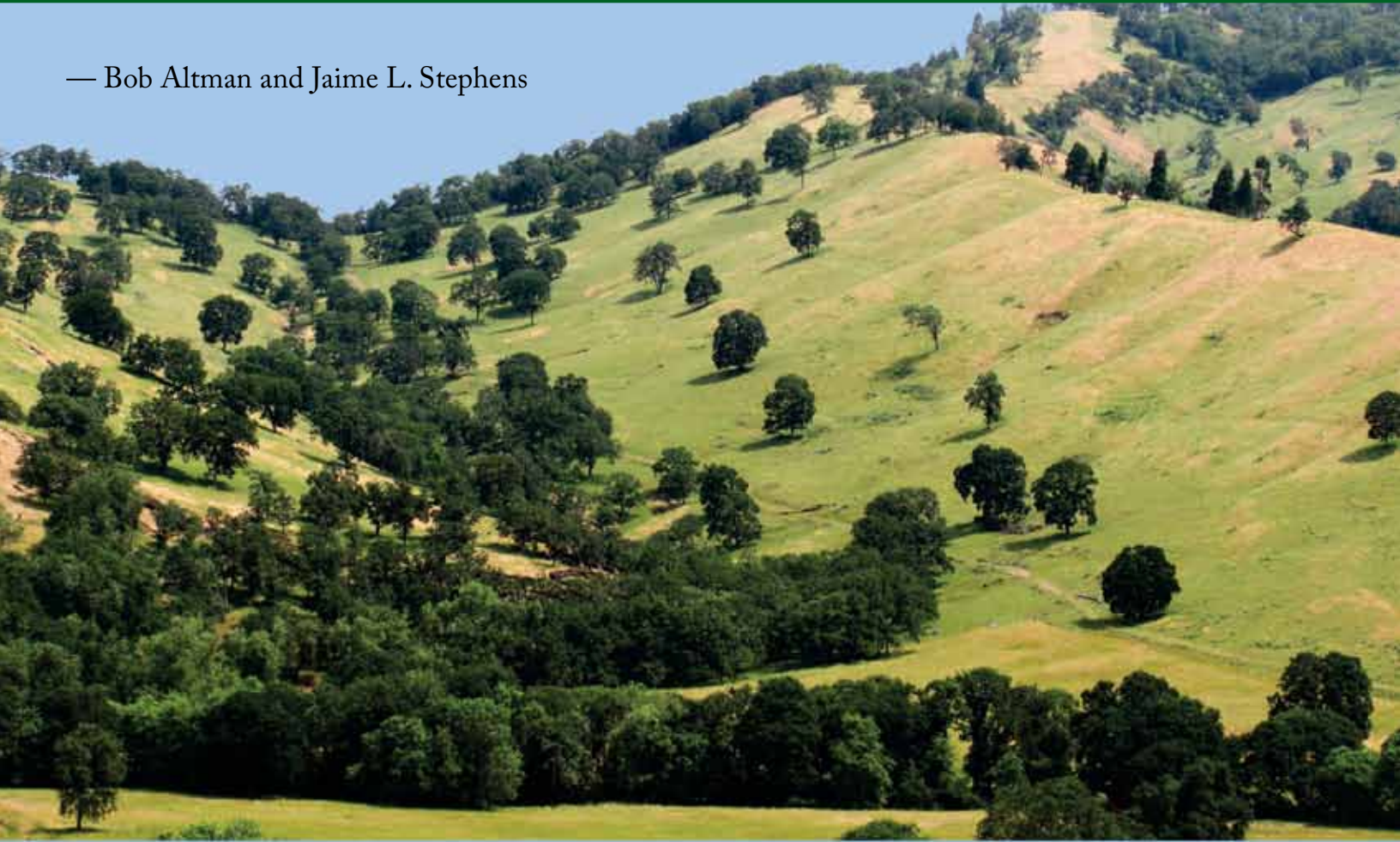


*Land Manager's Guide to*

# Bird Habitat and Populations in Oak Ecosystems of the Pacific Northwest



— Bob Altman and Jaime L. Stephens





Bob Altman

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# Oak Ecosystems in the Pacific Northwest

Oak ecosystems in the Pacific Northwest are relatively dry environments scattered across a large landscape that is dominated by dense coniferous rainforests. This uniqueness represents an important component of regional biodiversity, featuring a high degree of habitat specialization by bird species.<sup>1</sup>

Oak ecosystems often occupy a transitional zone between prairies and conifer forests. Their existence and persistence depends on a complex mix of geological and ecological processes, as well as culture, climate, and economics.<sup>2</sup> The near-exclusive oak tree species in the Pacific Northwest is the Oregon white oak, except for the southern Willamette Valley ecoregion where some black oaks occur, and the Klamath Mountains ecoregion where black oak is common along with some canyon live oaks.<sup>3</sup>

Most oak habitats today were created as a result of a managed fire regime that ended with European settlement in the mid 1800s. Historic burning by indigenous peoples was a major factor that maintained oak habitats in many parts of the region.<sup>4</sup> Frequent, low-intensity fires favor oaks which are fire-tolerant (especially mature trees), exclude conifers such as Douglas-fir which are fire-intolerant, and reduce the understory of shrubs and small trees. Thus, the historic condition in fire-maintained oak habitats was widely spaced, heavily branched, large, open-grown oak trees with a park-like understory dominated by fire-tolerant grasses and forbs and some scattered shrubs and small trees.<sup>5</sup> In the absence of fire, oak habitats typically succeed to conifer forest except in the driest areas where conifer trees cannot survive. Some examples of these non-fire maintained oak communities include south-facing rocky slopes found throughout the region and glacial soils found in the south Puget Lowlands ecoregion.

## Geographic Scope

This *Oak Bird Guide* covers Pacific Northwest oak ecosystems from their northern extent along the southeastern portion of Vancouver Island, British Columbia, south to the Oregon-California border, and east along the Columbia River and the east-slope of the Cascade Mountains in localized areas of central and south-central Washington and north and south-central Oregon. This primarily includes the Puget Lowlands, Willamette Valley, and Klamath Mountain's ecoregions, along with



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**Purpose of the Oak Bird Guide:** This *Oak Bird Guide* is intended to provide land managers in oak habitats with information on bird species' status, distribution, density, habitat relationships, and potential responses to oak habitat management or restoration activities. This information can be used to facilitate sound decisions to support bird conservation in the context of protection and management of the unique and threatened oak ecosystems of the Pacific Northwest.

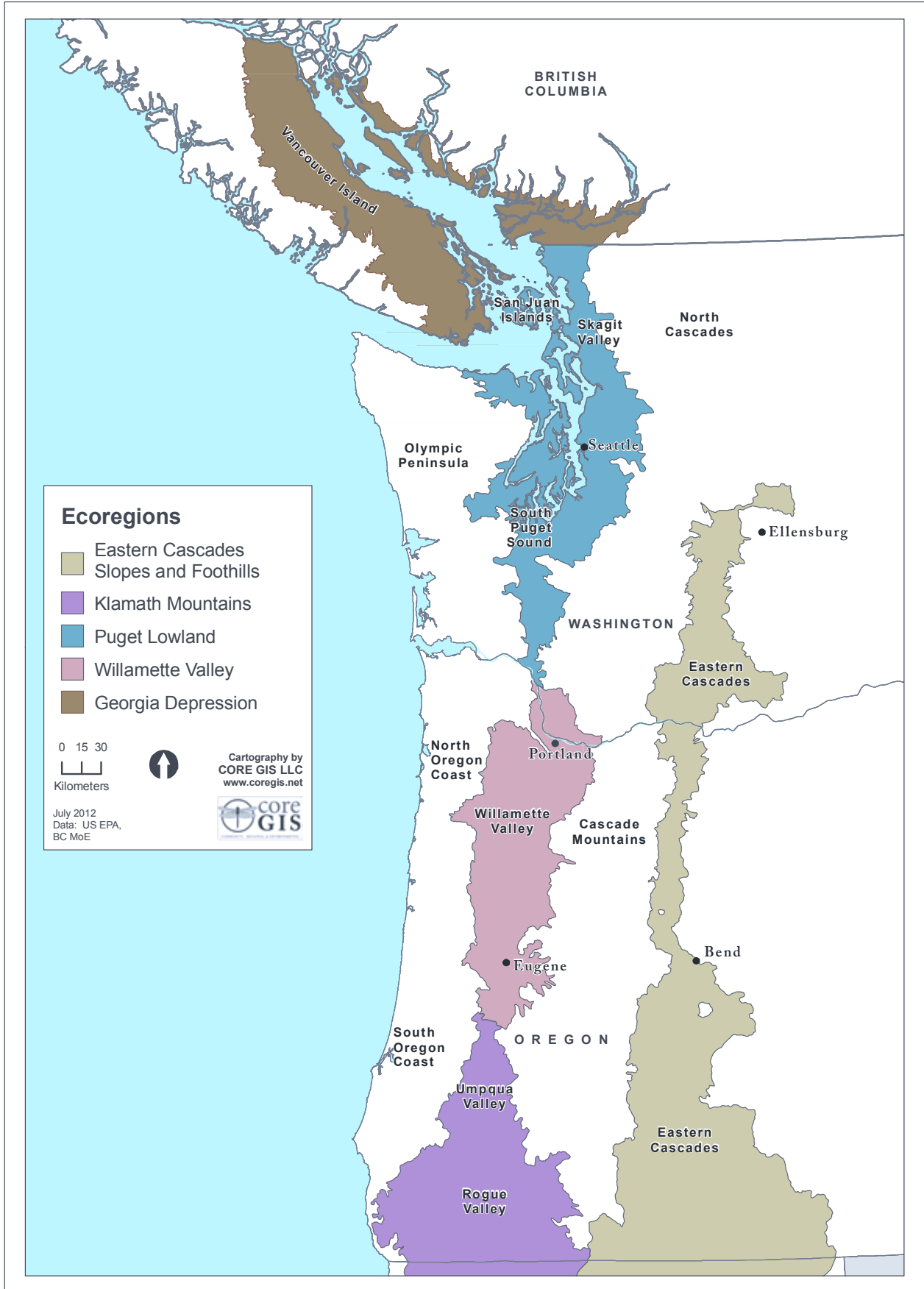
portions of the East-slope Cascade Mountains ecoregion in Oregon and Washington, and the Georgia Depression ecoregion in British Columbia (Figure 1).

## Changes and Threats

Changes to oak habitats in the Pacific Northwest have been profound. In British Columbia, <5% of pre-European settlement oak habitat remains.<sup>6</sup> In Washington on Joint Base Lewis McChord Military Installation, which contains approximately 35% of the oak in the Puget Lowlands ecoregion,<sup>7</sup> <35% of pre-settlement oak habitat remains.<sup>8</sup> In the Willamette Valley of Oregon, only 20% of the historic oak woodlands and savannah remains,<sup>9</sup> including <1% of the pre-settlement oak savannah.<sup>10</sup>

Threats to oak habitats in the Pacific Northwest are extensive and diverse. Most of the lowland and foothill oak habitats have been either eliminated by land development or agriculture, or ecologically degraded by invasive vegetation (e.g., Douglas-fir, non-native hawthorne, Himalayan blackberry, Scotch broom).<sup>2</sup> Where oak habitats occur in montane forests (e.g., East-slope Cascades, and Rogue Basin of southwest Oregon), oak habitats have been eliminated for timber production of faster growing conifers,

**Figure 1. Ecoregions with Oak Habitats in the Pacific Northwest**



**Quercus and Aves:** American Bird Conservancy, in partnership with numerous other organizations and agencies, has been leading the effort for bird conservation in oak communities in the Pacific Northwest since 2000 through its *Quercus* and Aves Program. The goal of this program is “full-spectrum and full life-cycle” that is, address all the important components of bird conservation in oak habitats, and do it both in the Pacific Northwest breeding grounds and in Mexico and Central America where most of the migratory bird species winter. Thanks to funding from the USFWS’ Neotropical Migratory Bird Conservation Act grant program and matching funds from our many partners, millions of dollars have been raised to support this work. Accomplishments include three land acquisitions in south-central Washington for Lewis’s Woodpecker (approximately 1,000 acres) and three acquisitions in El Salvador (approximately 120 acres); nearly 40,000 acres of Private Reserves (land committed to conservation) in Guatemala and Costa Rica including one 24,000 acre tract of primary forest; habitat management and restoration (e.g., invasive species control, thinning, planting, snag creation) on 300+ acres at 12 sites in Oregon, Washington, and British Columbia; bird monitoring and research at more than 100 sites in California, Oregon and Washington, and inventories at numerous sites for the endangered Golden-cheeked Warbler in Latin America; and extensive education and outreach activities in both North and Latin America including workshops, training, community and school presentations, and production of several booklets.



Greg Lavaty

Black-throated Gray Warbler

and altered by efforts to minimize the potential for wild-fire by reducing fuels loads.

Fire suppression since European settlement has drastically altered the structure of oak habitats, the most pronounced being the reduction in open savannah habitats which were much more common than today.<sup>3</sup> Historic oak savannahs and open-canopy woodlands have become dense forests, both oak and mixed oak-conifer forests, with higher tree densities in both the overstory and understory.<sup>11,12</sup> Fire suppression also has resulted in a more extensive shrub understory, and an abundance of nonnative plants in the herbaceous ground cover.<sup>12</sup>

There has been a lack of recruitment of new oaks in many areas due to a variety of factors. These include fire suppression strategies which thwart oak regeneration by sprouting which is stimulated by fire,<sup>4,11</sup> reduced acorn production associated with the reduction of older oak trees, and overgrazing by livestock and/or native ungulates. The consequence is the inability of a sufficient number of seedlings to become young trees and ultimately replace the dying older trees.

Remaining oak habitats tend to be small and disconnected, and conservation efforts are problematic because most of the land ownership is private. In the Puget Lowlands ecoregion, approximately 60% of the oak habitat is on private land, and nearly all the public oak habitat is at one site, Joint Base Lewis McChord Military Installation.<sup>7</sup> In the

Willamette Valley ecoregion, approximately 98% of the remaining oak habitat is on private lands.<sup>9</sup> In the Klamath Mountains ecoregion, where oak habitats extend into montane areas with more public land ownership, approximately 65% of the oak habitat is on private land. Thus, habitat protection and restoration to ensure healthy populations of bird species is heavily dependent on conservation on private lands.

## Ecoregions and Oak Habitats

Ecoregions are relatively large areas with similar assemblages of natural communities defined by characteristics such as climate, geology, and vegetation. There are five ecoregions in the Pacific Northwest where oak habitats and their associated bird species are an important component of regional biodiversity (Figure 1). Within some of these ecoregions there are several discreet sub-regions based on geography and/or ecological differences.

### Georgia Depression

Oak habitats of the Georgia Depression ecoregion, at the northern end of oak distribution in the Pacific Northwest, occur mostly on southeastern Vancouver Island and the Gulf Islands, and at a few locations in the Fraser River Valley on the mainland of British Columbia.<sup>13</sup> On Vancouver Island and the Gulf Islands, oak habitats mostly occur in the rain shadow that results in dry summers and



shallow soils.<sup>14</sup> Site-specific characteristics include either deep-soil parklands where wildfires maintained their existence over conifer trees, or well-drained soils on south and west-facing slopes with exposed bedrock.

## **Puget Lowlands**

Oak habitats of the Puget Lowlands ecoregion in Washington occur primarily in well-drained gravelly soils that are the result of glacial history.<sup>2</sup> After glacial retreat, oak habitats may have been maintained first by harsh conditions, then by natural fires, and finally by fires set by native people to ensure a continuing supply of food from these systems.<sup>15</sup> The current distribution of oak habitats is primarily in the south Puget Lowlands sub-region and mostly on Joint Base Lewis McChord Military Installation. Oak habitats of the north Puget Lowlands sub-region occur primarily on San Juan Island. These habitats have more similarities to those of the Georgia Depression ecoregion than the south Puget Lowlands sub-region.

## **Willamette Valley**

Oak habitats in the lowlands of the Willamette Valley ecoregion are characterized by deep and productive soils resulting in oak trees that reach their greatest physical stature in the Pacific Northwest.<sup>5</sup> This is especially true in the central and southern Willamette Valley where there are large areas of oak habitat. In the foothills of the Willamette Valley, oak habitats tend to occur in drier and less productive soils on south and west-facing slopes, especially in the western Willamette Valley in the rain shadow of the Coast Range mountains. Oak habitats in the northern Willamette Valley are most prevalent in the Lower Columbia River sub-region which includes the metropolitan area around Portland, Oregon and Vancouver, Washington.

## **Klamath Mountains**

Oak habitats of the Klamath Mountains ecoregion in southwest Oregon are the most ecologically diverse oak habitats in the Pacific Northwest. Here, the occurrence of multiple oak tree species represents the convergence of California and Pacific Northwest oak communities.<sup>11</sup> Oaks occur from the deep clay soils of the lowland valleys, into the drought-prone environments of the foothills, and also in the higher precipitation montane environments. Oak/chaparral habitats, where shrub cover dominates, also are a prominent feature of these foothill and montane oak habitats. In many of the dry, south-facing slopes, oak trees often occur as short, shrub-layer trees, or

a multi-stemmed growth form that functions like chaparral shrubs. Within the Klamath Mountain ecoregion, two sub-regions are recognized, the Umpqua Valley and the Rogue Basin. The latter is referred to as basin rather than valley because oak distribution extends into much higher elevations outside the valley.

## **East-Slope Cascades**

Oak habitats of the East-slope Cascades ecoregion occur primarily in central and south-central Washington, north-central Oregon, and in the Klamath Basin of south-central Oregon in the rain shadow of the Cascade Mountains, often along streams and adjacent slopes in canyons associated with major rivers. They occupy a transition zone between conifer forests and shrub-steppe, often being co-dominant with ponderosa pine.<sup>16</sup> These drought-prone conditions and steep slopes often result in less shrub understory than oak habitats west of the Cascade Mountains.

## **Oak Habitat Types**

We recognize four oak-dominant habitat types (where oak trees typically comprise > 90% of the canopy) based on the amount of canopy cover. These include Oak Savannah, Oak Woodland Open, Oak Woodland Closed, and Oak Forest. There are several other habitat types where oak is co-dominant with other tree species or types (Oak/Fir, Oak/Hardwood, Oak/Pine) or growth forms (Oak/Chaparral). We also consider Riparian Oak as a unique habitat type, although its canopy cover or tree species/growth form characteristics are consistent with one of the other oak habitat types.

## **Oak Savannah**

Oak Savannah habitats are grasslands with scattered oak trees and an open canopy (<25% cover) with approximately 1-5 large trees or 1-10 younger trees per acre. Oak trees in savannahs are “open-grown” (i.e., without nearby competition for resources), which at maturity results in large mushroom-shaped trees with well-developed limbs and canopies. Historically, the understory was typically dominated by a ground cover of grasses and forbs with < 10% shrub cover. Under current conditions of fire suppression and associated habitat degradation, the understory may include significantly more shrub and small tree cover depending on land use and management. Characteristic bird species include Lazuli Bunting and Western Bluebird.



## Oak Woodland Open

Oak Woodland Open habitats are characterized by a relatively open canopy (25-50% cover) with approximately 5-10 large trees or 10-20 younger trees per acre. Oak trees in open oak woodlands are often a mixture of open-grown trees and columnar shaped trees with limited lower branch and foliage development. The understory was historically dominated by herbaceous ground cover with variable shrub cover <30% depending on site conditions. Under current conditions of fire suppression and associated habitat degradation, the understory may include significantly more shrub and small tree cover in the absence of management or disturbance. Alternatively, the understory may include limited or no shrub cover where management is occurring (e.g., grazing, mowing). Characteristic bird species include Chipping Sparrow in the understory and Western Wood-pewee in the canopy.



Bob Altman

Mix of Oak Woodland Open and Closed in the Umpqua Valley. Characteristic bird species include Black-capped Chickadee, Cassin's Vireo, and Western Wood-pewee

## Oak Woodland Closed

Oak Woodland Closed habitats are characterized by a relatively closed canopy (50-75% cover) with approximately 10-30 large trees or 20-40 younger trees per acre. Oak trees in closed oak woodlands are mostly columnar shaped with limited lower branch and foliage development. The understory was historically dominated by herbaceous ground cover with variable shrub cover <30% depending on site conditions. Under current conditions of fire suppression and associated habitat degradation, the understory may include some patches of shrub and small tree cover in forest canopy openings. Characteristic bird species include Purple Finch and White-breasted Nuthatch (subspecies).

## Oak Forest

Oak Forest habitats are characterized by a nearly closed canopy (greater than 75% cover) with typically >30 large trees or >40 younger trees per acre. Oak trees in a dense oak forest compete for resources and are almost exclusively columnar in shape with limited branching and crown foliage volume. The sub-canopy and understory can be devoid of woody vegetation where there is a lack of sunlight reaching the forest floor. Alternatively, in moist, productive soils, the sub-canopy and understory can be densely vegetated with shade tolerant shrub and tree species. Characteristic bird species include Nashville Warbler in the dense understory and Black-headed Grosbeak in the canopy and sub-canopy.



Bob Altman

Oak/Pine habitat, such as this area in the East-slope Cascades, typically hosts species such as Lewis's Woodpecker and Western Tanager.

## Oak/Pine

Oak/Pine habitats are typically woodlands or savannahs characterized by the co-dominance of oak and ponderosa pine. These habitats predominantly occur in the east-slope Cascades ecoregion, and to a lesser extent in the Klamath Mountains ecoregion at relatively drier sites, often on moderate to steep slopes in canyons and foothills or on plateaus.<sup>17</sup> The understory may include pockets of shrubs, but is more typically dominated by grasses and forbs. Characteristic bird species include Lewis's Woodpecker in savannah habitats and Western Tanager in woodland and forest habitats.

## Oak/Fir

Oak/Fir habitats are typically closed woodland or forests where there is a relatively equal representation of oak and Douglas-fir in the canopy. This may be a natural community type which occurred primarily in the foothill elevational

transition into Douglas-fir forests, or where site-specific conditions (e.g., north aspects, moister soil types) were present at the interface with oak habitats. However, the most common manifestation of this co-dominance today is the result of the encroachment of Douglas-fir as a result of fire suppression. There is often some representation of dying or dead oak trees in the canopy or sub-canopy as a result of the competition and over-topping of Douglas-fir. The understory is typically limited because of the closed canopy, but shade-tolerant conifer tree species (e.g., Douglas-fir, grand fir) are often a component of the sub-canopy and shrub layers. Characteristic bird species include Black-throated Gray Warbler and Cassin's Vireo.

### Oak/Hardwood

Oak/Hardwood habitats are typically closed woodland or forests characterized by the co-dominance of oak with other hardwood species such as madrone, big leaf maple, or Oregon ash. The former is characteristic of dry sites, and the latter two of wetter sites such as riparian. The understory is variable in extent - typically limited in both open-grown conditions where tree branching occupies much of the space, or in closed canopies where lack of sunlight limits development; but more robust in the wetter sites, which support shrub and sapling tree development. This habitat type occurs throughout the region, but is most prominent in the Klamath Mountains ecoregion. Characteristic bird species include Hutton's Vireo and Black-capped Chickadee.

### Oak/Chaparral

Oak/Chaparral is a shrub-dominated habitat type (often >50% shrub cover) that includes an open canopy of oak trees with scattered grassy openings amid dense patches of shrubs, in particular evergreen shrubs such as ceanothus and manzanita.<sup>1</sup> Oak trees tend to be relatively short in stature and often take on a shrub-form growth in the driest sites. Oak/Chaparral occurs nearly exclusively in the Rogue Basin and Umpqua Valley sub-regions of the Klamath Mountains ecoregion as valley chaparral or montane chaparral. Characteristic bird species include Blue-gray Gnatcatcher and California Towhee.

### Riparian Oak

Riparian Oak habitats are located adjacent to water bodies and can be further defined by any of the other habitat types. The main difference is that because of the higher productivity of riparian soils, Riparian Oak habitats tend to support denser shrub and sub-canopy cover, and often more tree diversity in the canopy, although pure oak in riparian sites is not uncommon. It occurs in all ecoregions, but is most prevalent in the Puget Lowlands and Willamette Valley. Bird species composition in riparian oak is similar to other oak-dominant or co-dominant types. However, because vegetation volume is high, there may be a greater species diversity and/or higher densities of insectivores and foliage-gleaning birds than occur in non-riparian oak sites. Characteristic bird species include Black-headed Grosbeak, Bushtit, and Downy Woodpecker.



Bob Altman

Oak/Chaparral habitat in the Rogue Basin. Birds characteristic of this habitat type include Blue-gray Gnatcatcher and California Towhee.



Bob Altman

Riparian Oak habitat in the Puget Lowlands. Characteristic birds species include Black-headed Grosbeak, Bushtit, and Downy Woodpecker.



**The Rogue Basin and Oak Bird-Habitat Associations:** There are a few unique features about oak habitats in the Rogue Basin that make it challenging to provide a single Pacific Northwest regional characterization for a bird species relationship to habitat types and conditions. In fact, several species show the opposite habitat associations in the Rogue Basin than elsewhere in the region. For example, species such as Bushtit and Lesser Goldfinch are highly associated with oak savannah in the Rogue, but elsewhere are least associated with oak savannah. Species that typically show this difference are shrub/understory species, and the reason appears to be that the understory of oak savannah in most places in the region is open with limited shrub cover, but in the Rogue Basin the understory is often chaparral vegetation which results in a relatively dense shrub layer. Thus, shrub-associated species in the Rogue Basin often reach high densities in oak savannah as classified by canopy cover. Another issue is that in many places in the Rogue Basin, oak trees do not grow as tall as elsewhere in the region, and there is less vertical structural layering of vegetation. In these cases, a sub-canopy layer is often absent, and the canopy and shrub layer are compressed closer together and become less distinguishable. Species such as Purple Finch and Downy Woodpecker, which are canopy or sub-canopy associated elsewhere in the region, show associations with the shrub layer in the Rogue Basin because the tops of shrubs in chaparral become part of the canopy of the habitat. Further, species such as Blue-gray Gnatcatcher and Lesser Goldfinch are associated with both the savannah and forest ends of the canopy gradient in the Rogue Basin, because both can contain a dense shrub layer – chaparral in savannah and a dense forest canopy where the site is dominated by short-statured, multi-stemmed oaks that function like shrubs.



Jaime Stephens



Lesser Goldfinch

Oscar Deutsch

## Oaks and Birds

Amid the vast landscape of Pacific Northwest coniferous forests, oak habitats support a unique avifauna with a high degree of habitat specialization.<sup>18</sup> Bird species composition, especially in the Klamath Mountains ecoregion, is in part a northern extension of bird communities of the dry lowlands and foothill oak habitats of central and northern California.<sup>2</sup> Despite the diversity of oak habitat types and conditions across the region, there is a relatively similar bird community characterized by a disproportionate number of cavity nesters, resident species, foliage gleaners, and species associated with habitat edges. There are several features of oak trees and associated oak habitats that support the dominance of bird species associated with these features.

### Large Trees

Mature, large-diameter trees may be the most important structural element for birds in oak habitats. Large, mature trees produce more acorns and have disproportionately more cavities that are used as roosts and nest sites by numerous species of birds. Older oak trees support a great diversity of epiphytic plants (lichens and bryophytes) and invertebrates, which offer a corresponding richness of insect resources available to birds that forage on branches



Bob Altman

Large, "open-grown" oak trees are especially important for bird species such as Western Scrub-jay, White-breasted Nuthatch, and Western Bluebird.

such as Hutton's Vireos and House Wrens. The White-breasted Nuthatch is particularly adapted to gleaning insects from the deeply-fissured bark that only occurs on large, mature oaks. The berries of the oak mistletoe, found most commonly in mature oak trees, provide an important non-breeding season food resource for Western Bluebirds outside the breeding season.



Acorn Woodpeckers act as seed dispersers for future oak trees.



Cavities in old, decaying oak limbs provide nesting habitat for species such as Ash-throated Flycatcher and Black-capped Chickadee.

## Acorns

The production of acorns (often referred to as “mast”) is an important feature of oak trees for many bird species. Acorns have a high caloric content and can be an important food resource for species such as Band-tailed Pigeon and Lewis’s Woodpecker during fall and winter when other food resources are scarce. Bird species that cache acorns in the ground such as Western Scrub-jay, and species that drop acorns in transit to cache them in trees such as Acorn Woodpecker and Oak Titmouse, act as seed dispersers for future oak trees. Annual acorn production is highly variable, and few bird species can risk being entirely dependent on acorns. However, good acorn crop years can boost survival and reproduction rates, permitting some bird populations to attain greater densities than would be possible without this resource. Likewise, reduced acorn production as a result of loss or compromised vitality of acorn-producing trees, can negatively affect populations of those same bird species in the long-term.

## Dead Wood/Cavities

The availability of large-diameter standing dead trees (i.e., snags) or dead portions of otherwise live trees is the most limiting factor to populations of cavity-nesting birds, which as a group comprise approximately 25-30% of the breeding bird species composition in oak habitats, but often more than 50% of the individuals.<sup>19</sup> Oak trees support significantly more cavities than conifer trees.<sup>20</sup> Further, like many hardwood species, oak trees are better able to compartmentalize injuries and insect damage than conifers, thus providing significant dead wood habitat in an otherwise live tree for primary cavity-excavators such as Lewis’s and Acorn Woodpeckers. In fact, most decaying wood available to birds in oak habitats exists in dead branches of living oak trees.<sup>20</sup> As large branches fall off live, mature oaks, pockets of decaying wood become future cavities for secondary cavity-nesting species such as Ash-throated Flycatcher and Black-capped Chickadee. Lastly, arthropods that dwell in decaying wood such as carpenter ants, termites, and beetle larvae are a primary food source for many bird species.

## Tree Structure

One of the most characteristic features and important habitat components of open-grown oak trees is their mushroom-shape architecture with extensive branching and foliage down to the ground. This branching provides cover from weather and predators, and extensive foliage



development and surface area for foraging and nesting for birds such as Black-throated Gray Warbler, Blue-gray Gnatcatcher, and Purple Finch. Open-grown oak tree structural development also includes the presence of large lateral branches that provide unique perching opportunities for large birds requiring flatter surfaces such as Turkey Vulture and Wood Duck.

## Shrubs

Shrubs historically occurred in scattered patches where they escaped fires or in more productive microclimates, and were not as characteristically important as the aforementioned features. The major exception to this is Oak/Chaparral habitats of the Klamath Mountains ecoregion of southwestern Oregon, where shrubs are the dominant habitat feature. Typical shrub species throughout oak habitats include snowberry, poison oak, California hazel, and ocean spray, with ceanothus and manzanita prominent in the Klamath Mountains ecoregion. The presence of shrubs adds another stratum to the vertical structure of oak habitats that can increase foraging and nesting opportunities for bird species such as Bushtit and Nashville Warbler. Shrubs also provide a substrate for insect hatches, providing aerial insects for species such as Ash-throated Flycatcher and Western Wood-pewee. A dense, shrub understory supports species such as Bewick's Wren and Spotted Towhee that are not strongly associated with oak trees, and are common species in many other habitats dominated by a shrub layer. However, the expansive shrub development that has occurred in many oak habitats from fire suppression and other factors has resulted in the loss and degradation of the herbaceous-dominated understory of oak savannah and open oak woodland habitats.<sup>5</sup> In these instances reduction of shrub cover is often considered a management goal.



Bob Altman

**Patch Size and Edge Habitat:** Patch size, connectivity, and the negative consequences of habitat fragmentation are familiar themes in landbird conservation. However, these factors appear to be relatively unimportant to most oak-associated bird species. This is likely due to the ecological evolution and maintenance of the oak ecosystems in which these species evolved. A combination of the vagaries of the different fire intensities and extent that maintained these systems, along with the specializations of oak trees to fine-scaled issues of soil type, aspect, moisture, and microclimate etc., likely resulted in a landscape mosaic of naturally fragmented and variable-sized oak patches with a significant amount of edge habitat. Thus, the habitat preferences exhibited today by many oak-associated bird species are a reflection of these historic conditions dominated by savannah and edges. This includes oak savannah species such as Lazuli Bunting, Lewis's Woodpecker, and Western Bluebird, and edge species such as Ash-throated Flycatcher, Slender-billed White-breasted Nuthatch, Western Scrub-jay, and Western Wood-pewee. However, it should be noted that some oak-associated bird species do show some association with larger patch sizes including Black-throated Gray Warbler, Hutton's Vireo, and Purple Finch.

Bob Altman



Oak Savannah invaded by Himalayan blackberry in the Umpqua Valley. The change has likely moved it from Chipping Sparrow and Western Bluebird habitat to Lazuli Bunting habitat, although the dense blackberry in the upper left has probably exceeded suitability for Lazuli Bunting.



Bill Hübner

Purple Finch

**Table 1.** Summary of breeding season habitat relationships of oak-associated bird species in the Pacific Northwest

Species (Subspecies)	Primary Structural Layer <sup>1</sup>			Cavity Nester	Edges <sup>2</sup>	Patch Size <sup>3</sup>
	Canopy/ Sub-canopy	Shrub/ Midstory	Ground/ Shrub			
<b>Obligate or Near-Obligate</b>						
Acorn Woodpecker	X			X		
Ash-throated Flycatcher	X			X	X	
Blue-gray Gnatcatcher		X				
California Towhee			X			
Oak Titmouse	X			X		
White-breasted Nuthatch	X			X	X	
<b>Highly Associated</b>						
Bewick's Wren		X		X		
Black-capped Chickadee	X			X		
Black-headed Grosbeak	X					
Black-throated Gray Warbler	X					X
Bushtit		X				X
Cassin's Vireo	X					
Chipping Sparrow			X			
Downy Woodpecker	X			X		
House Wren		X		X		
Hutton's Vireo		X				X
Lazuli Bunting			X			
Lesser Goldfinch					X	
Lewis's Woodpecker	X			X		
Nashville Warbler		X				
Purple Finch	X					X
Spotted Towhee			X			
Western Bluebird			X	X		
Western Scrub-jay					X	
Western Tanager	X				X	
Western Wood-pewee	X				X	
<b>Oak Savannah/Grassland Associates</b>						
American Kestrel				X		
Lark Sparrow			X			
Vesper Sparrow			X			
Western Kingbird	X					
Western Meadowlark			X			

<sup>1</sup> X = The structural layer where the species most regularly occurs (only one per species). We recognize that some species use multiple layers, but wanted to characterize the predominant one. Some examples of species using multiple layers include Nashville Warbler, which nests on the ground but is most associated with the shrub/midstory layer, and Chipping Sparrow, which may sing from the canopy/sub-canopy, but forages on the ground and most often nests in the shrub layer. Alternatively, no layer is indicated as primary for Lesser Goldfinch and Western Scrub-jay which use all three categories similarly, and are most characterized by their association with the edges.

<sup>2</sup> Many species occur on edges of habitats, but edge species as recognized here are those that are rarely found in the interior of the habitat type during the breeding season, and use edge habitats for all their nesting and foraging activities.

<sup>3</sup> Species reported to have requirements for larger patch sizes based on two studies that assessed this parameter.<sup>22,23</sup> Only Black-throated Gray Warbler was reported in both studies.



Tom Grey

Western Bluebirds; female on left, male on right.

## Oak Bird Species

Our list of oak-associated bird species is based on three previous assessments<sup>1,18,21</sup> with several modifications based on more recent data and analyses. Obligate or near-obligate species are those with > 75% of their historic or current population in the Pacific Northwest in oak habitats (Table 1). It is noteworthy that none of these six species are distributed throughout the region, but they all occur in the Rogue Basin sub-region and southern portion of the East-slope Cascades ecoregion. Four of the six obligate or near-obligate species (67%) are resident cavity-nesters primarily associated with canopy or sub-canopy habitats.

Highly associated species are those that are abundant in some other habitat(s), but reach some of their highest densities in oak habitats (Table 1). The majority of oak-associated bird species fit this description. Among these 20 species, six (30%) are cavity-nesters and eight (40%) are resident species.

Lastly, we recognize five additional species that are primarily grassland species, but regularly occur in oak savannah (Table 1). There also are a few species not included in Table 1 that can be regularly found in oak habitats, but tend to have broader habitat preferences and occur in higher densities in other habitat types (e.g., Bullock's Oriole in riparian, Wrentit in early-successional conifer forest, and Band-tailed Pigeon in mixed-conifer forest).

### Oak Habitat Conservation for Resident and Cavity-Nesting Birds:

Among the 26 species we consider to be most highly associated with oak habitats in the Pacific Northwest, 10 (39%) are cavity-nesters and 12 (46%) are resident species. These numbers are the highest for these categories in any habitat type in the Pacific Northwest. This provides some relatively clear direction for a primary bird conservation strategy in oak habitats in the Pacific Northwest – the protection of mature oak trees and habitat management and restoration to promote the development of mature trees and their associated characteristics. Natural cavities are disproportionately more available in mature trees, especially open-grown trees, and year-round habitat for resident and cavity-nesting birds requires suitable conditions and adequate resources, both of which are more available with mature trees. This includes cavity roosting sites, acorns as food for some species (e.g., Acorn Woodpecker, Lewis's Woodpecker), and non-acorn foraging resources such as invertebrates living in lichens and bryophytes, arthropods in decaying branches, and mistletoe berries in canopy branches, all of which are most prevalent in mature trees.



Greg Lavaty

Downy Woodpecker



**Table 2.** Oak-associated bird species designated as being of conservation concern by the primary wildlife natural resource agencies in the Pacific Northwest

Species (Subspecies)	USFWS <sup>1</sup>	ODFW <sup>2</sup>	WDFW <sup>3</sup>
Acorn Woodpecker		W	
Blue-gray Gnatcatcher		K	
Chipping Sparrow		W	
Vesper Sparrow (Oregon)	X	KW	P
Lewis's Woodpecker		K	
White-breasted Nuthatch		W	P
Western Bluebird		W	P
Western Meadowlark		W	

<sup>1</sup> USFWS = U.S. Fish and Wildlife Service Birds of Conservation Concern in Bird Conservation Region 5<sup>24</sup>

<sup>2</sup> ODFW = Oregon Department of Fish and Wildlife Species of Greatest Conservation Need<sup>25</sup> (W = Willamette Valley ecoregion; K = Klamath Mountains ecoregion)

<sup>3</sup> WDFW = Washington Department of Fish and Wildlife Species of Greatest Conservation Need<sup>26</sup> (P = Puget Lowlands ecoregion)



Bob Altman

**Oak Bird-Habitat Relationships Summaries:** The habitat associations and finer-scaled habitat relationships of our 26 oak-associated bird species are presented in several ways. Relationships to habitat structure and special habitat features are indicated in Table 1. The degree of occurrence of each species across the gradient of oak habitat types is depicted in Figure 2. The habitat condition(s) that each species is most associated with is presented in Table 3. Potential population response to typical habitat management and restoration activities is projected in Tables 4 and 5. Finally, for each species there is a Species Account in Appendix A that provides supplementary information on population trends, range, nesting, and density estimates by ecoregion and habitat type based on data from a variety of sources listed in Appendix B.



James Livaudais

White-breasted Nuthatch

### Priority and Focal Species

Many bird species associated with oak habitats are of conservation concern due to declines in populations, local extirpations, or close associations with declining habitat types (e.g., oak savannah) (Table 2). This includes three cavity-nesting breeding species with local or regional extirpations: Lewis's Woodpecker from western Oregon, western Washington, and southwestern British Columbia since the 1960s; Western Bluebird from southwestern British Columbia and northwestern Washington since the 1960-1970s, and Slender-billed White-breasted Nuthatch recently extirpated (1990s) from the south Puget Lowlands of western Washington.<sup>18</sup> Further, there are two oak savannah ground-nesting species that have experienced local extirpations: Western Meadowlark from southwestern



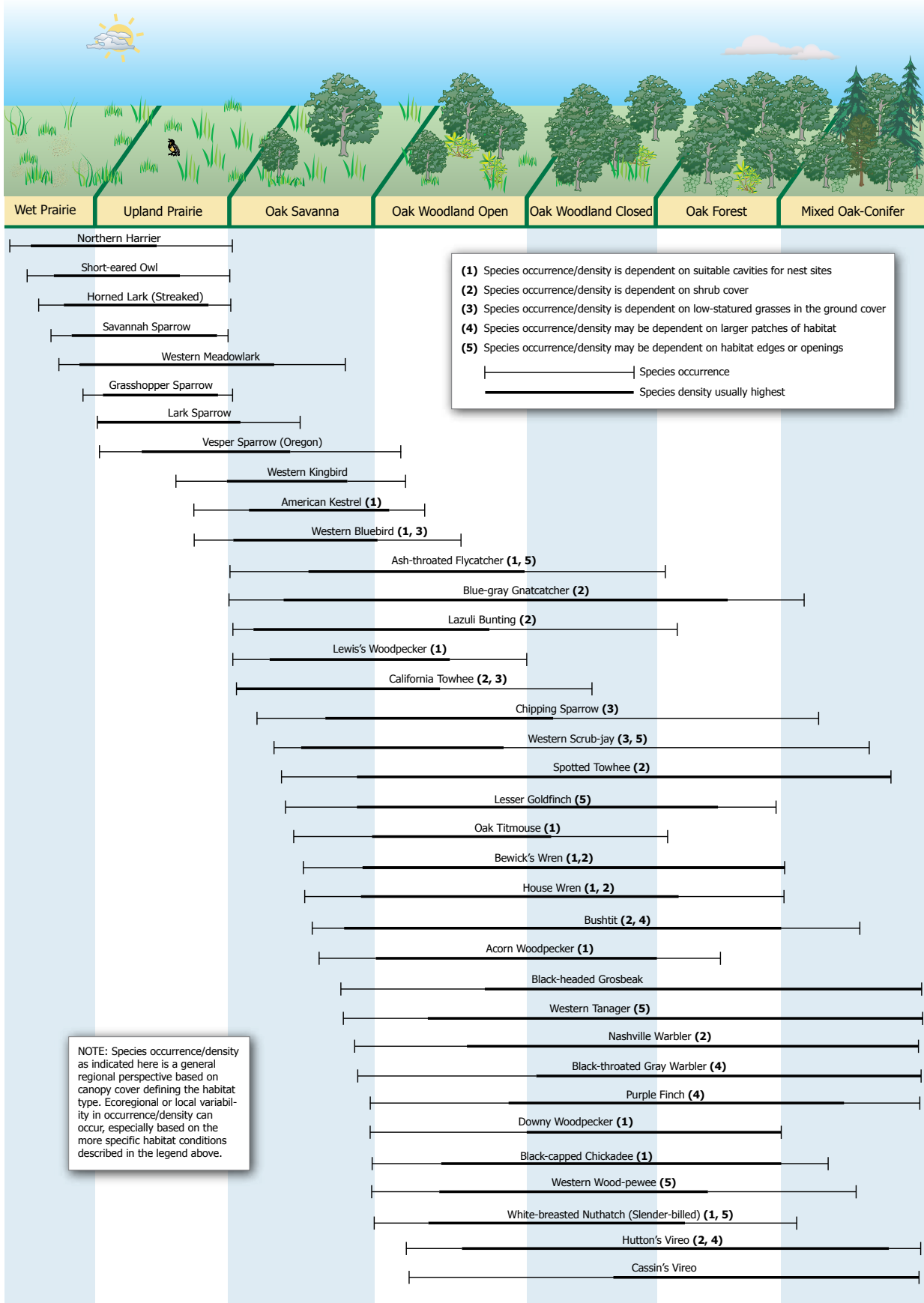
## Lewis's Woodpecker: Poster Bird for Oak Savannah Conservation

Lewis's Woodpecker was formerly an uncommon to locally abundant breeding species in oak habitats in all four of the ecoregions of western Oregon and Washington and southwestern British Columbia.<sup>18</sup> By the early 1960s it began to disappear as a breeding species starting in the Georgia Depression and San Juan Islands of the north Puget Lowlands. By the early 1970s it was gone as a breeding species in the south Puget Lowlands and Willamette Valley. It maintained a breeding presence in the Klamath Mountains through the 1980s, but is currently not known to breed anywhere in these ecoregions. This regional extirpation mirrors the loss and degradation of oak habitats in the region, particularly the extensive areas of oak savannah dominated by large trees which is the required habitat for this cavity-nesting bird. Bringing back breeding populations of Lewis's Woodpecker, and the expansive oak savannahs they depended on, is a driving vision for bird conservationists in oak habitats of the Pacific Northwest.



John White

**Figure 2.** Degree of Occurrence of Bird Species Across the Gradient of Prairie-Oak Habitat Types





**Using Focal Species in Conservation Planning and Implementation:** Focal species are typically used as representatives of the desired habitat conditions for conservation. If the desired objective is for an oak savannah or open woodland landscape (e.g., 10–40% canopy cover), useful focal species might be Western Scrub-jay for canopy cover and Chipping Sparrow or Lazuli Bunting for the relationship between understory shrub cover and herbaceous ground cover. In the Rogue Basin of the Klamath Mountains ecoregion, California Towhee could be used to capture the relationship between shrub cover and herbaceous ground cover. If the objective is for an oak woodland of 30–70% cover, useful focal species would be White-breasted Nuthatch for tree size, Western Wood-pewee for the more open canopy with edges desired condition, Cassin's Vireo or Purple Finch for the more closed canopy condition, and House Wren or Hutton's Vireo for shrub cover in the understory (Nashville Warbler in the Klamath Mountains ecoregion). It is important to recognize that these conditions are not the full habitat requirements for the focal species; the conservation emphasis is on using the focal species to describe the desired habitat conditions, but not to describe the conservation of the species itself.

British Columbia and northwestern Washington in the 1970–1980s, and Oregon Vesper Sparrow nearly extirpated from southwestern British Columbia.<sup>18</sup>

Another way of considering important species for conservation is the concept of focal species.<sup>27</sup> These are species that are highly associated with a particular habitat type or habitat feature and can be used as indicators of that habitat condition(s) in conservation planning, implementation, and monitoring. The occurrence and/or density of focal species or their associated habitat conditions also can be used as representative of the conservation of other species associated with the same or similar conditions. The premise is that a site or landscape that meets the habitat requirements of a suite of focal species representative of

the desired conditions is likely to encompass the habitat requirements of most if not all the other species in the bird community.

Focal species for oak habitats in the Pacific Northwest were originally identified by the Oregon-Washington Partners in Flight initiative ([www.orwapif.org](http://www.orwapif.org)) in two bird conservation plans, Westside Lowlands and Valleys<sup>21</sup> and East-slope Cascades.<sup>28</sup> A more extensive assessment of oak habitat focal species was prepared for use in setting population and habitat objectives in oak habitats in the Pacific Northwest.<sup>29</sup> Significant bird and habitat monitoring in oak habitats over the last few years has resulted in new data that provides us with an opportunity to update those efforts (Table 3).

**Focal Bird Species and Effectiveness Monitoring:** By monitoring both birds and vegetation before and after restoration, we can evaluate whether a project has achieved its intended outcome and guide further restoration actions if needed. While, the ultimate metric of the success of the habitat management or restoration actions should be the assessment of the vegetative conditions created to support focal species, the response of focal species provides us with additional understanding of ecological change. The use of a suite of focal species representing a range of the habitat conditions will provide a more robust measure of effectiveness than a single species. The presence or density of a suite of focal bird species can be used as a positive indicator of the “effectiveness or success” of habitat management or restoration activities at a site, but should not be used as the primary metric for effectiveness because of the potential for factors beyond habitat to affect bird species. There are a number of reasons why a bird species may not occur at a site with seemingly appropriate habitat, such as proximity and status of the nearest species populations and the ability of those populations to provide recruitment into the site, or that our knowledge of the targeted habitat conditions for the species is incomplete or inaccurate. Thus, it is possible that habitat management or restoration can be successful in achieving the desired habitat conditions, but still not support the targeted focal species. While the absence or low density of some focal species might not indicate failure, it should prompt further evaluation of restoration effectiveness and/or species ecology. From a bird conservation perspective, understanding what is limiting populations in restored oak habitat is critical to both inform future restoration and refine our knowledge of the habitat needs of focal species.



**Table 3.** Focal species habitat associations by ecoregion/sub-region for oak habitats in the Pacific Northwest

Oak Habitat Type	Age	Habitat Condition	Focal Species <sup>1</sup>	Ecoregion/Sub-Region <sup>2</sup>								
				Georgia Depression	Puget Lowlands		Willamette Valley		Klamath Mountains		East-slope Cascades	
					North	South	Lower Columbia River	Central and South	Umpqua Valley	Rogue Basin	North and Central	Klamath Basin
<b>Oak Savannah or Oak Woodland Open</b>												
Savannah	Mature	low-statured grass understory	Western Bluebird			X	X	X	X	X	X	X
Savannah or Open Woodland	Young or Mature	low-statured grass understory	Chipping Sparrow	X	X	X	X	X	X	X	X	X
		moderate and patchy shrub cover	Lazuli Bunting			X	X	X	X	X	X	X
	Mature	edges and openings	Western Scrub-jay			X	X	X	X	X		X
<b>Oak Woodland Closed or Oak Forest</b>												
Woodland	Mature	edges and openings	White-breasted Nuthatch				X	X	X	X		
Woodland or Forest	Mature	open subcanopy	Acorn Woodpecker					X	X	X		X
		exterior edges	Ash-throated Flycatcher						X	X	X	X
		interior or exterior canopy edges and openings	Western Wood-pewee	X	X	X	X	X	X	X	X	X
		moderate subcanopy cover	Purple Finch	X	X	X	X	X	X	X	X	X
		moderate subcanopy or shrub layer cover	Oak Titmouse							X		X
	Young or Mature	dense shrub layer cover or open-canopy chaparral	Bewick's Wren	X	X	X	X	X	X	X		X
		moderate subcanopy cover	Black-headed Grosbeak	X	X	X	X	X	X	X	X	X
<b>Oak Savannah, Oak Woodland Open, Oak Woodland Closed, Oak Forest</b>												
Savannah, Woodland, or Forest	Mature	moderate shrub cover with open-canopy trees	House Wren	X	X	X	X	X	X	X	X	X
	Young or Mature	moderate shrub layer cover	Spotted Towhee	X	X	X	X	X	X	X	X	X
		edges and openings	Lesser Goldfinch				X	X	X	X	X	X
<b>Oak/Fir</b>												
Closed Woodland or Forest	Young or Mature	moderate to high canopy and subcanopy cover	Black-throated Gray Warbler		X	X	X	X	X	X	X	X
		moderate to high subcanopy or shrub layer	Nashville Warbler						X	X	X	X
<b>Oak/Pine</b>												
Open or Closed Woodland	Mature	moderate canopy cover with edges and openings	Western Tanager	X	X	X	X	X	X	X	X	X
Closed Woodland or Forest	Young or Mature	moderate to high canopy and subcanopy cover	Cassin's Vireo	X	X	X	X	X	X	X	X	X
<b>Oak/Hardwood</b>												
Woodland or Forest	Young or Mature	moderate subcanopy or shrub layer cover	Hutton's Vireo	X	X	X	X	X	X	X		
		moderate subcanopy cover	Black-capped Chickadee			X	X	X	X	X	X	
<b>Oak/Chaparral</b>												
Savannah	Young or Mature	dense shrub layer cover and grass openings	California Towhee						X	X		
Savannah, Woodland, or Forest	Young or Mature	moderate to high shrub layer cover	Blue-gray Gnatcatcher							X		X
<b>Riparian Oak</b>												
Woodland or Forest	Young or Mature	moderate subcanopy and shrub layer cover	Bushtit	X	X	X	X	X		X		X
		moderate subcanopy cover	Downy Woodpecker	X	X	X	X	X	X	X	X	X

<sup>1</sup>Although each species is only listed for one habitat category, they may be used as focal species for the same habitat condition in other habitat categories if they are also regularly occurring in those categories.

<sup>2</sup>Shading indicates the species does not occur or only occurs to a very limited degree as a breeding species in oak habitats in an ecoregion/sub-region, and is not useful as a focal species; **X** indicates species that are suggested as focal species to be used in planning, implementation, and monitoring because their distribution and density is relatively good throughout the ecoregion/sub-region. **X** indicates species that could be used as focal species, but their densities are relatively low. If any of the suggested focal species are not present or are only minimally present at a particular site or area, use of other focal species with similar habitat associations may be appropriate.



There are two ways to use bird focal species in the conservation of oak habitats. First, the specifics of their representative habitat associations (e.g., canopy cover or shrub cover, tree size) can be used in the planning process to set habitat objectives for a site or landscape. Secondly, their occurrence or density can be used as a metric to track positive progress of management or restoration towards the habitat objectives they represent. Although both of these can be done for individual species, the most ecologically sound approach is to use a suite of focal species whose habitat associations capture the range of desired conditions at a site or across a landscape.

## Density Estimates

Bird density estimates (i.e., number of birds per area) can be an important tool in bird conservation. Firstly, density estimates for a habitat type provides the opportunity to calculate an estimate of the population of a species. Secondly, density estimates used in conjunction with other information on population trends, historic population baselines, or desired populations can be used to set population objectives. Through bird monitoring, a density estimate can be readily calculated, which can become the metric used to set the objective or easily converted to a population estimate as the objective. The use of density estimates to calculate population estimates and set population objectives has been done for oak and other habitats in the Puget Lowlands ecoregion.<sup>30</sup> Some examples of ecoregional mean density estimates for oak-associated bird species are provided in Table 4.



Greg Homel, Natural Elements Productions

Ash-throated Flycatcher

**Table 4. Ecoregion/sub-region mean density estimates (birds/ha) for oak-associated bird species in oak-dominant habitats in the Pacific Northwest<sup>1</sup>**

**Georgia Depression**

Spotted Towhee	1.24
Bewick's Wren	0.66
Chipping Sparrow	0.26
Western Tanager	0.13
House Wren	0.11

**Puget Lowlands**

Spotted Towhee	0.89
Western Wood-pewee	0.60
Chipping Sparrow	0.42
House Wren	0.41
Black-capped Chickadee	0.28
Purple Finch	0.28
Western Tanager	0.11

**Umpqua Valley**

Spotted Towhee	0.75
Lazuli Bunting	0.54
Black-capped Chickadee	0.33
Chipping Sparrow	0.19
Western Tanager	0.19
Western Wood-pewee	0.15
Black-headed Grosbeak	0.14
House Wren	0.12
Lesser Goldfinch	0.10
White-breasted Nuthatch	0.10

**Willamette Valley**

Spotted Towhee	1.20
Black-capped Chickadee	0.55
Western Wood-pewee	0.52
House Wren	0.30
Bewick's Wren	0.22
Black-headed Grosbeak	0.17
Lesser Goldfinch	0.17
White-breasted Nuthatch	0.17
Purple Finch	0.16
Lazuli Bunting	0.14
Western Scrub-jay	0.11
Western Tanager	0.11
Black-throated Gray Warbler	0.10
Chipping Sparrow	0.10
Downy Woodpecker	0.10

**East-slope Cascades**

Chipping Sparrow	0.47
Spotted Towhee	0.39
Nashville Warbler	0.34
Lazuli Bunting	0.25
Western Tanager	0.20
Black-throated Gray Warbler	0.13
Western Wood-pewee	0.10

**Rogue Basin**

Spotted Towhee	0.80
Lesser Goldfinch	0.70
Lazuli Bunting	0.68
Blue-gray Gnatcatcher	0.51
Black-headed Grosbeak	0.43
Nashville Warbler	0.41
Chipping Sparrow	0.36
Western Tanager	0.30
Western Wood-pewee	0.23
California Towhee	0.22
Ash-throated Flycatcher	0.20
Bushtit	0.19
House Wren	0.19
Oak Titmouse	0.19
Purple Finch	0.17
White-breasted Nuthatch	0.13
Black-throated Gray Warbler	0.11

Tom Grey



Spotted Towhee

<sup>1</sup> Only species with density estimates  $\geq 0.10$  birds/ha. are included. Ecoregion/sub-region mean density estimates are derived from an analysis of the data sources listed in Appendix B, which include data from all oak-dominant habitat types and from multiple methods (e.g., fixed and variable radius point counts, spot-mapping). There is inherent variability and uncertainty when combining data from different habitat types and multiple methods, but density estimate comparisons among species within an ecoregion/sub-region provides a starting point for identifying relative importance and potential value of species for use in planning or monitoring. Further, since the numbers reflect a singular mean density estimate for an entire ecoregion/sub-region, they are best used in landscape level analyses of multiple sites, rather than as representative of any individual site.



Black-headed Grosbeak

Greg Lavaty

Density estimates also can be used to predict changes in a species population based on habitat management or restoration activities. Knowledge of a species density estimate for both the baseline and projected future habitat type or condition provides an easy method for calculating the corresponding predicted changes in a species population (Tables 5 and 6).

## Response to Habitat Management and Restoration

Significant oak habitat management and restoration has been and continues to be implemented throughout the region in the last 10-15 years. Detailed information on planning, decision-making, techniques etc. for oak habitat management and restoration is beyond the scope of this document, but is available in numerous sources.<sup>16,31,32,33,34,35</sup>

Herein, we provide some quantitative and qualitative context for how different oak habitat management and restoration activities might potentially affect bird species populations in the short term. We do not do this for activities with long-term objectives such as planting oaks for future habitat or releasing oak trees from competition to encourage “open-growth” and development of lateral branching.

### Canopy

Density data (Appendices A and B) were used to predict the potential change in population from habitat management or restoration activities that would change the habitat type based on canopy cover (Table 5). We only considered substantial changes in type where the habitat would move at least two habitat types to avoid trying to distinguish between more subtle changes. The canopy management or restoration examples considered here include:

- oak thinning that would reduce canopy cover and change Oak Forest to Oak Woodland Open or Oak Savannah.
- oak thinning that would reduce canopy cover and change Oak Woodland Closed to Oak Savannah.
- removal of conifers, especially Douglas-fir to “release” oaks that would reduce canopy cover and change Oak/Fir forest to Oak Woodland Closed, Oak Woodland Open, or Oak Savannah.



Bob Altman

### Sub-canopy and Understory

Bird species response to habitat management or restoration that would change sub-canopy, shrub, or ground cover were subjectively indicated as positive, negative, or neutral (Table 6) based on an understanding of species associations with these conditions from various studies and data sets (Appendices A and B). The sub-canopy and understory management or restoration examples considered here include:

- thinning from below of sub-canopy oak trees, conifer trees, or invasive trees (e.g., hawthorne) that would reduce midstory structural diversity.
- removal of shrub cover that would open up the understory and provide more herbaceous openings.
- herbaceous height control through poor soil productivity (e.g., gravelly soils, shallow soils on dry sites) or management such as mowing or grazing outside the nesting season.



John White

Western Tanager



**Table 5.** Projected potential bird species short-term population response to canopy management in oak habitats<sup>1</sup>

Species	Canopy Oak Thinning <sup>2</sup>			Canopy Douglas-fir Removal <sup>2</sup>		
	OF→OWO	OF→OS	OWC→OS	ODF→OWC	ODF→OWO	ODF→OS
Acorn Woodpecker	o	o	o	o	o	o
Ash-throated Flycatcher	++++	++++	++++	+	++++	++++
Bewick's Wren	o	o	o	++++	++++	++++
Black-capped Chickadee	--	----	----	++	++	-
Black-headed Grosbeak	-	----	--	-	--	----
Black-throated Gray Warbler	-	--	-	---	-	---
Blue-gray Gnatcatcher	--	+	++++	+++	++++	++++
Bushtit	+++	++++	+++	o	+++	++++
California Towhee	++++	++++	++++	+++	+++	++++
Cassin's Vireo	o	---	---	-	---	---
Chipping Sparrow	++++	++++	+	+	++++	++++
Downy Woodpecker	---	---	---	o	o	o
House Wren	+	++	+	++++	++++	++++
Hutton's Vireo	-	---	o	o	o	---
Lazuli Bunting	++++	++++	++	++	++++	++++
Lesser Goldfinch	++	++++	++++	+	++++	++++
Nashville Warbler	+	--	--	--	--	----
Oak Titmouse	++++	++++	+	+++	++++	++++
Purple Finch	o	o	o	+	o	+
Spotted Towhee	o	o	o	o	o	o
White-breasted Nuthatch	-	-	o	+++	++++	+++
Western Bluebird	o	o	o	o	o	o
Western Scrub-jay	+	+	+++	o	+++	+++
Western Tanager	+	-	--	o	o	----
Western Wood-pewee	o	--	--	++++	++++	+

<sup>1</sup>Projected *potential* bird species short-term population response is based on changes in mean regional density estimates. *Potential* is dependent on many factors beyond the actual habitat management or restoration, thus is not the *expected* response. Further, local or ecoregional variability in species density estimates may result in different projections of change than the region-wide projections presented below. Thus, use of this table should provide an initial projection of bird population response based on regional data that should be further assessed with local data.

<sup>2</sup>The degree of population response as indicated by the number of positive (+) or negative (-) signs is used to distinguish between species with low, moderate, or high densities where similar percent changes in density can result in different degrees of population response. For example, an increase of 100% or doubling of the population from a density of 1.0 birds/ha to 2.0 birds/ha results in one new bird, whereas a 100% increase or doubling of the population from a density of 3.0 birds/ha to 6.0 birds/ha results in three new birds; hence, a greater increase in the local population. Thus, based on the criteria below, more signs indicate the potential for greater change in the actual population.

+ or - = <100% change in density and <.10 change in actual density

++ or -- = <100% change in density and >.10 change in actual density

+++ or --- = >100% change in density and <.10 change in actual density

++++ or ---- = >100% change in density and >.10 change in actual density

o = same density or <25% change in density or ≤.02 change in actual density

OS = 1-25% canopy cover; OWO = 25-50% canopy cover; OWC = 50-75% canopy cover; OF = 75-100% canopy cover; ODF = Oak/Fir



Lazuli Bunting

Greg Homel, Natural Elements Productions



**Table 6.** Projected potential bird species short-term population response to sub-canopy and understory management in oak habitats<sup>1</sup>

Species	Sub-canopy Tree Thinning <sup>2</sup>	Shrub Cover Reduction <sup>2</sup>			Herbaceous Height Control <sup>2</sup>
		Closed to Semi-Open	Closed to Open	Semi-Open to Open	
Acorn Woodpecker	+	o	o	o	o
Ash-throated Flycatcher	+	o	o	o	o
Bewick's Wren	o	-	-	-	o
Black-capped Chickadee	-	o	-	-	o
Black-headed Grosbeak	-	o	o	o	o
Black-throated Gray Warbler	-	o	o	o	o
Blue-gray Gnatcatcher	o	o	-	-	o
Bushtit	-	o	-	-	o
California Towhee	o	o	-	-	+
Cassin's Vireo	-	o	o	o	o
Chipping Sparrow	o	+	+	+	+
Downy Woodpecker	-	o	o	o	o
House Wren	o	o	-	-	o
Hutton's Vireo	-	o	-	-	o
Lazuli Bunting	o	o	-	-	-
Lesser Goldfinch	o	o	o	+	-
Nashville Warbler	-	-	-	-	o
Oak Titmouse	o	o	-	-	o
Purple Finch	-	o	o	o	o
Spotted Towhee	o	o	o	-	-
White-breasted Nuthatch	+	o	o	o	o
Western Bluebird	o	+	+	+	+
Western Scrub-jay	+	o	+	+	+
Western Tanager	+	o	o	o	o
Western Wood-pewee	+	o	o	o	o

<sup>1</sup> Projected *potential* bird species short-term population response is based on subjective assessments of species habitat relationships and knowledge of the effects on vegetation from the activities. *Potential* is dependent on many factors beyond the actual habitat management or restoration, thus is not the *expected* response. Thus, use of this table should provide an initial projection of bird population response that needs to be further assessed with local data.

<sup>2</sup> Projected potential population response is positive (+), negative (-), or neutral (o). An attempt was made to provide a singular response to each action based on the most likely scenario using the following parameters: Sub-canopy tree thinning from > 20% cover to <20% cover; Shrub cover reduction amounts, Closed = >60%; Semi-open = 20-60%; Open = <20%; and herbaceous height control, maintaining herbaceous layer <0.5 meters high from normal growth exceeding that. However, species potential response is invariably more complex than a simple positive, negative or neutral and dependent on a variety of factors. Neutral (o) was the default response when there was not a relatively clear relationship and much uncertainty existed.

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# Appendix A. Oak Bird Species Accounts

## Key to the Oak Bird Species Accounts

### Population Status and Trends:

BBS = Breeding Bird Survey [www.mbr-pwrc.usgs.gov/bbs/trend/tf10.html](http://www.mbr-pwrc.usgs.gov/bbs/trend/tf10.html)

NPR = Northern Pacific Rainforest is a Bird Conservation Region (BCR) that includes northwestern California (CA), western Oregon (OR), western Washington (WA), western British Columbia, and southeastern and southcoastal Alaska. Oak habitat only occurs north to southwestern British Columbia, but some of the non-obligate oak bird species have data from BBS routes north of southwestern British Columbia. Although California is not part of the geographic scope of this document, population trend information from California is included to assess its potential effect on the entire BCR population trend.

All statistically significant trends<sup>36</sup> are in **bold**. For species that are not obligate to oak habitats (most oak-associated species), trends represent their status in all habitats in which they occur.

### Nest Location and Timing:

The locations and dates are those most typical for each species. There will be exceptions, and nesting dates can vary some with latitude – nesting and finishing earlier in the Klamath Mountains, and later in the north Puget Lowlands and Georgia Depression.

### Breeding Range in Oak Habitats:

The basic geographic scope of each species breeding range. However, nesting at a particular site or area within the range is based on local and/or landscape factors.

### Comments:

Noteworthy observations relative to a species ecology or conservation that might be useful to a land manager.

### Ecoregional/Sub-Regional Oak Habitat Density Estimates:

Ecoregional/sub-regional density estimates are based on data as described in Appendix B. There was no data available for the Klamath Basin sub-region.

### Oak Habitat Type Regional Density Estimates:

Oak habitat type density estimates are regional mean estimates based on a subset of data from Appendix B that included an assessment of habitat type at point count stations. This includes the following fixed-radius

and variable-radius data sets from the Willamette Valley, Umpqua Valley, and Rogue Basin:

- 192 point counts at 8 point count stations during three years at Owens Farm in the central Willamette Valley (B. Altman unpublished data)
- 56 point counts at 22 point count stations at nine sites during one year in the central and southern Willamette Valley (B. Altman unpublished data)
- 251 point counts at 15 point count stations during three years at Coburg Hills in the southern Willamette Valley (B. Altman unpublished data)
- 33 point counts at 13 point count stations during one year at three sites in the central Willamette Valley (B. Altman unpublished data)
- 298 point counts at 101 point count stations during one year at 11 sites throughout the northern Umpqua Valley (Klamath Bird Observatory unpublished data)
- 332 point counts at 332 point count stations during one year throughout the Rogue Basin (Klamath Bird Observatory unpublished data)
- 109 point counts at 109 point count stations (oak-conifer) during one year throughout the Rogue Basin (Klamath Bird Observatory unpublished data)
- 74 point counts at 74 point count stations (oak-hardwood) during one year throughout the Rogue Basin (Klamath Bird Observatory unpublished data)

### Oak Habitat Conditions/Relationships:

This summary only included results from studies in oak or mixed oak types during the breeding season that reported significant correlations between species abundance and different habitat variables. We include some results from northern California studies because of the likely similarities, especially in the Klamath Mountains ecoregion, and to supplement limited data from Oregon, Washington, and British Columbia.

dbh = diameter at breast height

### Optimal Oak Habitat:

The habitat conditions (e.g., tree size, canopy cover, shrub cover) most suitable for the species in oak habitats. Species may occur outside these conditions in lesser quality oak habitat.