the most reported extirpation patterns (Brown 1984), especially for birds (Curnutt et al. 1996, Donald and Greenwood 2001). Edge of range populations often are more susceptible to several factors relative to the core of their range including less connectivity and higher isolation of populations, which results in lower immigration rates, less genetic variability, and reduced adaptability options (Bahn et al. 2006). Population density also tends to decline and distribution may be patchier towards the edge of species ranges (Maurer and Villard 1994, Brown et al. 1995). Thus, the magnitude of change in species abundance is often greatest at range edges, which tends to result in local extirpations (Clark et al. 1990) and contraction of species ranges to their core (Mehlman 1997).

There have been many observations of recent extirpations or near-extirpations that are likely due to change in habitat (Altman 2016). These appear to be due to either succession and/or invasion of woody vegetation that exceeds conditions suitable for Oregon Vesper Sparrow, or the opposite, complete or near complete removal of shrubs and trees for general prairie restoration or ESA-listed species conservation. There is high confidence in speculation of the former, but certainty about the latter is potentially confounded by the presence of existing small populations that could have been subject to other factors affecting population status. Some noteworthy examples of recent extirpations with formerly modest populations due to succession or invasion include Vashon Island in the Puget Lowlands; and Mt Pisgah near Eugene, and Finley National Wildlife Refuge near Corvallis in the Willamette Valley. Examples potentially due to complete removal of shrubs and trees include 13th Division Prairie on JBLM in the Puget Lowlands, and Lupine Meadows near Corvallis in the Willamette Valley.

There have been a few situations where extirpations may have occurred, but the anecdotal records of the historic status precludes confirmation of a breeding population. For example, in the 1920s and 1930s, Oregon Vesper Sparrow was considered a breeding bird in the Rogue Valley (Gabrielson 1931, Gabrielson and Jewett 1940). However, by the 1970s, it was recognized as a breeding bird only in the mountains in the Rogue Basin with migrants occurring in the Rogue Valley (Browning 1975). This suggests either extirpation from the Rogue Valley, or a broader interpretation of the term Rogue Valley by early authors to include the montane areas of the Rogue Basin. Extensive surveys throughout the Rogue Valley and Rogue Basin in 2013 resulted in detections only in montane meadows (Altman 2015).

In addition to the breeding season, there have been extirpations and range contractions on the wintering grounds. There are no recent wintering records from Baja California, suggesting both extirpation as a wintering bird, and also contraction of the southern edge of the winter range northward (Patten et al. 2003). There have also been contractions of the winter range along the southern California coast in Los Angeles and Orange Counties in the Los Angeles Basin and San Fernando Valley, where the extensive human footprint of development has removed habitat (Erickson 2008).

CRITERIA FOR ENDANGERED SPECIES ACT LISTING

Under the ESA, 16 U.S.C. § 1533(a)(1), USFWS is required to list a species for protection if it is in danger of extinction or threatened by possible extinction in all or a significant portion of its range. In making such a determination, USFWS must analyze the species' status in light of five statutory listing factors or threat categories. These five factors are discussed below.

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range *Habitat Loss*

Habitat loss has been and continues to be a threat to Oregon Vesper Sparrow populations throughout their range. This primarily includes a permanent loss to development (e.g., residential, rural) or semipermanent conversion to unsuitable habitat (e.g., cropland agriculture such as grass seed fields and vineyards). Other known examples of habitat loss include habitat restoration for other species that take the conditions outside their range of habitat suitability (e.g., complete shrub removal for listed butterflies or Streaked Horned Lark), or overgrazing by livestock which reduces ground cover below threshold levels for habitat suitability (B. Altman pers. obs.).

In general, almost all the natural habitat options of native grasslands or savannah within the range of Oregon Vesper Sparrow have been lost or degraded, and the ones that remain exist only as small remnants. Exceptions to this include the Artillery Impact Area on JBLM near Olympia, Washington which is maintained by fire from spent ammunition, some montane meadows in the Klamath Mountains where

cattle-grazing has not significantly altered herbaceous species composition, and restoration sites throughout the range with varying degrees of native conditions.

Loss of grassland and savannah habitat has been profound from an historical perspective, and was likely the major factor in historic population declines. In British Columbia, oak and associated ecosystems (i.e., grasslands) have declined in area by 95% (Fuchs 2001). Principal factors have been fire suppression, urbanization, invasion of exotic species, and intensification of agriculture.

In the Puget Lowlands, grasslands made up approximately 10% of the landscape pre-European settlement, but have been reduced by >90% (Crawford and Hall 1997). During this period, the number of prairies in the south Puget Lowlands fell from 233 to 29, and average size decreased from 641 to 433 acres (260 to 175 hectares). Primary causes of loss have been attributed to urban development (33%), forest invasion and conversion (32%), and agricultural uses (30%).

In the Willamette Valley, grassland and savannah habitat comprised approximately 40% of the landscape pre-European settlement, but <1% of native conditions remain (Christy and Alverson 2011). Principal factors have been conversion to agriculture and enhanced natural succession due to fire suppression.

In the Umpqua Valley, grassland and savannah habitat comprised approximately 55% of the landscape pre-European settlement, but only 20% remains, and nearly all is managed as pastureland (i.e., not native conditions) (The Nature Conservancy 2013).

In California, where Oregon Vesper Sparrows winter, there has been an estimated 99% loss of native grassland habitat (Vickery et al. 1999). Even when these grasslands were converted to potential habitat in non-native grasslands and agricultural lands, habitat loss to development continues to be extensive. This includes the near complete loss of grasslands in the Los Angeles Basin and the San Fernando Valley, where Oregon Vesper Sparrow was once considered common (Erickson 2008). Currently, agricultural pressures, especially a proliferation of vineyards, may be the greatest threat north of the Tehachapi Mountains, whereas residential and commercial pressures are probably the greatest to the south.

One of the most recent breeding season threats from habitat loss is the conversion of grassland and savannah habitats to vineyards, especially in the Willamette and Umpqua Valleys. This has greatly accelerated in the last decade. For example, in the north Willamette Valley from 2005-2015, there was an 83% increase in the number of acres in vineyards to 17,000 acres currently; and in the Umpqua Valley there was a 300% increase to 2,660 acres (Southern Oregon University 2015). The desired location for vineyards is the same foothill habitats used by Oregon Vesper Sparrow. In both ecoregions, vineyards have been established in sites where Oregon Vesper Sparrows were nesting (B. Altman pers. obs.). Approximately 80% of the range-wide population occurs in these ecoregions, thus the potential impact is not only local but significant from a range-wide perspective.

Habitat Degradation

Habitat degradation has occurred primarily from extensive encroachment of invasive shrubs and trees into grasslands and savannahs, facilitated by suppression of fires which historically maintained those ecosystems (Chappell and Kagan 2001). The invasives include both non-native species such as Armenian blackberry (*Rubus armeniacus*), Scotch broom (*Cytisus scoparius*), and English hawthorne (*Crataegus laevigata*), but also native species such as Douglas-fir (*Pseudotsuga menziesii*). Some low-level occurrence of invasive tree and shrub species can maintain habitat suitability as long as it stays

within the desired cover range (i.e., <15% cover). However, if these invasive species are not controlled they will take over dominance of the site, and quickly exceed suitability thresholds for Oregon Vesper Sparrow. This results in loss of the amount of suitable habitat at a site, and ultimately loss of the site.

Another aspect of grassland and savannah habitat degradation is the establishment and development of herbaceous communities dominated by one or a few invasive non-native species such as tall oat grass (*Arrhenatherum elatius*), tall fescue (*Festuca arundinacea*), or velvet grass (*Holcus lanatus*), which are replacing native short-statured grasses and forbs. This type of habitat degradation results in tall and dense herbaceous vegetation which compromises suitability of the habitat for Oregon Vesper Sparrow by physically interfering with movement and foraging, reducing structural diversity, and reducing the amount of bare ground. Although this has not been studied for Oregon Vesper Sparrow, these structurally simple plant communities also likely impact the diversity and or abundance of invertebrate food sources.

Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no information available or speculation that overutilization for commercial, recreational, scientific, or educational purposes is a threat to Oregon Vesper Sparrow populations at this time.

Disease or Predation

There is no information available or speculation regarding disease as a threat to Oregon Vesper Sparrow populations (Jones and Cornely 2002).

Predation is the primary cause of nest failure for ground-nesting birds including Vesper Sparrow (Rodenhouse and Best 1983, Best and Rodenhouse 1984, Patterson and Best 1996, Best et al. 1997). Nest predation has not been studied for Oregon Vesper Sparrow, but is likely subject to a wide variety of site-specific mammalian, reptilian, and avian predators (Altman 1999, Rogers 2000, COSEWIC 2006). Domestic cats (*Felis catus*) were suggested as the greatest predation threat on the former population at Nanaimo Airport on Vancouver Island, British Columbia, where they were frequently observed as a result of close proximity to human habitation (Beauchesne 2002).

The Adequacy of Existing Regulatory Mechanisms

Oregon Vesper Sparrow is protected under the British Columbia Wildlife Act, which prohibits shooting, trapping, poisoning or any other measure of killing of wildlife, or the disturbance or destruction of eggs or active nests. It is also protected by the U.S. Federal Migratory Bird Treaty Act (MBTA) 1994, which makes it illegal to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter any migratory birds or the parts, nests, or eggs of such birds. However, in the MBTA there are no provisions for addressing issues of habitat loss and degradation which continue to be one of the primary threats.

Under the National Environmental Policy Act (NEPA), federal agencies are required to consider the impacts of their actions on the environment, including Oregon Vesper Sparrow and its habitat. However, NEPA does not require the selection of favorable alternatives to a species or its habitat. Further, the percent of their range-wide population on federal lands is only 15-20%. Thus, NEPA provides little to no regulatory protection for Oregon Vesper Sparrow.

State Fish and Wildlife agencies in Oregon and Washington have included Oregon Vesper Sparrow as a Strategy Species in their State Wildlife Action Plans (ODFW 2016a, WDFW 2015). However, this designation does not provide any regulatory protection. Further, those agencies have no existing

programs directed specifically towards Oregon Vesper Sparrow conservation. In both states and in California, grassland and savannah conservation has been a priority for 15-20 years, but the goals and objectives of these efforts have not been specific for Oregon Vesper Sparrow.

The only regulatory mechanism established specifically for the conservation of Oregon Vesper Sparrow is at Nanaimo Airport on Vancouver Island, British Columbia, where it is an Endangered species. The Vertebrates Recovery Implementation Group of the Garry Oak Ecosystems Recovery Team adopted a formal Stewardship Agreement with the Nanaimo Airport to incorporate management for Oregon Vesper Sparrow with the goal of maintaining current population levels (Chatwin 2004). The agreement was signed in 2003, and included issues such as the timing of mowing, timing and location of pesticide applications, control of invasive species (including feral cats), and other vegetation management issues. The agreement also supported research to better document habitat use, and an annual inventory of the breeding population.

Land Ownership

The inadequacy of existing regulatory mechanisms to support Oregon Vesper Sparrow conservation is further illuminated by their limited occurrence on public lands, where most of the potential regulatory mechanisms are applicable. Approximately 20% of the range-wide estimated population occurs on public lands. This is due to the predominance of private ownership in the Willamette Valley and Umpqua Valley, where approximately 80% of the population occurs. Additionally, the relatively small population along the southern Oregon coast is exclusively on private lands.

Opportunities for conservation actions or agreements on public lands are limited and variable among sites and ecoregions. Oregon Vesper Sparrow populations in the Puget Lowlands are almost entirely on public lands and almost exclusively at one site, JBLM under the Department of Defense (>95% of the Puget Lowlands population). There is no current effort to manage for Oregon Vesper Sparrow. However, they do benefit from the nature of the JBLM mission of ground-based training, which requires open landscapes and results in extensive habitat management that supports suitable conditions for Oregon Vesper Sparrow (J. Lynch pers. comm.). Further, suitable grassland habitat is maintained on the Artillery Impact Area by annual fires from spent ammunition.

The only other location where Oregon Vesper Sparrow populations occur on federal lands to any degree is in several montane meadows east of Ashland, Oregon in the Klamath Mountains. The populations here are dispersed among private and public lands (i.e., Jackson County and BLM). Many of the BLM sites are leased for cattle grazing, where there is the potential to manage grazing to support Oregon Vesper Sparrow conservation. However, even with compatible grazing, the overall population and the amount of meadow habitat area on BLM lands is small relative to the range-wide population (i.e., <2%).

There are no known breeding populations of Oregon Vesper Sparrow on any of the six major federal USFWS refuges in Willamette Valley and the Puget Lowlands (B. Altman unpubl. data). These refuges often function as core conservation sites for many other imperiled and ESA-listed grassland and savannah species. At least three of the refuges in the Willamette Valley historically had breeding populations. Extensive grassland and savannah habitat management on these three refuges in the last 10 years has not resulted in a breeding population.

The only other area where most of the Oregon Vesper Sparrow population is on public lands is islands in the Columbia River, most of which are State-owned. Many of the islands have existing agreements and/or mandates as Columbia River dredge spoil sites. The timing and degree of this activity often

conflicts with the nesting season. It also removes the habitat from suitability for 2-4 years until sufficient vegetation is reestablished after a deposition; thus challenging the persistence of populations.

Overall, the ability of federal land managers to directly or indirectly provide for the conservation of Oregon Vesper Sparrow is very limited in terms of scope of the range-wide population, and exclusively currently limited to populations in the Puget Lowlands and to a much lesser extent the Klamath Mountains.

On private lands, the success and sustainability of Oregon Vesper Sparrow populations is dependent on maintenance of specific habitat conditions in the context of working lands. Since land use is at the discretion of the landowner, it is subject to changes for economic or other reasons, and subject to little or no existing regulatory mechanisms. Further, there is an inherent greater risk of nest failure on the types of working private lands where Oregon Vesper Sparrows occur (e.g., pastureland, Christmas tree farms), from varying types and levels of human-induced disturbances associated with operations and maintenance. The degree of these types of activities, of which there is no regulatory mechanism to control, can make the difference between a sustainable local population and one that is declining or ultimately extirpated.

Other Natural or Manmade Factors Affecting its Continued Existence

Oregon Vesper Sparrow is threatened by several other natural or man-made factors, including the negative impacts of land use/management on nesting birds, but particularly by the potential demographic consequences of many small, isolated, and declining populations.

Negative Impacts of Land Use/Management to Nesting Birds

Oregon Vesper Sparrow nesting throughout their range occurs almost exclusively in locations subject to a variety of land use/management activities that have the potential to negatively impact reproduction.

Mowing and other vegetation management practices represent a significant hazard for Vesper Sparrow by destroying nests if conducted during the incubation and nestling period (Jones and Cornely 2002). For Oregon Vesper Sparrow, the primary nesting locations where mowing occurs are airports (e.g., Shelton, Olympia, and JBLM airports in the Puget Lowlands), grasslands and savannahs undergoing restoration, and in some instances pastures and fallow fields. Airports provide some of the largest remaining open grasslands, and can provide important habitat for grassland birds if nesting birds are considered during airport operations (Kershner and Bolinger 1996). However, many airports in the eastern United States were found to be population sinks for grassland bird species, likely due to mowing practices (Kershner and Bolinger 1996).

Habitat restoration or management in grassland and savannah habitats (e.g., invasive species control, prescribed burning, woody vegetation removal), even when being conducted with purposeful or incidental benefits for Oregon Vesper Sparrow, can be harmful to populations if not conducted outside the breeding season (i.e., disturbance leading to abandonment, destroying nests). This has not been studied for Oregon Vesper Sparrow, but there is extensive literature on negative impacts to ground-nesting birds from habitat management during the breeding season, including Vesper Sparrow (Dechant et al. 2002). The significance of the negative impacts of these types of activities is exacerbated at sites where there is a small population that is vulnerable to extirpation.

Even when habitat restoration and management is conducted outside the breeding season, it can negatively impact a breeding population of Oregon Vesper Sparrow if there is removal of most if not all the woody vegetation (i.e., shrubs or small trees) for other species or other goals. This has been observed at several places including Lupine Meadows near Corvallis, Oregon for Fender's Blue Butterfly, and 13th

Division Prairie on JBLM, Washington for Streaked Horned Lark (B. Altman pers. obs.). A direct correlation of Oregon Vesper Sparrow population extirpation at these sites due to habitat restoration cannot be made because these were small populations potentially subject to other factors that could have resulted in extirpation. However, the examples do suggest the need for caution when implementing complete shrub or tree removal for other conservation values if Oregon Vesper Sparrow is present as a breeding species on the site, especially if the population already is small.

Some Oregon Vesper Sparrow nesting sites are subject to extensive recreational uses with potential negative effects on reproduction, especially in high-traffic areas for people and domestic dogs (Altman 1999, Rogers 2000, COSEWIC 2006). On public lands in the south Puget Lowlands, potential disturbances include dog field trials, off-leash dog walking and training, horseback riding, bicycling, hiking, and model airplane flying (Rogers 2000). Heavy recreational use in regional parks with potential habitat on Vancouver Island, British Columbia has been suggested as being potentially detrimental and precluding a nesting population (COSEWIC 2006).

There have been several studies on the impacts of livestock grazing on Vesper Sparrow populations (none on Oregon Vesper Sparrow) (Jones and Cornely 2002). The results are variable depending on the amount and timing of grazing, and type of habitat and soil type. In general, among ground-nesting birds, heavy grazing is most likely to be detrimental and light grazing can be beneficial or neutral (Bock et al. 1993, Saab et al. 1995). For Oregon Vesper Sparrow, light to moderate livestock grazing can be a positive for desired habitat conditions (B. Altman pers. obs.). However, if heavily grazed either in duration or intensity, it can both reduce the quality of the habitat by reduction of cover or influencing structural shifts in the plant community making nesting conditions unfavorable (Boyle and Reeder 2005), and/or disrupt breeding and destroy nests from trampling (Bock et al. 1993).

On JBLM, where nearly all the Oregon Vesper Sparrow population in Washington occurs, military training exercises can disturb nesting and degrade habitat if excessive.

Small, Isolated, and Declining Populations

In the Puget Lowlands, >75% of the estimated population of 200 birds occurs on the Artillery Impact Area of JBLM (Altman 2016). Of the remaining approximately 10 known sites, all have <10 pairs and most have <5 pairs (Altman 2015, G. Slater pers. comm.). The nearest distance between any of the occupied sites is approximately one mile (1.6 kilometers) and ranges out to 30 miles (48.3 kilometers). Additionally, the only two known occupied sites in the north Puget Lowlands on San Juan Island both have <3 pairs and are approximately 4 miles (6.4 kilometers) apart.

In the Willamette Valley, there are numerous known isolated populations with <5 pairs (Altman 2015, B. Altman unpubl. data). These are often the consequence of land use differences across the landscape that fragment and isolate suitable habitat (e.g., pastureland in a matrix of other agricultural fields such as cropland). However, there also are some small populations on private lands in the context of larger areas of suitable habitat (B. Altman pers. obs.).

In the Umpqua Valley, there is less natural or man-made fragmentation and isolation of populations and more uncertainty in population sizes and degree of isolation due to access. However, some isolated populations have been observed at the foothill edges of their range, usually where suitable habitat is embedded within patches or stringers of forest (B. Altman pers. obs.).

In the Klamath Mountains, where occupied sites are exclusively montane meadows embedded in coniferous forest, only one of the approximately 10 known sites has >10 pairs (B. Altman unpubl. data).

The nearest distance between any of the occupied sites is one mile (1.6 kilometers) and ranges out to 8 miles (12.9 kilometers)

In the southern Coast Range of Oregon, the only known population, estimated at 25-50 pairs, occurs in an area of relatively unfragmented pastureland approximately six miles (9.7 kilometers) long and three miles (4.8 kilometers) wide. However this population is over 50 miles (80 kilometers) from the nearest population.

There are several inherent characteristics of small populations that make them vulnerable. *Small populations are at a greater risk of extirpation than larger populations* due to a reduced ability to handle stochastic events such as natural and anthropogenic demographic fluctuations in birth and death rates and uneven sex ratios; environmental fluctuations due to variation in predation, competition, disease, and food supply; and natural catastrophes that occur at irregular intervals such as fires, floods, storms, and drought (Shaffer 1981). There have been several recent extirpations of small populations of Oregon Vesper Sparrow, including at both the northern and southern edges of the range (Altman 2016). These populations were 5-10 pairs and 15-25 pairs, respectively as recent as 10-15 years ago (Beauchesne 2002, Erickson 2008).

Among the known local extirpations of small populations of Oregon Vesper Sparrow, some have been independent of habitat changes, suggesting the likelihood of demographic issues related to small populations (Altman 2016). The natural fragmentation of populations exacerbated with human-induced fragmentation of populations through habitat loss or degradation has created greater potential barriers to dispersal and recruitment between populations. Further, pressures are greater on small populations to maintain λ annually, whereas in large populations occasional years of poor reproduction can be more readily overcome. The potential for demographic issues as limiting factors is especially true at both the southern and northern edges of its breeding range, where extirpations have occurred, recruitment can only come from one direction, and the existing populations are relatively distant from each other. For example, with the recent extirpation of the only known population on Vancouver Island, British Columbia, the small population on San Juan Island (2 pairs in 2017; S. Vernon, pers. comm.), approximately 50 miles (80 kilometers) south of Vancouver Island, is still approximately 100 miles (161 kilometers) north of the south Puget Lowlands population.

Small and isolated populations are disproportionately subject to greater risk of rapid population decline than larger populations due to loss of genetic variability and related problems of inbreeding and genetic drift (Shaffer 1981). No genetic work has been done to evaluate the population structure of Oregon Vesper Sparrow. However, concerns are warranted based on the likely lack of gene flow among the many small and isolated populations, and the observed local population declines and extirpations with no apparent change in habitat. Further, inbreeding depression has been determined for Streaked Horned Lark, another grassland species with a similar population status and range as Oregon Vesper Sparrow, at the northern edge of its current range in the south Puget Lowlands (S. Pearson pers. comm.). Genetic rescue has been initiated for that bird with egg translocations from the Willamette Valley.

The primary example of an existing small and isolated population facing challenges for genetic exchange or recruitment is along the southern Oregon Coast. The only known population is on private pastureland south of Bandon, Oregon. The closest coastal population, near Crescent City, California (approximately 75 miles [121 kilometers]), is likely extirpated (B. Altman pers. obs.). The next nearest known population is in the Umpqua Valley, over 50 miles (80 kilometers) away across entirely unsuitable forest habitat.

Small and isolated populations have a greater need than larger populations to recruit new birds to ensure population viability, but this is problematic due to their distance from other populations. No data is available on Oregon Vesper Sparrow dispersal and recruitment between populations, and this uncertainty limits the projected ability of habitat management or restoration to successfully create or expand populations. The only data on dispersal and recruitment within a population is one example of a bird moving approximately 12 miles (19 kilometers) between breeding seasons (B. Altman unpubl. data).

Significant restoration of grassland and savannah habitats has occurred during the last 15-20 years within the range of Oregon Vesper Sparrow. Vesper Sparrows are considered to respond quickly to new areas when habitat becomes suitable (Jones and Cornely 2002). However, for Oregon Vesper Sparrow there have been only occasional detections and no known population establishment into those restored sites (B. Altman pers. obs.). Vesper Sparrows have relatively high site fidelity (Jones and Cornely 2002), which also challenges their ability to expand into new areas or recolonize old areas where they have been locally extirpated. Colonization of these areas is likely dependent on the proximity of source populations with the potential to provide surplus birds if the distance is not too great (Holmes and Sherry 1988, Telleria and Santos 1999). However, this is problematic given the range-wide significant population declines and many local extirpations creating greater distances between populations. At a couple restoration sites there has been an occasional male singing for a few days during late migration/early nesting, but with no documented success in pairing (e.g., a singing male three years in a row at Baskett Slough National Wildlife Refuge near Salem, Oregon, B. Altman pers. obs.).

Although habitat loss and degradation continues in both occupied and unoccupied sites, there is significant unoccupied habitat available in many places (B. Altman pers. comm.). This includes relatively large geographic areas with few birds in the landscape (e.g., northern Willamette Valley), but more importantly in several places where there is a population, but significant amounts of similar suitable habitat that is unoccupied. The latter includes places such as American Camp on San Juan Island, Weir and Tenalquot Prairies on JBLM, and Christmas tree farms in the southwestern Willamette Valley foothills.

The range-wide small population size of Oregon Vesper Sparrow and the extirpation of several populations without any apparent change in habitat also suggests a change from a *declining population paradigm* where populations decline deterministically and proportionately to the threats, to a *small population paradigm* where populations decline more rapidly due to demographic issues and more random environmental fluctuations beyond the immediate threats (Caughley 1994). Thus, extinction likelihood is accelerated (i.e., Extinction Vortex) as populations in decline are pushed into greater rate of decline, and addressing just the most obvious deterministic factors in the decline is insufficient (Fagan and Holmes 2006).

CONCLUSIONS

In conclusion, we feel the best scientific data indicates Oregon Vesper Sparrow is in danger of extinction or threatened by extinction in all or a significant portion of its range. More specifically, the prominent danger of extinction is high in every region throughout its range except for the Umpqua Valley. However, even there, where approximately 50% of the range-wide population occurs, the substantial expansion of vineyard habitat is a threat that could raise the danger of extinction to high levels.

There are many factors as described herein contributing to the conclusion of Oregon Vesper Sparrow being threatened with extinction including:

- extensive historic and significant continuing loss and degradation of suitable habitat

- small population size (<3,000 birds)
- statistically significant declining population trends (5.48%/year over the last 47 years)
- breeding range contractions at both the northern and southern edges of the range (i.e., southwestern British Columbia and northwestern California, respectively)
- wintering range contractions from Baja, California and southern California
- extirpations of many local populations, due to both habitat changes and no apparent habitat change
- a predominance of many small, isolated populations
- a predominance of the range-wide population on private lands (80%)
- nearly all the population on lands subject to potential negative impacts from land management
- the only stronghold of the range-wide population in the Umpqua Valley threatened by significant development of vineyards
- the absence of population establishment where significant habitat restoration has occurred
- the absence of Federal or State programs specifically for Oregon Vesper Sparrow
- the presence of existing mandates and policies that prioritize actions on public lands that are either not compatible with or not specific enough to Oregon Vesper Sparrow
- the inadequacy of existing regulatory mechanisms to provide the protection needed to prevent continued population declines and local and regional extirpations
- the challenges of a *small population paradigm* where populations declines are exacerbated and extinction likelihood is accelerated (i.e., Extinction Vortex)

These factors, acting both singly and in combination, result in our conclusion that Oregon Vesper Sparrow warrants recognition as threatened or endangered under the ESA.

LITERATURE CITED

- Adams, J. S., R. L. Knight, L. C. McEwen, and T. L. George. 1994. Survival and growth of nestling vesper sparrows exposed to experimental food reductions. *The Condor* 96:739-748.
- Altman, B. 1999. Status and conservation of state sensitive grassland bird species in the Willamette Valley. Unpublished report by Avifauna Northwest prepared for Oregon Department of Fish and Wildlife. www.cascadiaprairieoak.org/technical-library.
- Altman, B. 2003. Vesper Sparrow *Pooecetes gramineus*. Pages 542-545 in *Birds of Oregon: a general reference* (D. B. Marshall, M. G. Hunter, and A. L. Contreras, editors). Oregon State University Press, Corvallis.
- Altman, B. 2011. Historical and current distribution and populations of bird species in prairie-oak habitats in the Pacific Northwest. *Northwest Science* 85:194-222.
- Altman, B. 2015. Oregon Vesper Sparrow range-wide inventory and habitat assessment: final report. Unpublished report American Bird Conservancy. Center for Natural Lands Management, State Wildlife Grant G1024-06. www.cascadiaprairieoak.org/technical-library.
- Altman, B. 2016. Conservation assessment for Oregon Vesper Sparrow (*Pooecetes gramineus affinis*). DRAFT. Prepared for USDA Forest Service, Region 6 and USDI Bureau of Land Management, Oregon and Washington: Interagency Special Status and Sensitive Species Program.
- American Ornithological Union. 1957. Checklist of North American Birds, 5th edition. American Ornithological Union, Baltimore.
- Bachelet, D., B. R. Johnson, S. D. Bridgham, P. V. Dunn, H. E. Anderson, and B. M. Rogers. 2011. Climate change impacts on western Pacific Northwest prairies and savannas. *Northwest Science* 85:411-429.
- Bahn, V., R. J. O'Conner, and W. B. Krohn. 2006. Effect of dispersal at range edges on the structure of a species ranges. *Oikos* 115:89-96.

- Bailey, A. M. and R. J. Niedrach. 1965. Birds of Colorado. Volume 2. Denver Museum of Natural History, Denver, Colorado.
- Beauchesne, S. M. 2002. Coastal Vesper Sparrow stewardship account. Report prepared for the Garry Oak Ecosystems Recovery Team, Vertebrates at Risk Recovery Implementation Group, Victoria, British Columbia. 16 pages.
- Behle, W. H. and Selander, R. K. 1952. New and additional records of Utah birds. *Wilson Bulletin* 64:2632.
- Berger, A. J. 1968. Eastern Vesper Sparrow. Pages 868-882 *in* Life histories of North American cardinals, grosbeaks, buntings, towhees, finches, sparrows, and allies (O. L. Austin, Jr., editor). Dover Publications, Incorporated, New York.
- Best, L. B., and N. L. Rodenhouse. 1984. Territory preference of Vesper Sparrows in cropland. *Wilson Bulletin* 96:72-82.
- Best, L. B., H. Campa, III, K. E. Kemp, R. J. Robel, M. R. Ryan, J. A. Savidge, H. P. Weeks, Jr., and S. R. Winterstein. 1997. Bird abundance and nesting in CRP fields and cropland in the Midwest: a regional approach. *Wildlife Society Bulletin* 25:864-877.
- Bock, C. E., V. A. Saab, T. D. Rich, and D. S. Dobkin. 1993. Effects of livestock grazing on neotropical migratory landbirds in western North America. Pages 296-309 *in* Status and management of neotropical migratory birds (D. Finch and P. Stangel, editors). USDA Forest Service General Technical Report RM-229.
- Boyle, S. A. and D. R. Reeder. 2005. Vesper Sparrow, *Pooecetes gramineus*. Pages A91-A102 *in* Colorado sagebrush: a conservation assessment and strategy. Colorado Division of Wildlife, Grand Junction.
- Brown, J. H. 1984. On the relationship between abundance and distributions of species. *American Naturalist* 124:255-279.
- Brown, J. H., D. W. Mehlman, and G. C. Stevens. 1995. Spatial variation in abundance. *Ecology* 76:2028-2043.
- Browning, M. R. 1975. The distribution and occurrence of the birds of Jackson County, Oregon and surrounding areas. *North American Fauna* No. 70.
- Campbell, R. W., N. K. Dawe, I. McTaggart-Cowan, J. M. Cooper, G. W. Kaiser, A. C. Stewart, and M. C. E. McNall. 2001. The birds of British Columbia. Volume 4: Passerines. Wood Warblers through Old World Sparrows. University of British Columbia Press, Vancouver.
- Cannings, R. J. 1998. The birds of British Columbia: a taxonomic catalogue. *Wildlife Bulletin* Number B-86. Ministry of Environment, Lands and Parks, Wildlife Branch, Victoria, British Columbia. 252 pages.
- Caughley, G. 1994. Directions in Conservation Biology. *Journal of Animal Ecology* 63:215-244.
- Chappell, C. B. and J. Kagan. 2001. Westside grasslands. Pages 41-43 *in* Wildlife-habitat relationships in Oregon and Washington (D. Johnson and T. O'Neil, editors). Oregon State University Press, Corvallis.
- Chatwin, T. 2004. Birds, Broom, Bunnies, and Biplanes: Conserving a remnant population of Coastal Vesper Sparrows at the Nanaimo Airport, Vancouver Island. Proceedings of Species at Risk 2004 Pathways to Recovery Conference. Victoria, British Columbia. British Columbia Ministry of Water, Land and Air Protection, Nanaimo, British Columbia, Canada.
- Christy, J. and E. R. Alverson. 2011. Historical vegetation of the Willamette Valley, Oregon, circa 1850. *Northwest Science* 85:93-107.
- Clark, T. W., R. M. Warnecke, and G. G. George. 1990. Management and conservation of small populations. *In* Management and conservation of small populations (T. W. Clark and J. H. Seebeck, editors). Chicago Zoological Society, Brookfield, IL.

- COSEWIC 2006. COSEWIC assessment and status report on the Vesper Sparrow *affinis* subspecies *Pooecetes gramineus affinis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 22 pages.
- Crawford, R. C. and H. Hall. 1997. Changes in the South Puget prairie landscape. Pages 11-16 in Ecology and conservation of the South Puget Sound prairie landscape (P. V. Dunn and K. Ewing, editors). The Nature Conservancy, Seattle WA. 289 pages.
- Curnutt, J. L., S. L. Pimm, and B. A. Maurer. 1996. Population variability of sparrows in space and time. *Oikos* 76:131-144.
- Davis, S. K. and D. C. Duncan. 1999. Grassland songbird occurrence in native and crested wheatgrass pastures of southern Saskatchewan. Pages 211-218 in Ecology and conservation of grassland birds of the Western Hemisphere (P. D. Vickery and J. R. Herkert, editors). *Studies in Avian Biology* 19.
- Dawson, W. R. and F. C. Evans. 1960. Relation of growth and development to temperature regulation in nestling Vesper Sparrows. *Condor* 62:329-340.
- Dechant, J. A., M. F. Dinkins, D. H. Johnson, L. D. Igl, C. M. Goldade, and B. R. Euliss. 2000 (revised 2002). Effects of management practices on grassland birds: Vesper Sparrow. Northern Prairie Wildlife Research Center, Jamestown, ND. 41 pages.
- DeSante, D. F., D. R. Kaschube, and J. F. Saracco. 2015. Vital Rates of North American Landbirds. The Institute for Bird Populations. www.VitalRatesOfNorthAmericanLandbirds.org.
- Dobkin, D. S. and J. D. Sauder. 2004. Shrubsteppe landscapes in jeopardy: distributions, abundances, and the uncertain future of birds and small mammals in the intermountain west. High Desert Ecological Research Institute, Bend, OR.
- Donald, P. F. and J. J. D. Greenwood. 2001. Spatial patterns of range contraction in British breeding birds. *Ibis* 143:593-601.
- Drovetski, S. V., S. F. Pearson, and S. Rohwer. 2005. Streaked horned lark (*Eremophila alpestris strigata*) has distinct mitochondrial DNA. *Conservation Genetics* 6:875-883.
- Environment Canada. 2014. Amended Recovery Strategy for the Horned Lark *strigata* subspecies (*Eremophila alpestris strigata*) and Recovery Strategy for the Vesper Sparrow *affinis* subspecies (*Pooecetes gramineus affinis*) in Canada [Proposed]. *Species at Risk Act Recovery Strategy Series*. Environment Canada, Ottawa. 34 pages.
- Erickson, R. A. 2008. Oregon Vesper Sparrow in California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California (W.D. Shuford and T Gardali, editors). *Studies of Western Birds* 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.
- Fagan, W. and E. Holmes. 2006. Quantifying the extinction vortex. *Ecology Letters* 9:51-60.
- Fuchs, M. A. 2001. Towards a recovery strategy for Garry Oak and associated ecosystems in Canada: ecological assessment and literature review. Technical report GBEI/EC-00-0300. Environment Canada, Canadian Wildlife Services, Pacific and Yukon region. 106 pages.
- Gabrielson, I. N. 1931. The birds of the Rogue River Valley, Oregon. *Condor* 33:110-121.
- Gabrielson, I. N. and S. G. Jewett. 1940. Birds of Oregon. Oregon State Monograph No. 2. Oregon State College, Corvallis.
- Garrett, K., and Dunn, J. 1981. Birds of Southern California: Status and Distribution. Los Angeles Audubon Society, Los Angeles.
- Gilligan, J., M. Smith, D. Rogers, and A. Contreras. 1994. Birds of Oregon: status and distribution. Cinclus Publications, McMinnville.
- Gordon, C. E. 2000. Movement patterns of wintering grassland sparrows in Arizona. *The Auk* 117:748759.

- Grinnell, J. 1898. Birds of the Pacific slope of Los Angeles County. Pasadena Academy of Science Publication 2.
- Grinnell, J., and A. H. Miller. 1944. The distribution of the birds of California. Pacific Coast Avifauna 27.
- Grubb, T. C. and V. V. Pravosudov. 2008. White-breasted Nuthatch (*Sitta carolinensis*), in the Birds of North America (A. Poole and F. Gill, editors), Number 54. Birds of North America, Philadelphia.
- Holmes, R. T. and T. W. Sherry. 1988. Assessing population trends of New Hampshire forest birds: local versus regional patterns. Auk 105:756-768.
- Jewett, S. G. 1916. Notes on some land birds of Tillamook County, Oregon. The Condor 18:74-80.
- Jewett, S. G., W. P. Taylor, W. T. Shaw, and J. W. Aldrich. 1953. Birds of Washington State. University of Washington Press, Seattle.
- Jones, S. L. and Cornely, J. E. 2002. Vesper Sparrow (*Pooecetes gramineus*), in The Birds of North America (A. Poole and F. Gill, editors), Number 624. Birds of North America, Philadelphia.
- King, J. R. 1968. *Pooecetes gramineus affinis* Miller, Oregon Vesper Sparrow, in Life histories of North American cardinals, grosbeaks, buntings, towhees, finches, sparrows, and allies, by A. C. Bent (O. L. Austin Jr., editor). U.S. National Museum Bulletin 237.
- Kershner, E. L. and E. K. Bollinger. 1996. Reproductive success of grassland birds at east-central Illinois airports. American Midland Naturalist 136:358-366.
- Lehman, P. E. 2017. The Birds of Santa Barbara County, California. Revised Edition, May 2017. Vertebrate Museum, University of California, Santa Barbara.
- Ligon, J. S. 1961. New Mexico birds and where to find them. University of New Mexico Press, Albuquerque.
- Maurer, B. A. and M. A. Villard. 1994. Population density: geographic variation in abundance of North American birds. National Geographic Research and Exploration 10:306-317.
- Mayfield, H. F. 1961. Nesting success calculated from exposure. Wilson Bulletin 73:255- 261.
- Mayfield, H. F. 1975. Suggestions for calculating nest success. Wilson Bulletin 87:456-466.
- McCaskie, G., P. DeBenedictis, R. Erickson, and J. Morlan. 1979. Birds of northern California: an annotated field list, Second Edition. Golden Gate Audubon Society, Berkeley.
- Mehlman, D. W. 1997. Changes in avian abundance across the geographic range in response to environmental change. Ecological Applications 7:614-624.
- Miller, G. S. 1888. Description of an apparently new *Pooecetes gramineus affinis*, subspecies from Oregon. Auk 5:404-405.
- Mlodinow, S. G. 2005. Vesper Sparrow *Pooecetes gramineus*. Pages 326-327 in Birds of Washington: Status and Distribution (T. R. Wahl, B. Tweit, and S. G. Mlodinow, editors). Oregon State University Press, Corvallis. 436 pages.
- Moynahan, B. J., M. S. Lindberg, J. J. Rotella, and J. W. Thomas. 2007. Factors affecting nest survival of Greater Sage-Grouse in northcentral Montana. Journal of Wildlife Management 71:1773-1783.
- Myers, A. M., and D. A. Kreager. 2010. Declining and state sensitive bird species breeding in Willamette valley grasslands: status update. Unpublished report prepared for Oregon Department of Fish and Wildlife, Corvallis, and The Oregon Zoo, Portland.
- National Research Council. 1995. Science and the Endangered Species Act. National Academy Press, Washington, D.C.
- Oregon Department of Fish and Wildlife. 2016a. Oregon Conservation Strategy. Oregon Department of Fish and Wildlife, Salem, Oregon.

- Oregon Department of Fish and Wildlife. 2016b. Sensitive Species List. Oregon Department of Fish and Wildlife, Salem, Oregon.
www.dfw.state.or.us/wildlife/diversity/species/docs/2017_Sensitive_Species_List.
- Patten, M. A., G. McCaskie, and P. Unitt. 2003. Birds of the Salton Sea: Status, Biogeography, and Ecology. University of California Press, Berkeley.
- Patterson, M. P., and L. B. Best. 1996. Bird abundance and nesting success in Iowa CRP fields: the importance of vegetation structure and composition. *American Midland Naturalist* 135:153-167.
- Paxton, E. H. 2000. Molecular genetic structuring and demographic history of the willow flycatcher (*Empidonax traillii*). M.S. Thesis, Northern Arizona University, Flagstaff.
- Perry, E. M. and A. W. Perry. 1918. Home life of the Vesper Sparrow and the Hermit Thrush. *Auk* 35:310-321.
- Pulliam, H. R. and G. S. Mills. 1977. The use of space by wintering sparrows. *Ecology* 58:1391-1399.
- Pyle, P. 1997. Identification guide to North American birds: part 1. Slate Creek Press, Bolinas, CA. 732 pages.
- Ridgeway, R. 1901. The birds of Middle and North America. Part 1. *Bulletin of the U.S. National Museum* 50:1-715.
- Rising, J. D. 1996. A guide to the identification and natural history of the sparrows of the United States and Canada. Academic Press, San Diego, California.
- Robbins, C. S., D. Bystrak, and P. H. Geissler. 1986. The Breeding Bird Survey: its first 15 years, 1965-1979. U. S. Department of the Interior, Fish and Wildlife Service Research Publication 157.
- Rodenhouse, N. L., and L. B. Best. 1983. Breeding ecology of Vesper Sparrows in corn and soybean fields. *American Midland Naturalist* 110:265-275.
- Rodenhouse, N. L., and L. B. Best. 1994. Foraging patterns of Vesper Sparrows (*Pooecetes gramineus*) breeding in cropland. *American Midland Naturalist* 131:196-206.
- Rogers, R. E., Jr. 2000. The status and microhabitat selection of Streaked Horned Lark, Western Bluebird, Oregon Vesper Sparrow, and Western Meadowlark in western Washington. M.S. thesis, Evergreen State College, Olympia, Washington.
- Rosenberg, K. V., D. Pashley, B. Andres, P. J. Blancher, G. S. Butcher, W. C. Hunter, D. Mehlman, A. O. Panjabi, M. Parr, G. Wallace, and D. Wiedenfeld. 2014. The State of the Birds 2014 Watch List. North American Bird Conservation Initiative, U.S. Committee. Washington, DC. 4 pages.
www.stateofthebirds.org/extinctions/watchlist.pdf.
- Rotenberry, J. T. 1980. Dietary relationships among shrubsteppe passerine birds: competition or opportunism in a variable environment? *Ecological Monographs* 50:93-110.
- Saab, V. A., C. E. Bock, T. D. Rich, and D. S. Dobkin. 1995. Livestock grazing effects in western North America. Pages 311-353 *in* Ecology and management of neotropical migratory birds (T. E. Martin and D. M. Finch, editors). Oxford University Press, New York.
- Sauer, J. R., D. K. Nivin, J. E. Hines, D. J. Ziolkowski, Jr., K. L. Pardieck, J. E. Fallon, and W. A. Link. 2017. The North American Breeding Bird Survey, Results and Analysis 1966-2015. Version 02.07.2017 U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, MD.
- Shaffer, M. L. 1981. Minimum population sizes for species conservation. *Bioscience* 31:131-134.
- Sibley, D. A. 2000. National Audubon Society: the Sibley Guide to Birds. Random House, Toronto, Canada.
- Southern Oregon University. 2015. 2015 Oregon vineyard and winery census report. Southern Oregon University Research Center, Ashland, Oregon.
- Tellería, J. L. and T. Santos. 1999. Distribution of birds in fragments of Mediterranean forests: the role of ecological densities. *Ecography* 22:13-19.
- The Nature Conservancy. 2013. Umpqua prairie and oak conservation partnership. The Nature Conservancy, Eugene, OR.

- U.S. Fish and Wildlife Service. 1996. Policy regarding the recognition of distinct vertebrate population segments under the Endangered Species Act. Federal register, Wednesday, February 7, 1996, Volume 61, pages 4722-4725.
- U. S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. U.S. Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pages. www.fws.gov/migratorybirds.
- Vickery, P. D., M. L. Hunter, and S. M. Melvin. 1994. Effects of habitat area on the distribution of grassland birds in Maine. *Conservation Biology* 8:1087-1097.
- Vickery, P. D., P. L. Tubaro, J. M. Cardoso da Silva, B. G. Peterjohn, J. R. Herkert, and R.B. Cavalcanti. 1999. Conservation of grassland birds in the Western Hemisphere. *Studies in Avian Biology* 19:2-26.
- Washington Department of Fish and Wildlife. 2013. Oregon Vesper Sparrow. WDFW Contract 132232, Thurston County Habitat Conservation Plan. Washington Department of Fish and Wildlife, Olympia, Washington.
- Washington Department of Fish and Wildlife. 2015. Washington's State Wildlife Action Plan, 2015 update. Washington Department of Fish and Wildlife, Olympia.
<http://wdfw.wa.gov/publications/01742/wdfw01742.pdf>.
- Weatherhead, P. J. and M. R. L. Forbes. 1994. Natal philopatry in passerine birds: genetic or ecological influences? *Behavioral Ecology* 5:426-433.
- Willett, G. 1933. A revised list of the birds of southwestern California. *Pacific Coast Avifauna* 21.
- Wray, T., K. A. Strait, and R. C. Whitmore. 1982. Reproductive success of grassland sparrows on a reclaimed surface mine in West Virginia. *Auk* 99:157-164.
- Zeiner, D. C., W.F. Laudenslayer Jr., K. E. Mayer, and M. White. 1990. California's Wildlife, Volume II, Birds. California Statewide Wildlife Habitat Relationship System, California Department of Fish and Game, 1416 Ninth Street, Sacramento, CA 95814.