Conservation Assessment
for

Gray Flycatcher
(*Empidonax wrightii*)

for
USDA Forest Service Region 6 and
USDI Bureau of Land Management, Oregon and Washington
Interagency Special Status and Sensitive Species Program

by
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Disclaimer
This Conservation Assessment was prepared to summarize published and unpublished information on the Gray Flycatcher (*Empidonax wrightii*). The Conservation Assessment does not represent a management decision by the U.S. Forest Service (USFS) Region 6 or the Oregon-Washington Bureau of Land Management (OR-WA BLM). Although the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the Gray Flycatcher, please contact the authors or the Interagency Special Status/Sensitive Species Conservation Planning Coordinator in the Portland, Oregon USFS Region 6 and OR-WA BLM offices.

Executive Summary

Species and Taxonomic Group
Gray Flycatcher (*Empidonax wrightii*): Birds.

Management Status
Gray Flycatcher is currently considered a Sensitive Species (Washington only) by the U.S. Forest Service (USFS) and Bureau of Land Management (BLM) Interagency Special Status Sensitive Species (ISSSS) Program. The global ranking from Nature Serve is G5. The Washington Natural Heritage Program gives it a state ranking of S2S3B (breeding only). Gray Flycatcher is not recognized as an at-risk or vulnerable species anywhere within its range outside of Washington, or by any federal, state, or non-governmental entity in Washington except the USFS and BLM and the Washington Natural Heritage Program ranking, which is the primary source of the USFS/BLM status. It is considered a State monitor species by the Washington Department of Fish and Wildlife, which focuses attention on monitoring status and distribution in order to prevent the species from becoming endangered, threatened, or sensitive.

Range & Habitat
Gray Flycatcher breeding range is the arid and semi-arid regions of western North America, especially the Great Basin ecoregion, from the southern Okanagan Valley in south-central British Columbia through central Washington, central and eastern Oregon, and eastern and southern California; east to southern Idaho, southwestern Wyoming, and central Colorado; and south through all of Nevada and Utah into northern and western Arizona and western New Mexico.

Gray Flycatcher breeding habitat associations are shrub-steppe and open woodlands of the arid intermountains of western North America between the crests of the Rocky Mountains and Cascade/Sierra Nevada Mountains. Within these associations, highest quality breeding habitat appears to be mature big sagebrush where the sagebrush is luxuriant and reaches small tree size, and semi-open to open woodlands of ponderosa pine, juniper, or pinyon-juniper with a relatively open understory. Additionally, high quality breeding habitat occurs at the ecotones of these open woodland types (pine or juniper) with sagebrush.

Threats

Habitat loss and habitat alteration that reduces the amount or suitability of Gray Flycatcher habitat is likely the greatest threat to populations throughout their range. This is especially true for its primary breeding habitat associations: tall, mature sagebrush; mature juniper and pinyon-juniper forests; and open ponderosa pine forests (especially in Oregon, Washington, and British Columbia). Habitat loss and alteration may come from a variety of sources including land clearing for development or agriculture/livestock grazing; land management/resource extraction for timber harvest or mining, road building, fuels reduction, fuelwood cutting, habitat restoration (e.g., invasive juniper removal), and overgrazing by ungulates, which reduces ground cover and inhibits regeneration of shrubs with negative affects on insect prey populations. Additionally, any habitat conversion to agriculture that enhances the suitability of a habitat for Brown-headed Cowbirds could impact local nesting populations of Gray Flycatcher because of their vulnerability to parasitism. All of these threats except land clearing for development or agriculture are applicable on USFS/BLM lands.

Management Considerations

In Washington, much of the suitable habitat is on federal lands of the USFS (particularly ponderosa pine) and BLM (particularly sagebrush). Thus, populations of Gray Flycatcher have the potential to be greatly impacted (both positively and negatively) by the land management activities of these agencies.

When managing to maintain or improve habitat and populations, we suggest the following management considerations:

• Retain juniper trees with old-growth characteristics.
• Where juniper management is occurring in historic juniper habitat or in areas where complete juniper removal is not the objective and some old-growth juniper is present:
    1) maintain stand-level stem densities of 5-15 juniper trees/hectare (2-6 trees/acre) with canopy cover in the 10-40% range and no areas with <5% cover or >70% cover,
    2) maintain stand-level shrub cover (i.e., shrubs and small trees that function as shrubs) <20%, and
    3) maintain stand-level herbaceous cover >50% with some areas of bare ground.
• In thinning and/or fuels reduction projects in mid to late successional ponderosa pine forests:
    1) maintain stand-level canopy cover in the 25-60% range with no areas <10% or >70%,
    2) maintain stand-level shrub cover (i.e., shrubs and small trees that function as shrubs) < 20%, and
    3) maintain stand-level herbaceous ground cover > 50% with some areas of bare ground.
• In early to mid-successional ponderosa pine forests (i.e., trees 15-25 centimeters dbh [6-10 inches dbh]) maintain small openings (i.e., 10-15 meters in diameter [33-49 feet in diameter) throughout the area.
• Protect tall sagebrush habitat (i.e., >1.5 meters tall [5 feet tall]).
• Within tall sagebrush habitat (i.e., >1.5 meters [5 feet]) maintain sagebrush cover >20% for optimal habitat but not <10%.
• In all habitats, maintain large and contiguous blocks of interior habitat to minimize habitat suitable for nest parasites such as Brown-headed Cowbirds.

• In all habitats, reduce or eliminate insecticide and herbicide use in suitable habitats and adopt Integrated Pest Management practices including limiting use to periods outside the breeding season.
• In all habitats, manage livestock grazing pressure to maintain shrub component and grass cover as described above for Gray Flycatcher breeding habitat.

Research, Inventory, and Monitoring Opportunities

There is a great need for research on nearly all aspects of the life history of Gray Flycatchers on both their breeding and wintering grounds (Sterling 1999). The needs are so all-encompassing that it is difficult to prioritize them for the species across its range. However, we suggest the following practical priorities based on 1) the need to determine if the species really should be a priority species, and 2) the need to assess its response to regularly occurring habitat management in the primary habitats it occupies:

• Conduct inventories in appropriate suitable habitats to delineate breeding distribution and determine population status.
• Quantify breeding habitat conditions and the relationship of those conditions to Gray Flycatcher abundance and demographic factors (e.g., productivity, population recruitment).
• Conduct effectiveness monitoring of fuelwood harvest, grazing, and fire on habitat suitability and Gray Flycatcher populations.
• Conduct effectiveness monitoring of sagebrush management for Greater Sage-grouse on Gray Flycatcher populations.
• Investigate Brown-headed Cowbird parasitism rates and their effect on productivity and population viability.

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I. Introduction

A. Goal

The goal of this Conservation Assessment is to summarize existing information regarding the biology and ecology of Gray Flycatcher (*Empidonax wrightii*), and identify threats to the species and management considerations to provide information to line managers to assist in the formulation of options for management activities. This species is of concern because of a small breeding population in Washington along with highly disjunct populations in both Oregon and Washington. They also occupy habitats that are heavily managed/altered for both economics (e.g., timber harvest in ponderosa pine forests, conversion of sagebrush to agriculture) and restoration or conservation.

B. Scope

The geographic scope of this assessment is the historic, known, and suspected range of Gray Flycatcher in Oregon and Washington with an emphasis on lands managed by the U.S. Forest Service, Region 6 (USFS) and the Oregon-Washington Bureau of Land Management (BLM), especially in Washington, where the species has status with the two Agencies. However, information is included from throughout the species range in western North America to enhance the limited information on the species in Oregon and Washington.

There is a paucity of biological information on Gray Flycatcher in the literature relative to most other passerine birds including all the other flycatchers of the genus *Empidonax*. There have been no species-specific studies on Gray Flycatcher throughout its range in the last 40 years. Thus, this assessment summarizes a limited amount of existing knowledge primarily from avian community studies. Because one of the goals of the assessment is to provide guidance to land managers, interpretation of this limited information is necessary to form recommendations to assist in land management decisions. There will be varying degrees of uncertainty in the synthesis of our knowledge for most aspects of this species ecology, threats, and management – and uncertainty and inference will be acknowledged where appropriate. Most importantly, information updates will be essential to keep this assessment current, and to further our ability to accurately consider this species in the context of land management activities.

C. Management Status

Gray Flycatcher is currently considered a Sensitive Species (Washington only) by the USFS and BLM Interagency Special Status Sensitive Species (ISSSS) Program (www.fs.fed.us/r6/sfpnw/issssp/agency-policy). Thus, federal management follows USFS Region 6 Sensitive Species (SS) and Oregon-Washington BLM Special Status Species (SSS) policies. For BLM administered lands, SSS policy details the need to manage for species conservation. For USFS administered lands, SS policy requires the agency to maintain viable populations of all native and desired non-native wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands. Management "must not result in a loss of species viability or create significant trends toward federal listing" (FSM 2670.32) for any identified SS.

Gray Flycatcher is not considered a Bird of Conservation Concern by the U.S. Fish and Wildlife Service (USFWS) in any Bird Conservation Region throughout its range, either currently (USFWS 2008) or previously (USFWS 2002). It is not on the Audubon/American Bird

Conservancy United States Watch List 2007 (www.abcbirds.org/abcprograms/science/watchlist/) for species considered in the greatest need of immediate conservation attention. It is not recognized as a "Strategy" species or Species of Greatest Conservation Need in either the Oregon (Oregon Department of Fish and Wildlife 2005) or Washington (Washington Department of Fish and Wildlife 2005) Comprehensive Wildlife Conservation Strategies. It is not considered a State Sensitive species by the Oregon Department of Fish and Wildlife (www.dfw.state.or.us/wildlife /diversity/species/docs/SSL_by_taxon.pdf). It is not on the current Washington Priority Habitats and Species List (Washington Department of Fish and Wildlife 2008). The Washington Department of Fish and Wildlife recognizes it a State Monitor species (www.wdfw.wa.gov/wlm/diversity/soc/state_monitor.htm). State monitor species are not considered species of concern, but are monitored for status and distribution in order to prevent the species from being listed as endangered, threatened, or sensitive.

The global ranking from Nature Serve is G5, which means it is secure globally (www.natureserve.org/explorer/servlet/NatureServe?init=Species). The Washington Natural Heritage Program includes the species on their rare animal list and gives it a state ranking of S2S3B, which indicates it is between the two categories of *imperiled, vulnerable to extirpation* and *rare to uncommon* (www.dnr.wa.gov/nhp/refdesk/lists/animal_ranks.htm#key) in relation to its breeding status in the State. The Oregon Biodiversity Information Center does not consider it a rare, threatened, or endangered taxon (Oregon Biodiversity Information Center 2010).

In the Partners in Flight (PIF) Continental Plan (Rich et al. 2004), Gray Flycatcher is considered a Stewardship Species for the Intermountain West Avifaunal Biome with the action category of Long-term Planning and Responsibility because greater than 75% of the species population occurs in the biome (i.e., 96%). In the Oregon-Washington PIF Bird Conservation Plan for the Columbia Plateau ecoregion (Altman and Holmes 2000), Gray Flycatcher is considered a "focal species" for mature juniper woodland. It is noteworthy that these PIF designations refer to the species *representativeness* of an area (PIF Continental Plan) or a habitat type (Oregon-Washington PIF), and not its vulnerability or at-risk status, the categories most often associated with priority species or species of concern.

In British Columbia it is on the Blue List (Harper et al. 1994), but is considered Not At Risk in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (www.cosewic.gc.ca/eng/sct0/rpt/dsp_booklet_e_htm#table8), despite a known population of only approximately 50 pairs. They recognize that despite a small population there is little concern for the species overall status because it is apparently expanding its range in western North America and they are at the northern extent of that range.

In summary, Gray Flycatcher is not recognized as an at-risk or vulnerable species anywhere within its range outside of Washington, or by any federal, state, or non-governmental entity in Washington except the USFS and BLM and the Washington Natural Heritage Program ranking, which is the primary source of the USFS/BLM status. Additionally, its global ranking by Nature Serve is G5, which indicates relatively secure status.

Management Plans/Conservation Agreements
There are no management plans or conservation agreements specific to Gray Flycatcher in Washington or elsewhere in its range. The only species-specific policy or regulatory guidance is that specific to its designation as a Sensitive species by the USFS and BLM in Washington (it does warrant non species-specific inclusion under things like the Migratory Bird Treaty Act etc.). There is a Gray Flycatcher status assessment for British Columbia, which provides limited management recommendations, but it does not constitute a management plan or conservation agreement (Cannings 1995). Management recommendations for Gray Flycatcher as a focal species representing late-successional juniper woodland in Oregon and Washington have been presented in the PIF Bird Conservation Plan for the Columbia Plateau ecoregion (Altman and Holmes 2000).

II. Classification and Description

A. Systematic and Synonymy

Family: Tyrannidae
Genus: *Empidonax*
Species: *wrightii*

There are seven similar looking flycatchers of the Genus *Empidonax* in Oregon and Washington, and their identification and taxonomy has been problematic for ornithologists for more than a century. The similarity of Gray Flycatcher with Dusky Flycatcher has lead to taxonomic confusion and subsequent name changes for both species. For 50 years after it was described in 1889 by William Brewster, Gray Flycatcher was known as *E. griseus*, and the bird we now call Dusky Flycatcher was known as *E. wrightii*, or Wright's Flycatcher (having been named by Baird in 1858). When Phillips (1939) examined the type specimen of *E. wrightii*, he determined that it was not a Wright's Flycatcher, but a Gray Flycatcher. In accordance with the rules of zoological nomenclature, the specimen became the type for Gray Flycatcher, enabling Phillips (1939) to give Wright's Flycatcher its current scientific name, *E. oberholseri*. Nearly 20 years later, the English name for *E. oberholseri* was changed to Dusky Flycatcher (AOU 1957). An extensive summary of the nomenclatural history of Gray Flycatcher and Dusky Flycatcher is presented in Johnson (1963).

Because of past taxonomic confusion and the reported relatively recent range expansion of the species into Washington and British Columbia (Larrison 1971, Yaich and Larrison 1973, Lavers 1975, Cannings 1987, Smith et al. 1997, and Sterling 1999), an effort was undertaken as part of this project, in cooperation with the Ornithology Division of the University of Washington Burke Museum, to locate and examine museum specimens from Washington and British Columbia prior to 1970. The purpose was to determine if collectors had taken Gray Flycatchers here before the reported "expansion" that had either been misidentified or overlooked in the taxonomic confusion; thus altering our current understanding of the history and status of Gray Flycatcher in the Pacific Northwest. Specimens were searched using the Ornithological Information System (ORNIS) online web portal that accesses several million bird specimens at 42 institutions with avian collections (http://www.ornisnet.org). *Empidonax wrightii* and *Empidonax griseus* were the names employed in searches. All specimens from Washington and British Columbia were requested and were examined, measured, and photographed by the

collections manager at the Burke Museum. An historic Gray Flycatcher specimen was located from Yakama County. Details are discussed in the Range, Distribution and Abundance section.

B. Species Description

Gray Flycatcher is a relatively small bird (length 14-16 centimeters [5-6 inches]), but larger than most other *Empidonax* flycatchers. Its general appearance relative to other *Empidonax* flycatchers is a slim grayish bird (whitish on the underside) with a small head and long and narrow bill and slightly notched tail with whitish outer edges to the tail feathers when unworn (Sterling 1999). Both sexes are similar in plumage. Gray Flycatcher is most similar in size, shape and coloration to Dusky Flycatcher, which is darker on the back and more olive-greenish in color.

In the field, Gray Flycatcher is best distinguished in appearance from other *Empidonax* flycatchers by its unique tail-wagging behavior – a gentle downward movement of the tail from the normal position followed by raising it back to that original position. This is noticeably unlike the rapid flicking of the tail up and down performed by other *Empidonax* flycatchers. Recognition of this behavior as a reliable characteristic for field identification of Gray Flycatcher among other *Empidonax* flycatchers was first proposed by Phillips (1944). However, its promotion and use along with other characteristics has been relatively recent (Whitney and Kaufman 1987), and has helped foster some understanding of the species life history (Sterling 1999).

III. Biology and Ecology

There is limited information on Gray Flycatcher biology and ecology, apparently due to difficulties in identification, early nomenclatural confusion, its relatively recent (early 1900s) recognition as breeding in the United States, and its occurrence in the least populated areas of the country (Sterling 1999). In fact, if not for the mid 1900s research of Russell and Woodbury (1941) on one nesting pair in Utah, and the extensive studies of Johnson (1963) in western Nevada and eastern California, our knowledge of Gray Flycatcher biology and ecology would be almost non-existent. These studies and recent information from avian community studies provide some understanding of their life history as presented below. However, our limited knowledge of Gray Flycatcher life history emphasizes the need for caution in the applicability of that information across the species range.

A. Life History

Detectability

Gray Flycatchers are most readily detectable during the breeding season when vocalizing their emphatic two syllable song as part of mate attraction/communication or territorial defense. Their detectability when not singing is greatly reduced due to small size, non-descript plumage, and similarities in appearance to other *Empidonax* flycatchers. It is possible that these challenges of detectability and identification have been a factor in the confusing taxonomic history (see above) and our understanding of the species breeding range (see below). For example, following the 1973 reports of Gray Flycatchers in Washington, Lavers (1975) notes that alerted birders began searching for the species in yellow pine (i.e., ponderosa pine) woodlands and found multiple locations "swarming" with them. He went on to acknowledge that "the south-central Washington locations where the various sightings of Gray Flycatchers

have been made are only a small fraction of an extensive area little explored by birders…there may be a number of these small 'colonies' undetected in Washington".

Pair Formation and Territories
Males arrive on the breeding areas about a week earlier than females (Johnson 1963). Mate attraction and pair formation occurs upon females arrival on the breeding grounds in early May in the southern portions of their range (Sterling 1999), but in mid-May in Oregon (Gilligan et al. 1994) and Washington (Wahl et al. 2005).

Gray Flycatcher appears to be monogamous because females defend a "core area" territory around the nest and males chase intruding females from the territory (Johnson 1963). Additionally, no observations of extra pair copulation have been reported, but no genetic studies of parentage of young have been conducted (Sterling 1999). Johnson (1963) reports interspecific territoriality of Gray Flycatcher with Dusky Flycatcher where the two species coexist.

Nests
Gray Flycatchers construct an open-cup nest in a tree or shrub, usually within a few meters of the ground, but up to 20 meters (66 feet). In lodgepole pine forests of central Oregon, nests (n=5) were placed wedged in the crotch of a branch attached to the trunk and within 1.6-2 meters (5-7 feet) from the ground (B. Altman, unpubl. data). In ponderosa pine forests in Yakima County of south-central Washington, two nests were located 1.5 and 6 meters (5 and 20 feet) off the ground in the crotch of a branch next to the trunk, and suspended in a clump of branches out away from the trunk, respectively (J. Kozma pers. comm.). In ponderosa pine forests of British Columbia, 10 nests were in ponderosa pine and one nest in Douglas-fir, and all were 1.5-9 meters (5-30 feet) off the ground (Campbell et al. 1997). Nests in Jeffrey pine and juniper in the Sierra Nevada mountains of western Nevada and eastern California ranged from 2-19 meters (7-62 feet) with a mean of 7.3 meters (24 feet) (Johnson 1963). They are not known to build alternate nests.

Nesting Phenology
Most nest building and egg-laying in Oregon and Washington occurs in early to mid June. The earliest date for nests with eggs in Oregon is June 1 (Gabrielson and Jewett 1940). First egg dates of four nests in lodgepole forest of central Oregon were June 16, 19, 20, and 20 (B. Altman unpubl. data). In British Columbia, the earliest date for a nest with eggs is June 5 (Campbell et al. 1997), which was calculated to have been initiated on May 28. In Washington at Wenas Park in Yakima County, dates for three nests were from May 23-30 (Yaich and Larrison 1973). A more typical date for nests with eggs in Washington was June 9 (Downes 2006). Mean laying date across their range is 178 days (11.3 SD) (i.e., late June) based on 56 nest records from museum nest egg sets (Murphy 1989). Late dates for nests with eggs in Oregon are July 25 (Gabrielson and Jewett 1940), and July 29 in British Columbia (Campbell et al. 1997).

All reported clutches are of 3-4 eggs (Sterling 1999), with a mean clutch size of 3.52 (0.54 SD) based on 56 nest records from museum egg sets (Murphy 1989). All four nests of know clutch size in lodgepole pine forests of central Oregon were four egg clutches (B. Altman unpubl. data). In British Columbia, three of four nests of known clutch size had four eggs and one had three eggs (Campbell et al. 1997).

The incubation period appears to be 14-15 days based on observations of one nest in Utah (14 days: Russell and Woodbury 1941), one nest in northeastern California (15 days: Johnson 1963), and two nests in central Oregon (14-15 days: B. Altman unpubl. data). The hatch date of one nest in central Oregon was July 6 (B. Altman unpubl. data). The nestling period appears to be 15-16 days based on observations of one nest in Utah (15 days: Russell and Woodbury 1941), and two nests in central Oregon (15-16 days: B. Altman unpubl. data).

Nest Success

There is limited information on nest success. Of nests followed to a known fate, nine of 16 nests failed in northeast California (L. George pers. comm. in Sterling 1999), two of four nests failed in lodgepole pine forests of central Oregon (B. Altman unpubl. data), and one of two nests failed in ponderosa pine forests of British Columbia (Campbell et al. 1997). Mayfield (1975) estimates of nest success for the four Oregon nests were 0.423.

Vital Rates

There is no data on the age at which individuals become reproductive, but presumably it is one year of age as in other *Empidonax* species. There have been no species-specific studies of marked birds, and there is insufficient data for analyses of productivity or survivorship in the MAPS program even at the range-wide scale (P. Nott pers. comm.). Lifespan is unknown because there has never been a recovery of the over 18,000 Gray Flycatchers that have been banded since 1960 (D. Bystrak, pers. comm.).

Site Fidelity

We are not aware of any studies of marked birds on the breeding grounds, thus, the degree of breeding site fidelity is unknown. However, some degree of site fidelity is expected based on anecdotal observations of singing males in the same locations each year (B. Altman pers. obs.), and the Monitoring Avian Productivity and Survivorship Program (MAPS) records of banded breeding adults returning to the same location in consecutive years (P. Nott pers. comm.).

Life Cycle Diagram

The annual cycle for Gray Flycatcher is typical of that of a nearctic-neotropical migratory bird (Figure 1). Note that in Figure 1, which is from the Birds of North America Gray Flycatcher account (Sterling 1999), the fall migration time period is not shown. It would occur almost exclusively in August and September in Oregon and Washington with some lingering into early October in the southwestern United States.

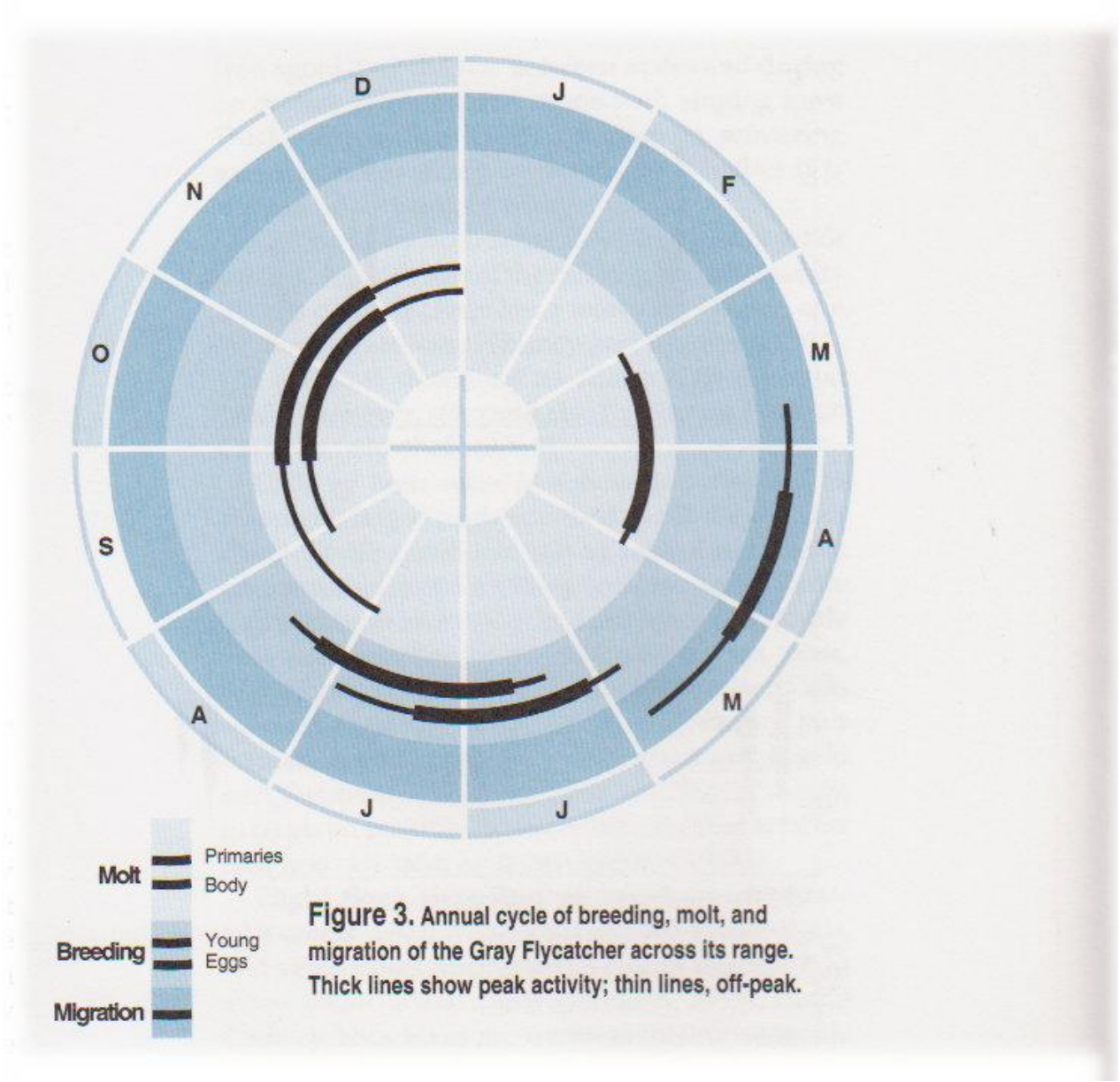

Figure 1. Gray Flycatcher annual cycle (from Sterling 1999).

B. Activity Pattern and Movements

Migration

Gray Flycatchers are a short to medium distance migrant with no overlap in breeding and wintering range and relatively small to moderate breeding and wintering distributions (Figure 2, Sterling 1999). Fall and spring migratory periods each last about 7 weeks. They are believed to be solitary during migration and do not appear to join mixed species flocks (Sterling 1999). There has never been a recovery of the over 18,000 Gray Flycatchers that have been banded since 1960 (D. Bystrak pers. comm.), so routes of migration or connectivity between populations on breeding and wintering grounds is unknown.

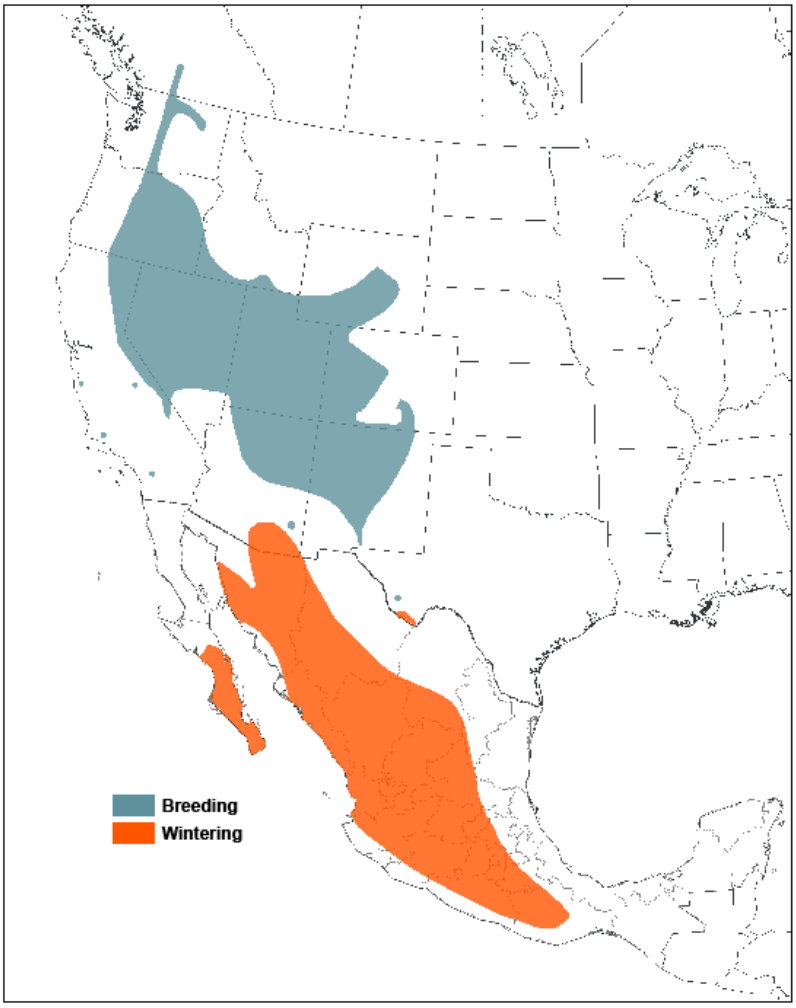

Figure 2. Breeding and wintering ranges of Gray Flycatcher (from Sterling 1999).

In British Columbia, a few birds may arrive in late April (earliest date April 29), but most birds begin arriving in early May with the peak movement from mid to late May (Campbell et al. 1997). Fall migration occurs in August and is complete by early September (late date Sept 2). In Washington, migratory passages occur from late April to late May and from early August to mid September (Wahl et al. 2005). In Oregon, spring migration begins in early to mid-April and is complete by the end of May (Gilligan et al. 1994). Fall migration extends from mid August to late September (Littlefield 1990).

Breeding Season

Gray Flycatchers are territorial during the breeding season with the male establishing and defending the territory through singing from song-posts (Sterling 1999). The female defends smaller areas around the nest (Johnson 1963). There are no direct measurements of territory size although subjective estimates include 1-4 hectares (3-10 acres) in eastern California and western Nevada (Johnson 1963), 1.6-2.0 hectares (3-5 acres) in Nevada (Neel 1999), and up to 5-10 hectares (13-25 acres) in eastern Washington (Downes 2006). Territory size based on density estimates from Breeding Bird Censuses in a New Mexico pinyon-juniper-ponderosa pine ecotone was reported to be from 3.3-5.3 hectares (8-13 acres) (McCallum et al. 1978).

Post-breeding Dispersal
The only information on post-breeding dispersal is from one nest in Utah where fledglings and adults generally stayed on the territory with fledglings dependent on the parents for two weeks after fledging (Russell and Woodbury 1941).

Winter
There is no information on intra-seasonal movements on the wintering grounds. However, winter territoriality is suspected but not confirmed in Arizona based on bird's response to playback of their own call notes, and individual birds in the same location all winter (K. Kaufman pers. comm. in Sterling 1999).

C. Food Habits
There have been no studies on the diet of Gray Flycatchers (Sterling 1999). Anecdotal observations on the breeding grounds indicate the species is exclusively an insectivore that feeds primarily on beetles, grasshoppers, moths, and other small flying insects.

Gray Flycatchers "flycatch" in the conventional manner of a sit-and-wait predator by sallying out from perches on tops of shrubs and trees to catch flying insects. Based on a synthesis of two studies (Eckhardt 1979 and Frakes 1978), Murphy (1989) reports that Gray Flycatchers forage exclusively by two methods and relatively equally - aerial hawking (48%) and hover and strike (52%) (n = 127). Johnson (1963) observed that Gray Flycatchers foraged more frequently by gleaning insects from the ground in his study area in western Nevada and eastern California than other *Empidonax* flycatchers nearby.

It is possible that Gray Flycatchers respond positively to the insect abundance that follows low to moderate intensity fire. Russell et al. (2009) noted that Gray Flycatcher populations responded positively to spring season prescribed fire in north-central Washington.

D. Range, Distribution, and Abundance
Current Range
Current breeding range is the arid and semi-arid regions of western North America, especially the Great Basin ecoregion, from the southern Okanagan Valley in south-central British Columbia through central Washington, central and eastern Oregon, and eastern and southern California; east to southern Idaho, southwestern Wyoming, and central Colorado; and south through all of Nevada and Utah into northern and western Arizona and western New Mexico (Sterling 1999) (Figure 2). They can occur from approximately 300 meters (980 feet) in elevation in British Columbia (Campbell et al. 1997) to 3,350 meters (11,000 feet) in elevation in California (Small 1994).

Gray Flycatchers migrate throughout their breeding range to wintering grounds from southeastern California (rarely, Garrett and Dunn 1981), extreme western Texas (American Ornithological Union, 1998), and south-central Arizona (Sterling 1999); south along the Pacific Slope and interior of Mexico to southern Baja California and Oaxaca (Howell and Webb 1995, Sterling 1999) (Figure 2). They occur from sea level to 2,500 meters (8,200 feet) in elevation within their wintering range (Howell and Webb 1995).

Historic Range

The published accounts of the range of the Gray Flycatcher reveal a frequently changing understanding of this birds' distribution from the initial description of specimens collected in Arizona, New Mexico, Nevada, and Oregon in the late 19th century (Brewster 1889, Oberholser 1920a, Oberholser 1920b), to nesting in southern Utah and northern Arizona in the 1930s (Russell and Woodbury 1941), to the 'expansion' into Washington (Yaich and Larrison 1973, Lavers 1975), and British Columbia (Cannings 1987). Figure 3 shows the range as understood by Johnson (1963) and also indicates where possible expansion occurred in all directions in the late 20th century (Johnson 1994). However, as noted by Sterling (1998) "…there is still much to be understood about this little gray bird", and the taxonomic confusion and identification challenges along with the remoteness of its occupied locations may have contributed to uncertainties in its historic and perhaps even current range. That is, new records may not necessarily always constitute range changes, but in fact new knowledge of what has historically been true.

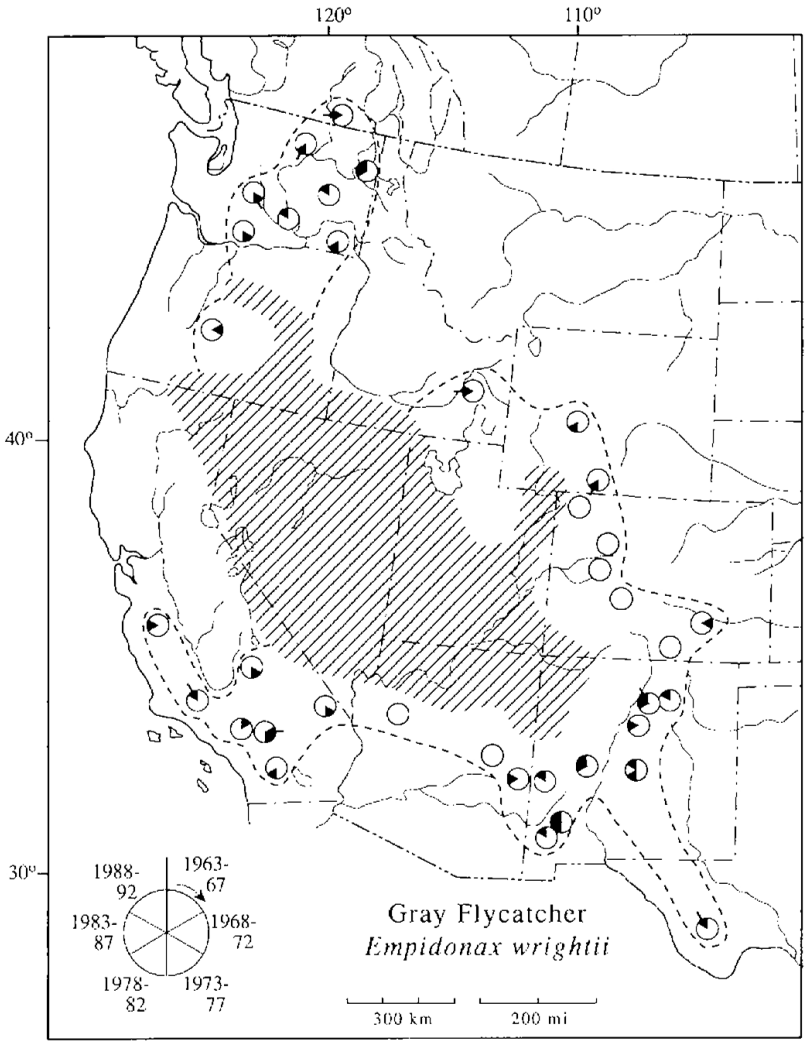

Figure 3. Approximate historic breeding range (diagonal lines) as documented by Johnson (1963) and locations of more recent nesting through 1993 (from Johnson 1994).

The earliest Gray Flycatcher specimens from Oregon were collected in 1896 at Elgin in Union County and Burns and Narrows in Harney County (Oberholser 1920), although the first published record of the species occurrence in the state was 1913 (Jewett 1913). Nearly all the early records through 1940 refer to its occurrence in sagebrush habitats in washes where soil and moisture conditions are suitable for growth of tall sagebrush (Gabrielson and Jewett 1940). However, Hoffman (1927) notes its breeding in open woods of ponderosa pine in Oregon.

Prior to 1970, Gray Flycatcher was not known to occur in Washington according to all sources (Larrison 1971, Yaich and Larrison 1973, Lavers 1975, Cannings 1987, Smith et al. 1997, and Sterling 1999). However, a specimen obtained for this project from the American Museum of Natural History and examined by the Bird Collections Manager at the University of Washington Burke Museum was documented to be a Gray Flycatcher that was collected near Yakima, Washington on April 20, 1913 by Dr. L.C. Sanford (Figure 4). Other historic specimens may exist. A more thorough specimen search, employing recent developments in availability of collections, may contribute to a clearer understanding of the historic distribution of this bird.

Figure 4. Gray Flycatcher specimen from American Museum of Natural History collected near Yakima, Washington in 1913, which predates existing understanding of species discovery in the state (1970).

Previous to this record, Gray Flycatcher was first recorded in Washington on May 31, 1970 in open ponderosa pine forests near Wenas Creek in Yakima County (Larrison 1971). The first nest for Washington was recorded at same location in 1971 (Yaich and Larrison 1973). More observations were reported in the following year including locations in Klickitat County (Lavers 1975), and a bird believed to be a Gray Flycatcher was recorded at the Columbia National Wildlife Refuge near Othello in Adams County (Rogers 1972).

Gray Flycatchers have since been found to be a fairly common breeder in the ponderosa pine foothills of the Cascade Mountains extending north and east to the Spokane area in Spokane, Lincoln, and Stevens counties (Smith et al. 1997). In 1992, the first recorded nesting in the central Columbia Basin at the Hanford (Department of Energy) site (Tweit and Johnson 1992) extended its breeding range into the shrub-steppe of Washington.

More recent nesting has been reported in the Kittitas County Breeding Bird Atlas near Cle Elum (Opperman et al. 2006), in ponderosa pine forests west of Yakima in Yakima County (J. Kozma pers. comm.), in shrub-steppe habitats 27 kilometers (17 miles) east of Ellensburg (Downes 2006), and in the U.S. Forest Service, Birds and Burns network investigations in the Methow Valley (K. Woodruff, unpublished data) .

Gray Flycatchers were first reported in British Columbia on June 19, 1984, 10 km east of Oliver in ponderosa pine forests in the southern Okanagan valley in south-central British Columbia (Cannings 1987). The site was not revisited until May 18, 1986 when a single male was seen and heard singing. On the same day another individual was heard about 7 kilometers (4 miles) to the southwest. Within the next month further searches of suitable habitat within 30 kilometers (19 miles) of the original sighting revealed up to 20 birds at several sites. Extensive searches in 1990 located 51 birds at 8 sites with at least 47 territorial males (Cannings 1995).

Regional Distribution

The regional distribution and abundance for Gray Flycatcher is very different in Oregon and Washington. In Oregon, it occurs throughout the Great Basin and East Slope Cascades ecoregion of eastern Oregon, and to a lesser degree in the Columbia Plateau, High Lava Plains, and Blue Mountains ecoregions up to 1,800 meters (6,000 feet) (Figure 5, Miller 2003).

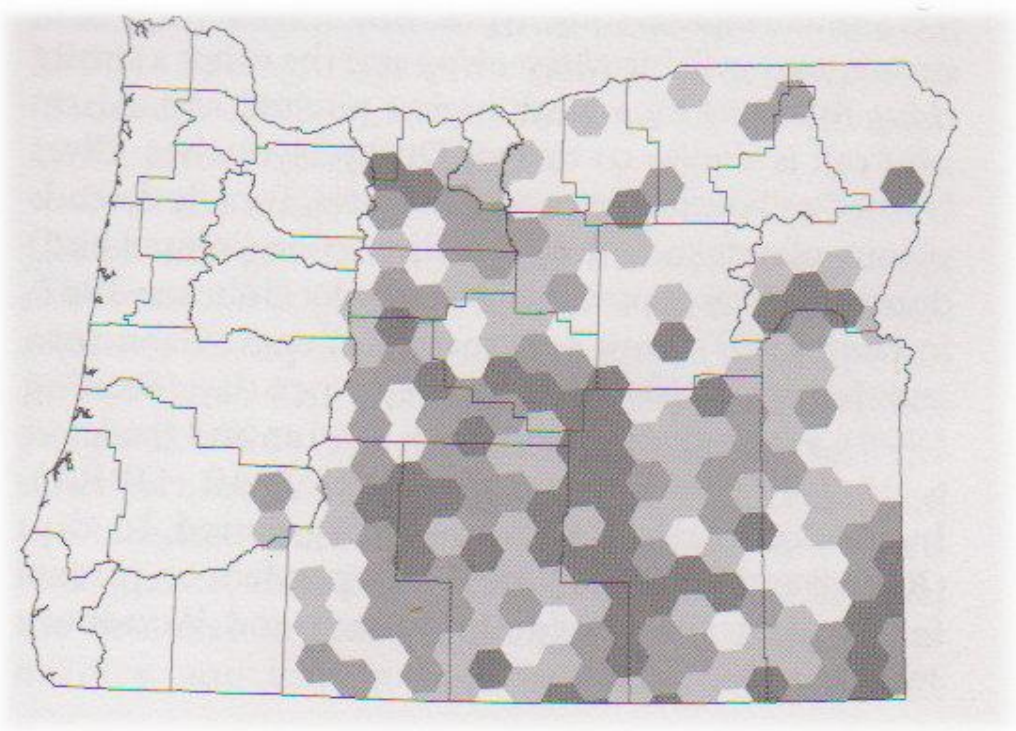

Figure 5. Oregon Breeding Bird Atlas Gray Flycatcher records (from Marshall et al. 2003). Darkest hexagons indicate *confirmed* breeding somewhere in that hexagon. Next darkest indicate *probable* breeding and lightest hexagons indicate *possible* breeding. Probable and possible breeding are standard breeding bird atlas terms based on degrees of potential breeding behaviors (e.g., singing male on multiple visits versus singing male on one visit only).

In Washington, at the northwestern edge of its range, it is known to breed locally primarily within the east-slope Cascades ecoregion from Klickitat County north to Okanogan County and then east along the Columbia and Spokane River drainages into Spokane County (Smith et al. 1997). A composite of detections from different sources shows the similarity in the shape of the documented Washington range with the Nature Serve range map, although the Nature Serve map is skewed too far west and includes habitat and elevations not suitable for Gray Flycatcher (Figure 6).

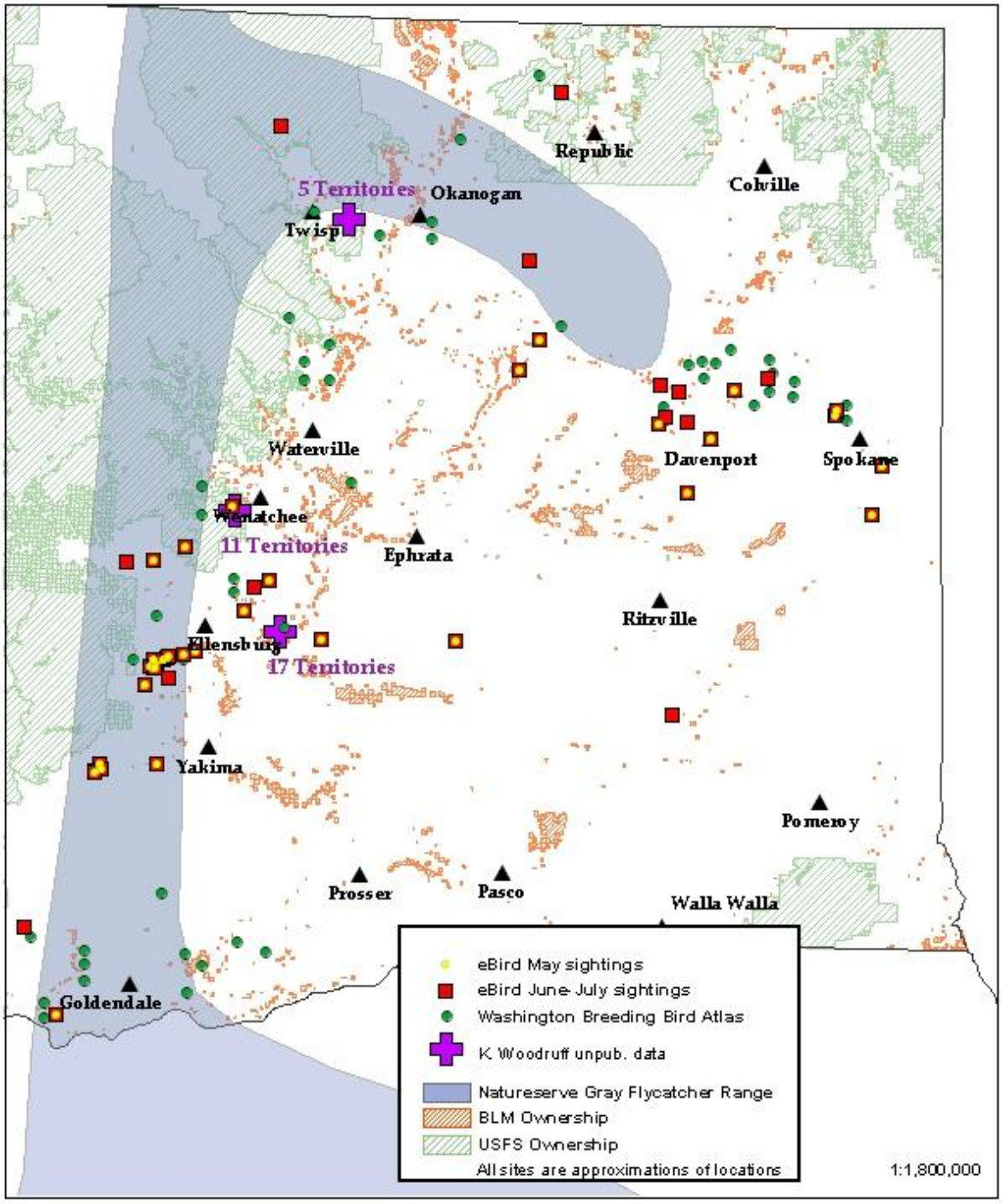

Figure 6. Noteworthy Gray Flycatcher detections in Washington from multiple sources.

Gray Flycatcher is currently known to occur as a breeding species in Washington on the BLM Spokane District, both Border and Wenatchee Resource Areas; and on the Okanogan/Wenatchee National Forest, but not the Gifford Pinchot, Umatilla, or Colville National Forests or the Columbia River Gorge National Scenic Area. In British Columbia, the known distribution is in the southern Okanagan Valley between Oliver and Summerland at elevations between 300-600 meters (980-1,970 feet) (Campbell et al. 1997). Throughout its breeding range in the Pacific Northwest, the distribution of Gray Flycatcher could be characterized as occurring in scattered locations (sometimes in small dense "colonies") within large areas of unoccupied seemingly similar habitat.

In western Oregon, Gray Flycatcher is a rare but annual visitor on the west-slope of the Cascade Mountains during spring migration (Miller 2003). There are no breeding records west of the Cascades summit. There are a few records (one fall and six spring) of non-breeding vagrant individuals in western Washington (e.g., near Seattle [Fix 1984] and [Tweit and Gilligan 1993]).

Discontinuities and Isolation in Populations

Within the current breeding range of Gray Flycatcher in Oregon and Washington, there are many discontinuities in distribution and isolation of populations based on topography, elevation, habitat, etc. (e.g., the Blue Mountains of Oregon [Miller 2003]). In fact, Gray Flycatcher has been referred to as breeding in "colonies" (H. Nehls pers. comm.), although "disjunct populations" based on the aforementioned factors is probably a better description of its distribution. In sagebrush habitats, the reason for these disjunct populations is likely due to their specific habitat requirements for tall sagebrush, which only occurs very locally where soil moisture conditions are conducive to the growth of tall sagebrush – often in linear "washes" or historic alluvial fans. In open arid woodlands, the reason for disjunct populations or "colonies" appears less clear as these habitat types and conditions seemingly occur over relatively large areas. Potentially there is some specific mechanism of habitat condition (e.g., canopy cover, ground cover) that delineates habitat suitability at a finer scale.

There are several examples of variability in the degree of occurrence within occupied habitat and area. For example, they were considered a "local" shrub-steppe species rather than widespread in the Great Basin of southeastern Oregon and northwestern Nevada (Weins and Rotenberry 1981) based on their occurrence on only 5% of surveys in shrub-steppe habitats. However, Gray Flycatcher occurred on 45.5% of 742 point count stations visited twice a year throughout eastern Oregon and Washington over a three-year period (2000-2002) (Holmes and Barton 2003).

Further, in sagebrush habitats in the four ecoregions of eastern Oregon and Washington (i.e., Columbia Basin, High Lava Plains, Basin and Range, and Owyhee Uplands), Gray Flycatcher occurred on 24.2% of point count stations (n=69) with mean number of detections per point count station 0.48 (Holmes and Geupel 2000). They were most abundant in the Basin and Range ecoregion (OR) with occurrence on 77% of the transects (n=40) and 0.71 mean number of detections per point count (Holmes and Geupel 2000), and absent from the Columbia Basin ecoregion (n=8) (Figure 7). Occurrence in other ecoregions included High Lava Plains, 80% frequency of occurrence on transects (n=5) with a mean of 0.45 birds/point, and Owyhee Uplands 50% occurrence on transects (n=16) with a mean of 0.18 birds/point.

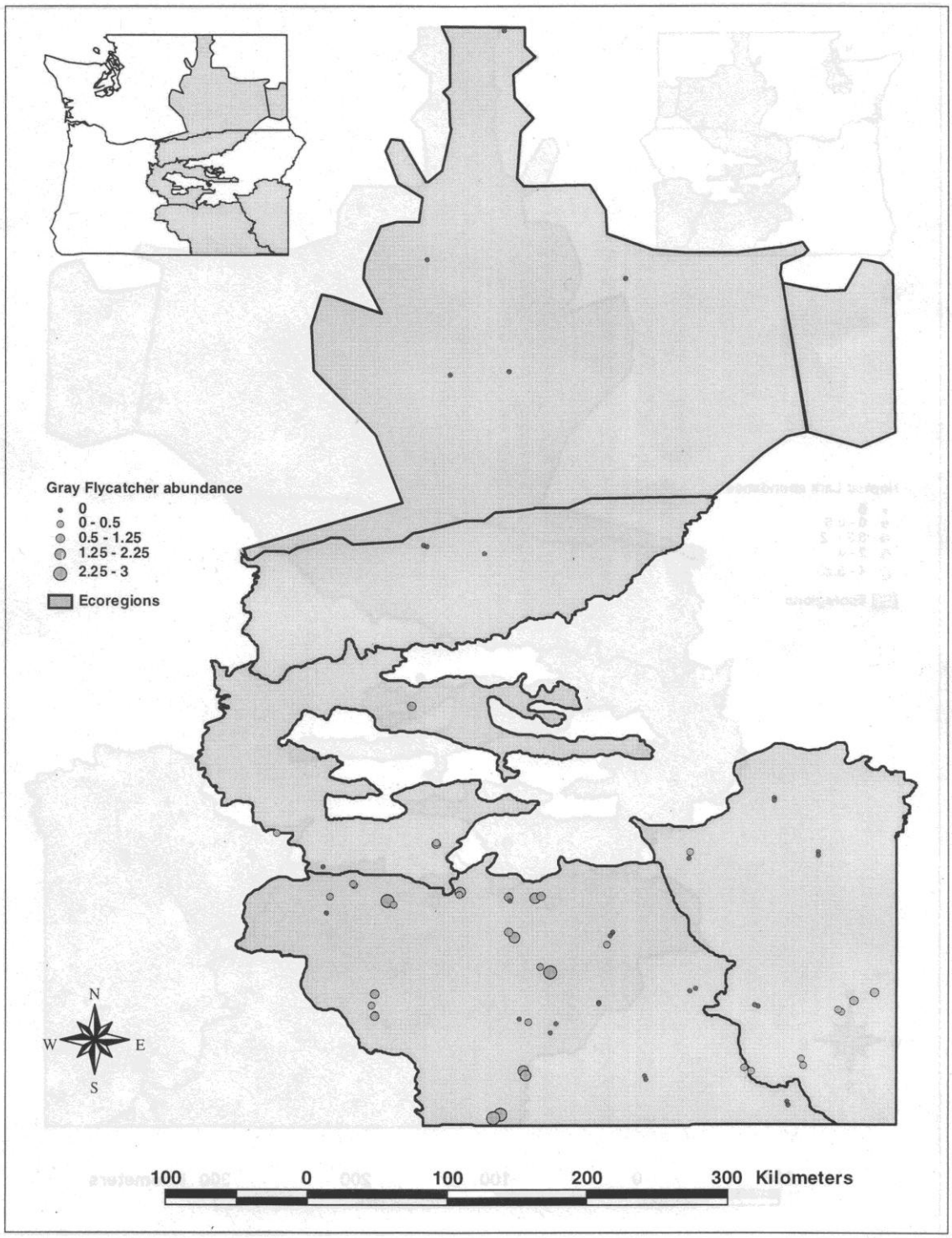

Figure 7. Gray Flycatcher abundance at transects in sagebrush habitats within ecoregions of eastern Oregon and Washington (from Holmes and Geupel 2000).

Gray Flycatchers are mostly absent from elevations <1,500 meters (4,900 feet) in Oregon and Washington. For example, they occurred only in low numbers below 1,300 meters (4,300 feet) in extensive sampling throughout shrub-steppe habitats in eastern Oregon and Washington (Holmes and Barton 2003). This included being virtually absent (one detection over three years) in big sagebrush/rabbitbrush/bitterbrush habitats at 122-274 meters on Boardman Bombing Range in northeastern Oregon (Holmes and Geupel 1998), and absent from big sagebrush (included spiny hopsage and rabbitbrush) at 190-260 meters (400-900 feet) on Department of Energy's Hanford Site in southeastern Washington. At the other end of the elevational gradient in Oregon and Washington, Gray Flycatcher was absent as a breeding species from mountain big sagebrush at 2133 meters (7,000 feet) in Oregon Canyon Mountains, Vale County, Oregon (Holmes 2007).

Outside of sagebrush habitats in Oregon and Washington, Gray Flycatcher occurred in low abundance (few detections in 5 of 8 years of monitoring) in ponderosa pine habitat on the Fremont and Winema National Forests (Huff and Brown 2006). In lodgepole pine habitats of central Oregon, Gray Flycatcher occurred in low densities with 0.01 birds/point count station in salvage logged treated stands and was absent from control stands on the Fremont National Forest (Arnett et al. 2001). On the adjacent Winema National Forest, abundance was slightly higher with 0.02 birds/point count station in treated stands and 0.15 birds/point count station in control stands. Conversely, in western juniper habitats of central Oregon, Friedmann et al. (1977) reported very high densities of 25 territories/kilometer2 (0.25 territories/hectare). Anecdotally, Harry Nehls (pers. comm.) noted that juniper habitat in central Oregon is 'overrun' with Gray Flycatcher, and by contrast they are uncommon in open sage flats.

Outside of Oregon and Washington, similar variability and discontinuities in populations have been observed. Suitable habitat in British Columbia (i.e., open ponderosa pine forests with a mostly grass understory) extends well beyond the known range of the species in the south Okanagan Valley, but the species has not been reported outside this relatively small area (Cannings 1995). Heath (2004) recorded them on only 8% of survey points in Wyoming big sagebrush within the Long Valley, Mono County, CA, and they were absent in mountain sagebrush in the Bodie Hills. Conversely, Shuford and Metropulos (1996) considered them a common and widespread breeder in the Glass Mountain region of Mono County, occurring in 74.3% of 74 atlas blocks (i.e., 5 kilometers X 5 kilometers squares [3 mile X 3 mile squares]). They were absent from sagebrush and juniper types on Wheeler Peak in east-central Nevada including Wyoming big sagebrush at 1,740 meters (5,700 feet), Wyoming big sagebrush-pinyon/juniper at 2,050 meters (6,700 feet), pinyon-/juniper- mountain big sagebrush and mountain big sagebrush at 2,550 meters (8,400 feet) (Medin et al. 2000). Nesting elevations in Arizona range from 1,400-2,300 meters (4,600-7,600 feet) although locally up to 2,750 meters (9,000 feet) (C. LaRue pers. comm. in Latta et al. 1998); and up to 3,350 meters (11,000 feet) in California (Small 1994).

Range-wide BBS Abundance

The Breeding Bird Survey (BBS) abundance map for Gray Flycatcher indicates the center of abundance is within the northern portions of the Great Basin ecoregion in south-central and southeastern Oregon, northeastern California, northern Nevada, and southwestern Idaho (Figure

8). Outside this part of the Great Basin ecoregion, there are a few pockets of abundance in the four corners area of the states of Utah, Colorado, New Mexico, and Arizona.

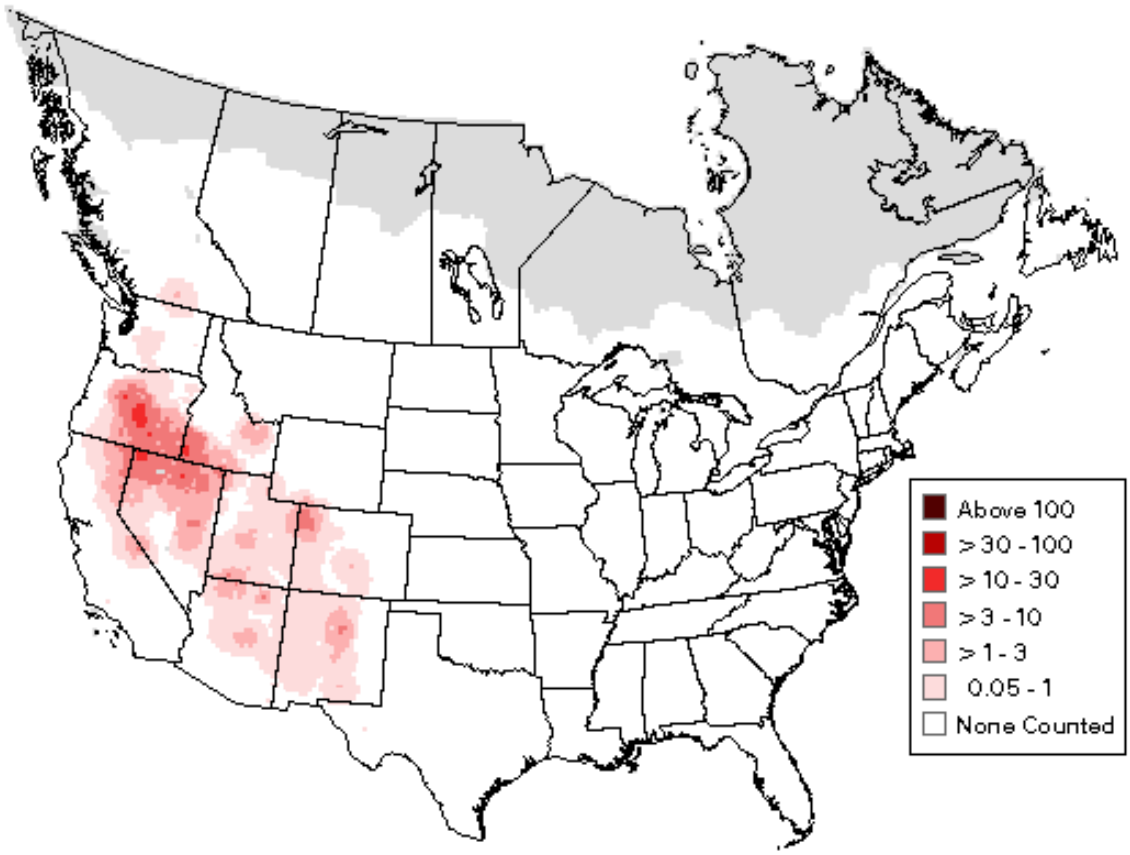

Figure 8. Breeding Bird Survey relative abundance map for Gray Flycatcher (birds/2.5 hrs) (from Sauer et al. 2008 using data from 1994-2003).

Based on BBS data at the state level, Gray Flycatchers reach their greatest abundance in Nevada (mean 4.39 birds/route) and Oregon (mean 3.51 birds/route) (Sauer et al. 2008). Only two other states have an abundance >1.00 birds/route, Idaho at 1.49 and California at 1.20. Further support for the center of abundance in eastern Oregon is the Columbia Plateau BBS physiographic area (i.e., the Great Basin ecoregion of eastern Oregon and Washington plus extreme northwestern Nevada) in which abundance is 5.06 birds/route, approximately double the abundance of the nearest other BBS physiographic area, 2.53 birds/route in the Pitt/Klamath Plateau (the Klamath Basin of south-central Oregon and northeastern California).

Density Estimates across Range

Gray Flycatcher density estimates in high quality habitat is remarkably consistent throughout their range. Some of the highest densities, 7.6-11.5 pairs/40 hectare (0.19-0.29 pairs/hectare [0.5-0.7 pairs/acre]), have been reported in the northern Black Mesa of the Colorado Plateau of northeastern Arizona based on spot-mapping in three pinyon-juniper plots over two years (LaRue 1994). At the same location there were 8.0 pairs/40 hectare (0.20 pairs/hectare [0.5 pairs/acre])

in greasewood-saltbrush shrubland plots. High breeding densities also have been reported in Nevada in the Great Basin ecoregion in pinyon-juniper habitats (0.28 birds/hectare [0.7 birds/acre]), mountain mahogany (0.21 birds/hectare [0.5 birds/acre]) and montane sagebrush (0.18 birds/hectare [0.4 birds/acre]) based on eight years of point count data (Great Basin Bird Observatory 2005). In Inyo County California, Woodman (1978) reported 22 territories/kilometer (0.22 territories/hectare).

Density Estimates in Oregon and Washington

Gray Flycatcher density estimates within Oregon and Washington are mostly based on data from several community studies in sagebrush and juniper habitats (Appendix A). The estimates are more variable than the aforementioned ones from outside Oregon and Washington, but are reasonably consistent within methodology indicating the differences may be due more to method than actual density.

E. Population Trends

The BBS is the primary source of population trend information for North American landbirds (www.mbr-pwrc.usgs.gov/bbs/). There is no standard analyses of BBS data for the geographic scope of this conservation assessment (i.e., Oregon and Washington), but three scales of BBS analyses provide insights into population trends for Gray Flycatcher in Oregon and Washington. These include trend analyses for three BBS physiographic regions, the Cascade Mountains, Columbia Plateau, and Basin and Range; two Bird Conservation Regions (BCRs), the Great Basin BCR and the Northern Rockies BCR; and the state of Oregon. Most of these analyses except the state of Oregon include some areas outside our geographic scope (i.e., Basin and Range physiographic region includes parts of Nevada; Great Basin BCR includes parts of British Columbia, Idaho, California, Nevada, and Utah; Northern Rockies BCR includes parts of British Columbia, Alberta, Idaho, Montana, and Wyoming).

The most noteworthy pattern apparent in Table 1 is that throughout their range nearly all trends at any scale or time period of analyses are increasing (significant or non-significant), and there are no significantly decreasing trends. The long-term (1968-2007) range-wide BBS trend for Gray Flycatcher is a highly significant ($p = 0.01$) increase of 4.6 %/year with a high degree of confidence (i.e., data is of sufficient sample size and at least moderate precision) (Table 1). The recent short-term (1980-2007) range-wide trend is still significantly ($p = 0.08$) increasing, but at a more moderate rate of 2.7%/year. All three BBS physiographic regions and both BCRs have increasing long-term trends, although only the two BCRs and the Cascade Mountains BBS physiographic region have significantly increasing trends (only Great Basin BCR with a high degree of confidence). In Oregon, the long-term and short-term BBS trends are increasing (1.6% and 1.8% respectively with a high degree confidence), but they are not significant ($p = 0.33$ and $p = 0.28$ respectively). In Washington, Gray Flycatchers have been detected on fewer than 14 routes (only 5), which is insufficient for trend analyses (Sauer et al. 2008).

Years	**1968-2007**			**1980-2007**		
Region	**Trend**	**p**	**N**	**Trend**	**p**	**n**
Arizona	2.8	0.41	10	4.0	0.42	10
British Columbia	9.8	0.13	2	8.4	0.22	2
California	3.3	0.22	20	0.8	0.54	19

Colorado	-0.9	0.30	15	-1.1	0.22	15
Idaho	18.2	0.60	5	21.5	0.56	5
Nevada	6.0	0.46	13	-0.4	0.94	12
New Mexico	8.1	0.00	20	14.6	0.02	20
Oregon	1.6	0.33	36	1.8	0.28	35
Utah	4.7	0.19	21	0.0	1.00	21
Southern Rockies	1.1	0.32	6	9.9	0.02	6
Central Rockies	9.8	0.13	2	8.4	0.21	2
Dissected Rockies	6.2	0.40	5	5.3	0.54	5
Sierra Nevada	-2.2	0.20	2	-2.3	0.20	2
Cascade Mountains	47.0	0.01	3	42.9	0.04	3
Pinyon-Juniper Woodland	2.9	0.03	38	3.2	0.02	38
Pitt-Klamath Plateau	7.5	0.02	18	4.4	0.17	18
Intermountain Grassland	8.2	0.09	17	12.3	0.26	17
Basin and Range	5.9	0.45	25	-0.4	0.93	24
Great Basin BCR	4.6	0.09	71	1.4	0.44	69
Northern Rockies BCR	8.5	0.06	10	10.3	0.03	10
Columbia Plateau	1.9	0.28	27	2.1	0.17	26
United States	3.7	0.08	143	2.1	0.20	140
Canada	9.8	0.13	2	8.5	0.22	2
Survey-wide	4.6	0.01	145	2.7	0.08	142

Shading indicates degree of confidence or credibility of the data as defined by Sauer et al. (2008)
Lightest = data with an important deficiency
Moderate = data with a deficiency
Darkest = data with sufficient sample size and of moderate precision

Table 1. Gray Flycatcher population trends based on Breeding Bird Survey data (Sauer et al. 2008).

Further assessment of population trends for this species both range-wide and within the geographic focus of this assessment can be determined from the BBS trend map (Figure 9). From a cursory assessment, it appears that the largest increases in Oregon and Washington might be occurring in forested habitats with more stable populations in the shrubland habitats of the Great Basin. For example, the large increases appear to be in the Cascade Mountains and foothills. Elsewhere in its range, the greatest increases appear to be occurring in the southwest, in particular Utah and Arizona in the Colorado Plateau ecoregion.

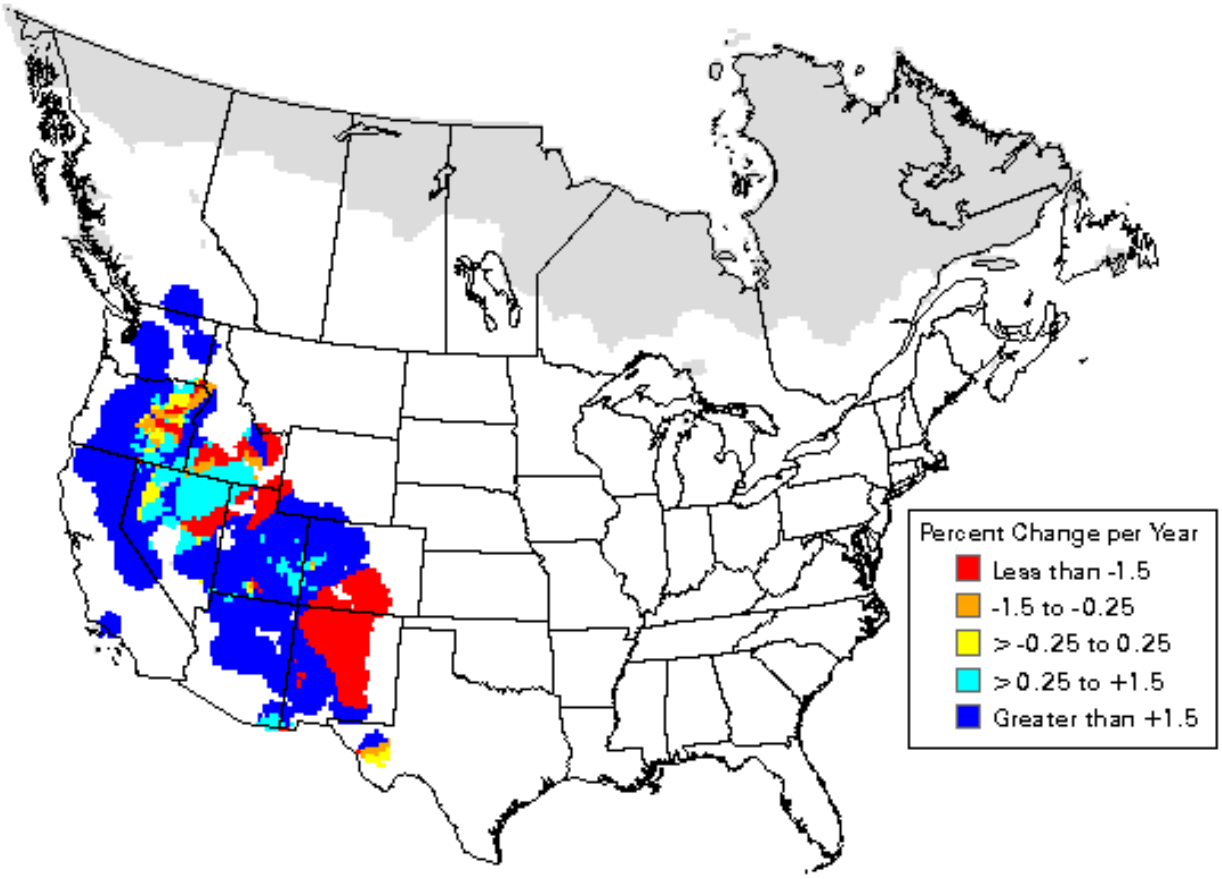

Figure 9. Breeding Bird Survey trend map for Gray Flycatcher, 1968-2003 (from Sauer et al. 2008).

F. Demography

Our limited knowledge of Gray Flycatcher ecology and life history significantly hampers our ability to assess the role demographic factors contribute to population status. The following brief discussions of demographic topics rely mostly on speculation using an indirect assessment of what we do know about the species.

Genetics and Hybridization.

No geographic variation or subspecies of Gray Flycatcher have been proposed (Sterling 1999). The apparently recent and small and isolated nature of peripheral populations in Washington and especially British Columbia raises concerns about future genetic diversity and demographic sustainability. However, if the range expansion is recent and those populations are increasing, gene flow is likely ongoing from source populations in the short-term.

Although hybridization in *Empidonax* flycatchers is rare, and Gray Flycatcher and Dusky Flycatcher are considered sibling species that rarely ever hybridize (Johnson 1963), one well-described specimen is believed to be a hybrid Gray Flycatcher/ Dusky Flycatcher (Phillips 1996).

Population Viability Analysis
No known population viability analyses have ever been conducted for this species. There are no data on vital rates to allow analyses of sources and sinks or metapopulation dynamics. The MAPS program does not capture enough individuals for analyses of productivity or survivorship (P. Nott pers. comm.).

Limiting Factors
The limited information on the ecology of the species precludes our ability to examine factors limiting population sustainability or growth at any scale. We assume that like many other migratory bird species, the risks and energy expenditure of long-distance migration are a contributing factor to population stability, although like other factors apparently not limiting for this increasing species. We also assume that since populations seem to be increasing through its range, that fecundity and reproductive success exceed mortality.

G. Habitat
General Associations
Gray Flycatcher breeding habitat associations are shrub-steppe and open woodlands of the arid intermountains of western North America between the crests of the Rocky Mountains and Cascade/Sierra Nevada Mountains. Within these associations, highest quality breeding habitat appears to be mature big sagebrush where the sagebrush is luxuriant and reaches small tree size, and semi-open to open woodlands of ponderosa pine, juniper, or pinyon-juniper with a relatively open understory. Additionally, high quality breeding habitat occurs at the ecotones of these open woodland types (pine or juniper) with sagebrush.

They breed to a lesser degree in other arid woodland types depending on location including Jeffrey pine in California and Nevada (Johnson 1963), lodgepole pine in Oregon (Arnett et al. 2001) and eastern California (Johnson 1963), Joshua tree in Nevada (Great Basin Bird Observatory 2005), mountain mahogany in Oregon (Miller 2003) and Nevada (Great Basin Bird Observatory 2005), and oak and oak-pine in south-central Washington (Manuwal 1997), and mixed forest types of any of the above. They also breed to some degree in low sagebrush/bitterbrush stands, especially if mature open-canopied stands of pinyon-juniper or other conifers are nearby to serve as nesting trees (Great Basin Bird Observatory 2005). Breeding also has been reported in some riparian habitats, and a wet meadow or riparian interface may provide important foraging habitat because of availability of flying insects (Great Basin Bird Observatory 2005).

In migration, primary habitat use appears to be arid shrublands similar to breeding habitat throughout the Great Basin, Mohave, Sonoran, and Chihuahuan deserts (Sterling 1999). They also use open riparian woodlands in California (Harris 1996), Oregon (Miller 2003), Nevada (Great Basin Bird Observatory 2005), and Arizona (Rosenberg et al. 1991); chaparral with scattered oaks and pines in California (Sterling 1999), and edges associated with the combinations of any interface of any woody and non-woody habitat types.

Gray Flycatcher wintering habitat includes open to semi-open arid shrublands (Howell and Webb 1995) including primarily mesquite (Russell and Monson 1998) and subtropical thorn scrub

(Hutto 1992). They also occasionally winter in pine-oak woodland in Sonora, Mexico (Russell and Monson 1998).

Geographic Variation

Despite the variety of breeding habitats they occupy throughout their range, there appears to be some degree of specialization of habitat types in some geographic areas, especially at the periphery of their range. At the northernmost extent of their range in British Columbia, they nest exclusively in open ponderosa pine forests with a grassy understory and small scattered shrubs (Cannings 1995), and nearly exclusively in this habitat in Washington (Lavers 1975, Smith et al. 1997). Thus, they do not nest in sagebrush in British Columbia and only to a limited degree in Washington (Downes 2006), despite seemingly adequate amounts of the habitat type (although perhaps not of sufficient quality), and their abundance elsewhere in this habitat throughout their range. Although ponderosa pine forest is still a primary habitat type in Oregon, south of Oregon within their range ponderosa pine is generally not considered to be primary habitat type, despite vast amounts of this forest type.

In Montana, at the northeastern part of their range where a small nesting population occurs, they also have not been reported breeding in ponderosa pine forest, but nest and forage almost exclusively in stands of basin big sagebrush that grow in dry washes and on terraces in the midst of vast expanses of Wyoming big sagebrush (J. Marks pers. comm.). In Oregon and Nevada in the core of their breeding range, they occur in both open woodland and arid shrubland habitat types in relatively equal abundance. At the western edge of their range in northern California, they breed in open stands of pure Jeffrey pine (Johnson 1963).

In Washington, nearly all the early nesting records in the 1970s were from open ponderosa pine forest with an understory of pinegrass (*Calamagrostis* sp.) (Larrison 1971, Yaich and Larrison 1973), or ponderosa pine/Oregon white oak woodland with a grassy understory (Lavers 1975). One of the nests occurred in a willow within the ponderosa pine forest zone (Yaich and Larrison 1973).

Extensive surveys over two years (1988-1990) throughout shrub-steppe habitats in the Columbia Basin (i.e., Yakima, Benton, Grant, Douglas, Lincoln, and Franklin Counties) did not record any detections of Gray Flycatcher (Dobler et al. 1996). More recent breeding season surveys in Columbia Basin sagebrush habitats of Washington did not record it at four sites (Lakeview Ranch in Lincoln County, Saddle Mountain East and West in Grant County, and Duffy Creek in Douglas County) (Holmes and Barton 2003). However, in the breeding seasons of 2002-2003, Downes (2006) reported at least 17 territorial males in eastern Kittitas County in valleys and shallow depressions where more fertile soils resulted in stands of tall sagebrush and lesser amounts of bitterbrush with perennial grass understory.

Habitat Selection

Comparisons among Habitat Types

In the Oregon Breeding Bird Atlas, Gray Flycatchers occurred most disproportionately in hexagons where there was more than 16% big sagebrush and the strongest habitat associations were western juniper woodlands and big sagebrush shrublands. (Adamus et al. 2001). Strong associations included mixed ponderosa pine-western juniper woodland, mountain mahogany

shrubland, sagebrush steppe, and salt desert scrub shrubland. Lesser habitat associations include pure ponderosa pine forest and mixed ponderosa pine with mixed conifer, oak, and lodgepole pine. Miller (2003) noted that preferred shrub habitat included big sagebrush, especially along dry washes, rather than in broad sagebrush flats, and woodland habitat included mountain mahogany, older juniper, and open ponderosa pine forests with an understory of sagebrush or bitterbrush. Arnett et al. (2001) reported a population nesting in lodgepole pine/bitterbrush forests in the Pumice Zone of the Cascades Mountains south of Bend, Oregon.

In four vegetation types in central Oregon, Gray Flycatchers were the most abundant species in juniper habitats (17% canopy cover) and slightly less abundant in ponderosa pine forest (37% canopy cover), but had only a few occurrences in big sagebrush (22% canopy cover) and lodgepole pine forest (46% canopy cover) (Gashwiler 1977). In the same general vicinity of central Oregon, Reinkensmeyer (2000) reported Gray Flycatcher as the most abundant species in both mid-successional (6-20% canopy cover) and old-growth juniper (10-35% canopy cover) habitats, but only a few occurrences in mountain big sagebrush (19% canopy cover) and mountain big sagebrush less than five years post-burn (5% canopy cover). It is important to note that in both the aforementioned studies in central Oregon, sagebrush study areas were mostly broad basins of extensive sagebrush of low to moderate height, not the preferred mature, tall sagebrush often found in pockets of more fertile soils.

Sagebrush

In Wyoming and basin big sagebrush habitats in eastern Oregon and Washington, Gray Flycatcher was positively associated with shrub height ($p < 0.001$) and percent shrub cover ($p < 0.05$), and negatively associated with percent annual grass cover ($p < 0.01$) and percent *Atriplex* spp cover ($p < 0.05$) (primarily spiny hopsage) (Holmes and Barton 2003). They also were positively associated with elevation and mean annual precipitation (both $p < 0.01$). At the landscape level, they were positively associated with proportion of the landscape within a 3 kilometer (2 miles) buffer around the study plot that was mapped as shrub habitat with a perennial understory ($p < 0.01$), and negatively correlated with the mean slope within a 1km buffer ($p < 0.01$). The final model that predicted the greatest relationship to abundance included three variables, negative association to percent cover of annual grass, and positive associations to shrub height (indexing vertical complexity in the shrub layer), and the amount of shrub habitat in the landscape.

In sagebrush habitats of the northwestern Great Basin ecoregion (i.e., southeast Oregon and northwest Nevada), Gray Flycatcher density was positively correlated with an increase in the total density of individuals of all other bird species, especially Brewer's Sparrow's (Weins and Rotenberry 1981). Its density was not correlated with any shrub species or any physiognomic variables, although the species was uncommon in their study area, occurring on only 5% of their surveys.

On BLM lands in three habitat types in northeastern California and northwestern Nevada, Gray Flycatcher was significantly more abundant in both Wyoming big sagebrush (mean 0.58 birds/point count, 0.11 SE) and mountain sagebrush/high juniper (mean 0.47 birds/point count, 0.09 SE) than mountain sagebrush/low juniper (0.05 birds/point count, 0.02 SE). Its abundance was positively associated with juniper density, responding at a stronger rate at high levels of tree

density (abundance highest at minimum 10 trees/hectare >8 centimeters dbh [25 trees/acre >3 inches dbh] and a similar density up to 40 trees/hectare [100 trees/acre]) (Barton and Holmes 2004).

In the Great Basin of Nevada, Gray Flycatchers use tall (>1.5 meters [5 feet]) sagebrush and bitterbrush stands and the sagebrush shrubland/pinyon-juniper transition zone, and avoid the sage-steppe, which contains a significant grass understory (Great Basin Bird Observatory 2005).

Juniper

In the mature juniper belt on Steen's Mountain in southeastern Oregon (1,200-2,100 meters [3,900-6,900 feet]), Gray Flycatcher habitat selection was determined among habitat types and for habitat conditions within types (Holmes et al. 2007). They occurred in significantly higher densities in untreated juniper (mean 50.7 territories/100 hectares [250 acres]) than sagebrush habitats (mean 4.2 territories/100 hectares [250 acres]). Among juniper habitats, higher densities occurred in burned juniper (mean 30.1 territories/100 hectares [250 acres]) than cut juniper (16.4 territories/100 hectares [250 acres]), although the differences were not significant. However, densities were significantly higher in untreated juniper than burned or cut juniper.

Further, Gray Flycatcher density was negatively correlated with all measures of herbaceous vegetation, overall shrub cover, sagebrush cover, and elevation. In fact, density declined by a mean of 3.8% (2.3 to 5.2%) for every one unit increase in shrub cover. There was a significantly positive linear relationship with Gray Flycatcher density and juniper cover and density, but also a negative quadratic relationship with juniper density (Holmes et al. 2007). This indicates that Gray Flycatcher density increased with increasing juniper density up to a mean 16 trees/hectare (6 trees/acre), then declined with further increases in juniper density.

Gray Flycatcher detections at point count stations on the Crooked River National Grassland were subjectively associated with juniper tree densities of 10-90%, with most between 25-65% (East Cascades Bird Conservancy 2007). At these stations, grasses covered between 60-90% of the understory.

Ponderosa Pine and Oak-Pine

In ponderosa pine forest, Gray Flycatchers seem to use a range of age class/tree sizes with the key characteristic being the openness of the forests. In central Oregon, Gray Flycatchers occur throughout mid and late-successional ponderosa pine forests (e.g., tree dbhs >30 centimeters [12 inches]) (B. Altman pers. obs.). In the central Washington Cascades, ponderosa pine trees within Gray Flycatcher territories were of mid-successional size (means 27-33 centimeters dbh [11-13 inches dbh]) (J. Kozma pers. comm.). In British Columbia, Gray Flycatchers are restricted to a narrow earlier seral stage where trees are young and sufficiently small (10-15 meters high and up to 25 centimeters dbh [33-49 feet high and up to 10 inches dbh]) to provide low-level foraging perches, but openings (10-15 meters diameter [33-49 feet diameter]) are large enough to provide foraging areas (Cannings 1995). Several of the sites are in young ponderosa pine forests thinned for silvicultural purposes. The understory varies from all herbaceous to moderately shrubby including bitterbrush, three-tip sagebrush, or buckbrush. Likewise in pure Jeffrey pine stands in northern California, territories were dominated by relatively small trees

(53% <15 centimeters dbh [6 inches dbh], tree density 450/hectare [180/acre]), and each territory was centered on one or more grassy openings in the forest (Johnson 1963).

Recent empirical data on tree size from several confirmed territories in open ponderosa pine forests (15-60% canopy cover) with bitterbrush and wax currant understory west of Yakima, Washington indicates Gray Flycatcher occurring in mid-successional forests (J. Kozma pers. comm.) (Table 2). Kozma also noted that Gray Flycatchers appear to be absent when Douglas-fir is mixed with the ponderosa pine, and at elevations where snowbrush and snowberry become dominant in the understory.

	Mean dbh (cm)	n	SE	Range (cm)
Stand 1	29.7	149	0.46	15.2-47.0
Stand 2	29.0	189	0.75	12.2-60.2
Stand 3	27.2	194	0.83	10.2-70.4
Stand 4	30.5	192	0.70	11.4-60.0
Stand 5	32.2	178	0.69	10.7-61.2
Stand 6	33.3	232	0.78	13.2-72.4

Table 2. Stand-level tree size data from Gray Flycatcher territories in ponderosa pine forests on the east-slope of the Cascade Mountains west of Yakima, Washington (J. Kozma pers. comm.).

Habitat associations in Washington were extended when Manuwal (1997) detected Gray Flycatchers at 37% of 15 upland oak and oak-pine sites over two years in south-central Washington. They only occurred in the small pine/small oak type and the mostly pure small oak type. They avoided areas with large pine and oaks, occurring only in areas dominated by small oaks with canopy gaps, habitat similarly preferred by Dusky Flycatcher. Their greatest density typically occurred along the edge of the small oaks bordering an extensive mountain meadow. Gray Flycatcher abundance was positively correlated with dense stands of oak ($r2 = 0.67$, $p = 0.001$), and negatively correlated with the height of oak trees ($r2 = -0.62$, $p = 0.004$) and dbh of oak trees ($r2 = -0.70$, $p = 0.001$).

In ponderosa pine dominated forests of north-central Washington, using logistic regression habitat models for habitat selection among Gray, Dusky, and Hammond's Flycatcher, Lindsay (2007) reported that Gray Flycatcher presence was positively correlated with more open canopy, more xeric communities, and lower elevations than the other two species. Johnson (1963) described a difference between habitat for the Dusky Flycatcher and Gray Flycatcher in western Nevada and eastern California as including a "dense chaparral or brush layer" (Dusky Flycatcher) and "places with considerable bare or sparsely covered ground" (Gray Flycatcher).

Lodgepole Pine

In lodgepole pine forests of the central Oregon Cascades, there was no significant difference in Gray Flycatcher occurrence in both treated (salvage logged after beetle infestation) and control sites on the Winema and Fremont National Forests, although sample sizes were low (i.e., Gray Flycatcher occurred on <5% of point stations) (Arnett et al. 2001). Habitat selection associated with point count stations (used versus unused) included positive associations with mean dbh and mean height of snags, and negative associations with percent ground debris, number of logs and number of saplings. Interestingly, of the four nests monitored, both nests in control sites on the

Winema National Forest failed, and both in treated sites on the adjacent Fremont National Forest were successful (B. Altman unpubl. data). These results suggest Gray Flycatcher selected for and were most reproductively successful in areas with lower canopy cover and more open ground cover.

Outside Oregon and Washington
Gray Flycatchers avoided montane chaparral, shorter sagebrush communities, and forested habitats lacking large shrubs (1.2-1.8 meters [4-6 feet]) in the Mono Lake basin (Gaines 1988). Johnson (1963) notes that the ground is often bare or sparsely vegetated where Gray Flycatchers occur, and speculates this may be conducive to its tendency to forage more on the ground than other *Empidonax* flycatchers.

Landscape
There is no information on the landscape effects on Gray Flycatcher populations. In general, *Empidonax* flycatchers are not considered to be "landscape species" in which patch size or proximity of patches is a limiting factor for their populations. However, they often use multiple habitats within the landscape gradient (i.e., sagebrush, juniper or pinyon-juniper, and ponderosa pines), which suggests the potential for greater populations where these habitats occur in juxtaposition.

Range Expansion
Gray Flycatchers have reportedly extended their breeding range since 1970 in several directions including northward along the east-slope of the Cascade Mountains into Washington (Lavers 1975, Yaich and Larrison 1973) and British Columbia (Cannings 1987), southwestward into several new locations in southern and central California (Johnson and Garrett 1974, Johnson and Cicero 1985, Lehman 1994), and eastward into Texas (G. Lasley pers. comm. in Cannings 1995) (*However see Historic Range section above for new record from Washington prior to 1970*). Johnson (1994) further maps the expansion of Gray Flycatcher radially in all directions from its core in the Great Basin and Colorado Plateau citing many of the same sources (Figure 3). He notes that unlike many other recent species expansions that can be explained at least in part by factors associated with climate change, the radial expansion of Gray Flycatcher in all directions remains unexplained.

Conversely, in the 1930s they were considered common during winter in the foothills and valleys of southern California, but now are very rare during winter (Garrett and Dunn 1981). The reason for this decline, especially in the context of apparent breeding range expansion, is unknown.

Despite the apparent radial expansion of their breeding range in all directions as described by Johnson (1994), several authors and ornithologists in the Pacific Northwest have speculated on whether the species was actually present before "discovery" in Washington or British Columbia, and simply not detected due to small population size, difficulty in identification in comparisons with other *Empidonax* flycatchers in the area, and occurrence in isolated "pockets" or "colonies." H. Nehls (pers. comm.) noted that this was how Gray Flycatchers "expanded" into areas north of the Ochoco Mountains in Oregon. Downes (2006) notes the possibility that Gray Flycatchers have gone undetected in some portions of their range in Washington. D. Stephens (pers. comm.) suggested that they were likely present in isolated pockets prior to being detected in Washington,

and once they were, more observers paid sufficient attention and enhanced their identification skills comparing *Empidonax* flycatchers to record their presence regularly. It is also noteworthy that this "expansion" occurred in the 1970s when there was a noteworthy increase in 'birding' by non-scientists which resulted in a greater effort to find birds and better skills at identification, especially among notoriously difficult identification challenges like *Empidonax* flycatchers.

It also is possible that this same mechanism (i.e., enhanced observer skills) has resulted in increased detections on BBS routes in Washington. For example, of the five BBS routes that have recorded Gray Flycatcher in Washington (Ellensburg, Ronald, Twisp, Wilbur, and Yakima) two of the routes first recorded Gray Flycatcher in the first year of a new observer, one in the second year of a new observer, and two in the third year of a new observer (Sauer et al. 2008). In one of the two first year observations (1996 on Yakima route), that was the only year that observer ran the route and the species has not been recorded since. In the other first year observation (1999 on Wilbur route), previous observers over 15 years had not recorded the species. Further, the Ellensburg route, which has recorded the most Gray Flycatchers, first recorded them in 1995 in the third year of a new observer after 13 years of no detections under a previous observer. Thus, in some cases the BBS data show a change of route observer led to new records for Gray Flycatchers, suggesting that range expansion or population growth could instead be due to variation in observer experience.

H. Ecological Considerations

Predators, Disease and Mortality

There is no information on the relationship of predators to Gray Flycatcher ecology and life history, although they are likely subject to the same general predators and predation rates (i.e., usually not limiting population stability) as any small passerine in western forests and rangelands. Among three Gray Flycatcher specimens from northeastern California, two had parasite infections, one with *Trypanasoma* and the other with *Haemoproteus* (Miller et al. 1978). There is no information on types of mortality in Gray Flycatchers.

Cowbird Parasitism

Limited data on nesting success in Gray Flycatchers indicates that they can be a regular host choice and highly vulnerable to Brown-headed Cowbird parasitism (Friedmann et al. 1977). Data from the juniper woodlands of central Oregon indicate Gray Flycatchers are unable to raise their own young if a cowbird chick fledges from the nest based on the following description in Friedmann et al. (1977):

> Mr. R. M. Lais informed us that another parasitized nest was found in the Malheur Lake area, central Oregon, by T. W. Haislip. In reply to request for more explicit data on this record, Mr. Haislip generously expanded it, as follows. In 1970 and 1971, in the western juniper woodlands of central Oregon, he found the Gray Flycatcher to be the most abundant breeding bird, averaging about 25 pairs per 100 hectares (cowbirds averaged about 3 "pairs" per 100 hectares). Of 28 nests found, 7 were parasitized; there was 30 percent parasitism in 1970, and 20 percent in 1971. Of the 7 parasitized nests only 3 fledged a single cowbird apiece. In none of the 7 did any of the host young survive, and in no nest was more than a single cowbird egg found.

The first recorded parasitism of a Gray Flycatcher nest in Washington was at Wenas Park on May 27, 1972 (Yaich and Larrison 1973). This was two years after the "discovery" of Gray Flycatchers in Washington at this same location, and one year after location of the first nest at this location. The first nest found in British Columbia also contained a cowbird egg (Cannings 1987), and it was noted that the Dusky Flycatcher, a close relative in similar habitats is heavily parasitized in the Okanagan.

In sagebrush habitats of eastern Oregon and Washington, Brown-headed Cowbird abundance was positively correlated with Gray Flycatcher abundance ($p=0.031$) (Holmes and Geupel 2000). It was speculated that cowbirds were most abundant in areas with greater number of shrub nesting species such as Gray Flycatcher.

IV. Conservation

A. Threats to Species

Our assessment of threats to Gray Flycatcher conservation is based on our limited knowledge of its life history and its known association with several habitat types where impacts are occurring. This assessment is somewhat subjective and intuitive, since there are minimal data on site-specific responses, and no data on population-level consequences resulting from habitat impacts. For this reason, and that fact that they occur in several different habitat types, we do not attempt to prioritize the threats.

Habitat loss and habitat alteration that reduces the amount or suitability of Gray Flycatcher habitat is likely the greatest threat to populations throughout their range. This is especially true for its primary breeding habitat associations; tall, mature sagebrush; mature juniper and pinyon-juniper forests; and open ponderosa pine forests (especially in Oregon, Washington, and British Columbia). Habitat loss and alteration may come from a variety of sources including land clearing for development or agriculture/livestock grazing; land management/resource extraction for timber harvest and mining, road building, fuels reduction, fuelwood cutting, habitat restoration (e.g., invasive juniper removal), and overgrazing by ungulates, which reduces ground cover and inhibits regeneration of shrubs with negative affects on insect prey populations. Additionally, any habitat conversion to agriculture that enhances the suitability of a habitat for Brown-headed Cowbirds could impact local nesting populations of Gray Flycatcher because of their vulnerability to parasitism.

Altman and Holmes (2000) listed the following four conservation threats in Oregon and Washington:

- Decline in mature and old-growth juniper trees.
- Targeting of juniper for removal in sagebrush restoration increases the risk of inappropriate or indiscriminate juniper removal (e.g., large trees in historically ecologically appropriate juniper areas).
- Pesticide use may be limiting prey populations.
- Cowbird parasitism.

Threats on the wintering grounds are unknown (Sterling 1999). Activities that would reduce habitat quantity and quality and potentially negatively affect wintering populations of Gray Flycatcher include conversion of suitable arid shrublands habitat to agriculture or development,

and any alteration of the habitat that reduces suitability. The latter might include intensive grazing that inhibits regeneration of shrubs or pesticide and herbicide use that reduces prey populations.

Among these potential threats on the wintering grounds, it is likely that habitat loss is not a significant factor due to the remoteness and inhospitable nature of the habitats for development. However, grazing is a common practice in these habitats with the potential for greater impacts.

Wildfire
Recent changes in fire regimes threaten persistence of the three primary habitat types for Gray Flycatcher in Oregon and Washington, ponderosa pine forests, juniper forests, and sagebrush. Fire suppression over the past 100 years has altered fire regimes so that ponderosa pine forests are no longer maintained by frequent natural fire, but are becoming denser and more susceptible to stand-replacing fires. Likewise, the invasion of non-native cheatgrass in many sagebrush habitats has altered fire regimes resulting in more frequent and more intense fires that can destroy and potentially eliminate sagebrush plants. Thus, sagebrush loss due to recurrent cheatgrass-fueled wildfires will eventually render the habitat unsuitable for Gray Flycatcher.

Grazing
Our understanding of the response of Gray Flycatcher populations to grazing is limited to the results of two studies. In Nevada, a positive response to heavy grazing was reported in shadscale/Indian ricegrass and bluegrass/sedge (Page et al. 1978). In big sagebrush/bluebunch wheatgrass habitats in southeastern Idaho, Reynolds and Trost (1981) reported a likely negative response to moderate grazing based on their occurrence in ungrazed sagebrush (17% cover sagebrush), and their absence in moderately grazed sagebrush (25% cover sagebrush). D. Cannings (pers. comm.) noted that while there is no available data on the benefits or impacts of grazing on Gray Flycatchers breeding in British Columbia, the open ponderosa pine forest sites where they have been found all have experienced a moderate amount of livestock grazing.

Land Clearing
The clearing of suitable Gray Flycatcher habitat for development or agriculture obviously has the potential to negatively impact Gray Flycatcher populations, especially in high density habitats such as juniper or pinyon-juniper. Where ‘chaining’ was employed to remove trees and shrubs in pinyon-juniper woodlands in Colorado, there were no Gray Flycatchers despite the fact that they were common in adjacent intact pinyon-juniper woodlands (O’Meara et al. 1981).

Juniper Management
The removal of invasive juniper from historic sagebrush habitats is a significant and ongoing land management activity in Oregon on BLM lands. Much of this habitat has become suitable for Gray Flycatcher, particularly in places where the juniper has reached mid-successional stages.

Timber Harvest
Although the commercial harvest of ponderosa pine forest on public lands has diminished some, there still is significant harvest on private lands. Timber harvest has the potential to negatively affect Gray Flycatcher populations if the harvest removes too much canopy.

B. Conservation Status

Gray Flycatcher is considered at risk in Washington primarily due to the small size and scattered occurrence of known populations which is driving its high scores in the Natural Heritage program ranking system, the source of its sensitive status for BLM and the Forest Service. This status is not believed to be due to land management or anthropogenic causes, but likely either due to being a naturally occurring small population on the periphery of its range or the result of limited detections that have been the hallmark for this species for perhaps as long as a century.

A principal vulnerability of this species in Washington is any of the factors that can affect small populations (e.g., genetic diversity, local extirpation due to stochastic events). However, conservation concern should be tempered by several factors. First, the Washington population is at the fringe of the species' range where small dispersed populations might be expected, thus ecologically this may be a naturally occurring peripheral population. Secondly, the limited available records, while subject to a variety of biases, have been increasing and it is likely that populations have at least been stable if not increasing in Washington for several decades. Lastly, the species occurs in two major habitat types, ponderosa pine forests and sagebrush, which enhances its ability to withstand negative affects on populations.

Despite these factors, Gray Flycatcher does occupy habitats significantly affected by development, fire, grazing, timber harvest, and habitat restoration, and these activities have the potential to influence the species population status and viability.

Land Ownership

In Washington, most of the suitable habitat for Gray Flycatcher is on federal lands of the USFS (particularly ponderosa pine) and BLM (particularly sagebrush). Thus, populations of Gray Flycatcher have the potential to be greatly impacted (both positively and negatively) by the land management activities of these agencies.

Greater Sage-grouse

It also is noteworthy that Gray Flycatchers breeding in sagebrush habitats within the range of the Greater Sage-grouse will be substantially affected by management and conservation activities for that species. Further, 61% of the range of Gray Flycatcher overlaps with the range of Greater Sage-grouse, and there is a significant correlation in relative abundance of the two species based on an analysis of BBS routes ($p<0.01$ with an R of 0.38) (Rich et al. 2005). Many of the recommendations for Greater Sage-grouse management and recovery, including limiting sage steppe habitat loss to fire, limiting sage habitat conversion to agriculture, avoiding sagebrush control with herbicides for forage enhancement, managing grazing for sustaining sage ecosystem health, and limiting the use of insecticides in sage dominated areas are mutually beneficial for sage grouse and sage-associated Gray Flycatchers. Thus, management activities that conserve sage-dominated shrub habitat for Greater Sage-grouse are consistent with and beneficial to Gray Flycatcher as well.

C. Known Management Approaches

We are not aware of any management implemented specifically for Gray Flycatcher anywhere in its range. However, Gray Flycatchers have been shown or suspected to respond positively to two

primary management actions for restoration of ponderosa pine forests - opening up the forest canopy (i.e., thinning) and maintaining an open understory (i.e., fuels reduction and prescribed fire).

Thinning in Ponderosa Pine Forests
In British Columbia, Gray Flycatchers only have been found in thinned ponderosa pine stands (Cannings 1995). Thinning with fire to reduce fuel loads has benefitted Gray Flycatchers in Washington (Russell et al. 2009). Mechanical thinning for silvicultural purposes that results in suitable canopy cover may benefit Gray Flycatcher by creating forest openings essential for foraging. However, the effect of thinning on available food or nest sites is not known.

Prescribed Fire in Ponderosa Pine Forests
Some data are available on the response of Gray Flycatchers to prescribed fire in ponderosa pine forests. In the east-slope Cascade Mountains of north-central Washington on the Okanogan National Forest, Gray Flycatcher rates of occupancy increased with prescribed fire treatments to reduce fuel loads based on two years of pre and two years of post burn data from mixed conifer forests (dominated by ponderosa pine) (Russell et al. 2009). These burns included both surface and ladder fuels, which resulted in reductions in downed woody material by 50%, and live stems by 31%, with no change in large stem (>23 centimeters dbh [9 inches dbh]) densities, a 29% increase in large snag (>23 centimeters dbh [9 inches dbh]) densities, and an overall doubling of snag densities. Lindsay (2007) also recorded a positive response (mild) to prescribed fire in ponderosa pine forests of north-central Washington. Smith et al. (1997) noted that Gray Flycatcher occupied an 'old burn' in Columbia County, Washington.

D. Management Considerations
There are significant opportunities for management to improve habitat and increase populations of Gray Flycatcher because of 1) its occurrence in Oregon and Washington in three habitat types with significant management and restoration activities (i.e., ponderosa pine, juniper, and sagebrush), and 2) the ownership of most of those habitats is federal lands. Further, we speculate that the best opportunities for management to maintain or increase populations of Gray Flycatcher may be in ponderosa pine habitats. The reasons for this include 1) restoration being done for historic ponderosa pine conditions is mostly compatible with Gray Flycatcher habitat requirements, 2) juniper management (primarily removal of invasive juniper) is more likely to decrease populations of Gray Flycatcher (where mid-successional juniper is being removed), and 3) the sagebrush habitat occupied by Gray Flycatcher only occurs very patchily where the soils are most fertile and protection of these sites rather than broad sagebrush management is likely the best conservation strategy.

The challenge is to provide prescriptive recommendations for management based on our limited knowledge of Gray Flycatcher life history and response to management. A few sources have provided management recommendations specifically for Gray Flycatcher, and many more have provided general conservation recommendations for the habitat types they occupy. Those specific to Gray Flycatcher include:

In sagebrush habitats of the intermountain west, Page and Ritter (1999) recommend:

• Maintenance of tall, mature big sagebrush/bunchgrass communities and of mature juniper and pinyon-juniper stands as primary nesting and feeding habitats.
• Reducing or eliminating insecticides may increase its prey base.

In juniper habitats of Oregon and Washington, Altman and Holmes (2000) recommend
• Retain and protect mature and old-growth juniper trees where Gray Flycatcher populations occur within the historical range of this habitat type.
• Provide 5 mature/old-growth juniper trees/ha >53 centimeters dbh (21 inches dbh).
• Provide 10% cover of juniper saplings to provide for recruitment trees.
• Maintain cowbird parasitism rates below 10% within specific-study areas.

In pinyon-juniper habitats of the intermountain west, Gillihan (2006) recommends:
• Retain old-growth shrublands (i.e., large shrubs).
• Retain mature trees.
• Create small openings within pinyon-juniper woodlands.
• Take steps to discourage Brown-headed Cowbird populations.
• Manage for a pinyon-to-juniper ratio of about 1:1, with at least 13% canopy cover.
• Retain snags and partially dead trees.
• Avoid insecticide use; adopt IPM (Integrated Pest Management) practices; limit insecticide use to periods outside the breeding season.

In pinyon-juniper habitats of Arizona, Latta et al. (1998) recommends:
• Discourage clearing of large mature tracts of woodland habitat and encourage small-scale openings.
• Manage grazing pressure to maintain shrub component and grass cover.
• Restrict livestock grazing from prime nesting habitat during the nesting season (May through July).
• Seasonal restrictions and limitations on fuelwood cutting and collection.
• Maintain mature trees in suitable habitat.

In Ponderosa pine habitat, results from Russell et al. (2009) indicate that to benefit Gray Flycatchers:
- Conduct prescribed burning with moderate intensity so that large stems (>23 centimeters dbh [9 inches dbh]) are retained and small stems are reduced.

Gray Flycatchers also would potentially benefit from standard recommendations espoused by many sources (e.g., Paige and Ritter 1999, Dobkin and Sauder 2004) to protect their habitats from loss and encourage management that attempts to restore historic conditions and functions. A caution is that the degree of benefit from restoration activities is likely variable based on the specificity of the restoration prescriptions and the habitat requirements of Gray Flycatcher. For example, a prescription for complete removal of shrubs and understory trees for fuels reduction in older ponderosa pine forest would likely reduce Gray Flycatcher habitat suitability by removing all under and mid-story structure for foraging perches and nest sites. However, a similar prescription in juniper habitat would likely maintain or enhance suitability because the height and growth form of older juniper trees results in maintenance of those desired structural conditions.

When managing to maintain or increase habitat potential for Gray Flycatchers, we suggest the following management considerations based on a synthesis of data presented earlier and the aforementioned recommendations of others:

Juniper

• Retain juniper trees with old-growth characteristics.

Rationale: Old-growth juniper trees should be almost exclusively in sites with an historic presence of juniper. The recent invasion of juniper into sagebrush habitats (<150 years) is not likely to have resulted in old-growth juniper trees except in areas with more productive soils and enhanced tree growth.

• Where juniper management is occurring in historic juniper habitat or in areas where complete juniper removal is not the objective and some old-growth juniper is present:
1) maintain stand-level stem densities of 5-15 juniper trees/hectare (2-6 trees/acre) with canopy cover in the 10-40% range and no areas with <5% cover or >70% cover,
2) maintain stand-level shrub cover (i.e., shrubs and small trees that function as shrubs) <20%, and
3) maintain stand-level herbaceous cover >50% with some areas of bare ground.

Rationale: The desired condition is a relatively open juniper forest with low to moderate levels of canopy and shrub cover in patches or dispersed throughout the area, and moderate to high levels of herbaceous ground cover with some areas of bare ground. Stem density recommendations are based on data from Holmes et al. (2007). Canopy cover recommendations are based on data from Reinkensmeyer (2000) for mid-successional (6-20% cover) and old-growth (10-35% cover), East Cascades Bird Conservancy 2005) (25-65% cover), and Gashwiler (1977) (17% cover). Recommendations for shrub and herbaceous cover are based on professional judgment. Note: It should be recognized that juniper removal in areas where juniper has invaded into sagebrush and the current juniper condition is mid-successional with cover values as described above has the potential to eliminate Gray Flycatcher populations (early-successional juniper is marginal or non-suitable habitat). However, it is assumed that the value of the invasive juniper removal to conservation of historic sagebrush conditions is greater than the potential losses of Gray Flycatcher populations.

• Where juniper management is occurring:
1) manual cutting and removal of juniper trees is preferable to chaining or mechanical efforts; consider using manual methods over some percentage (40%) of the project area

Rationale: Manual activities result in less damage to understory vegetation and soils (California Partners in Flight 2005).

Ponderosa Pine

• For thinning and/or fuels reduction management projects in mid to late successional ponderosa pine forests:
1) maintain stand-level canopy cover in the 25-60% range with few areas <10% or >70%,
2) maintain stand-level shrub cover (i.e., shrubs and small trees that function as shrubs) < 20%, and

3) maintain stand-level herbaceous ground cover > 50% with some areas of bare ground.

Rationale: The desired condition is a relatively open ponderosa pine forest with low to moderate levels of canopy and shrub cover in patches or dispersed throughout the area, and moderate to high levels of herbaceous ground cover with some areas of bare ground. Canopy cover recommendations are based on data from Kozma (pers. comm.) (15-60% cover) and Gashwiler (1977) (37% cover) and professional judgment. Recommendations for shrub and herbaceous cover are based on professional judgment.

• In early to mid-successional ponderosa pine forests (i.e., trees 15-25 centimeters dbh [6-10 inches dbh]):

1) maintain small openings (i.e., 10-15 meters in diameter [33-49 feet in diameter]) throughout the area.

Rationale: In these younger more densely growing forests, nesting opportunities are plentiful, but canopy cover is typically high and flycatching opportunities are restricted. Small openings can provide unobstructed foraging opportunities. The recommendation is based on data from Cannings (1995).

Sagebrush

• Protect tall sagebrush habitat (i.e., >1.5 meters tall [5 feet tall]).

Rationale: There are limited areas of tall sagebrush habitat. In sagebrush habitats, the most important factor is the height of sagebrush, unlike ponderosa pine and juniper habitats where the amount of cover is more important.

• Within tall sagebrush habitat (i.e., >1.5 meters [5 feet]) maintain sagebrush cover >20% for optimal habitat but not <10%.

Rationale: The recommendations for shrub cover are based on professional judgment within the context of a positive relationship with shrub cover (Holmes and Barton 2003) and knowledge of the range of sagebrush cover in high and low quality habitats.

Other Habitats: Lodgepole Pine and Oak-Pine

Gray Flycatcher occurrence in these habitats is limited and local. Where the species is present in these habitats, utilize the recommendations provided above for juniper and or ponderosa pine as a means to provide suitable habitat.

All Habitats

• Maintain habitat suitable for Gray Flycatchers in blocks as large and contiguous as possible to provide abundant interior habitat most suitable for Gray Flycatchers and limit edge habitat more suitable for Gray Flycatcher nest parasites such as Brown-headed Cowbirds.

Rationale: Gray Flycatchers have been documented as a choice host for cowbirds with limited to no Gray Flycatcher productivity resulting from a parasitized nest.

• Reduce or eliminate insecticide use in suitable habitats and adopt Integrated Pest Management practices including limiting use to periods outside the breeding season.

Rationale: Use of insecticides directly affects the prey base (i.e., aerial insects) of Gray Flycatcher with likely affects on reproduction and population viability.

• Reduce or eliminate broadcast herbicide use for habitat conversion in sage and juniper habitat. Spot spraying for invasive weed control likely has little effect on Gray Flycatchers.

• Manage livestock grazing pressure to maintain shrub component and grass cover as described above for Gray Flycatcher habitat.

Rationale: Livestock grazing directly affects potential nesting substrates and cover and indirectly affects the prey base (i.e., insects) of Gray Flycatcher with likely affects on reproduction and population viability.

• Consider retention or acquisition of lands that provide Gray Flycatcher habitat for protection and favorable habitat management.

V. Research, Inventory and Monitoring Opportunities

There is a need for research on nearly all aspects of the life history of Gray Flycatchers on both their breeding and wintering grounds (Sterling 1999). The needs are so all-encompassing that it is difficult to prioritize them for the species across its range. However, in Washington, we suggest the following practical priorities based on 1) the need to determine if the species really should be a priority species, and 2) the need to assess its response to regularly occurring habitat management in the primary habitats it occupies:

• Conduct inventories in appropriate suitable habitats to delineate breeding distribution and determine population status.
• Quantify breeding habitat conditions and the relationship of those conditions to Gray Flycatcher abundance and demographic factors (e.g., productivity, population recruitment).
• Conduct effectiveness monitoring of fuelwood harvest, grazing, and fire on habitat suitability and Gray Flycatcher populations.
• Conduct effectiveness monitoring of sagebrush management for Greater Sage-grouse on Gray Flycatcher populations.
• Investigate Brown-headed Cowbird parasitism rates and their effect on productivity and population viability.

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References Cited

Arnett, E.B., B. Altman, W.P. Erickson, and K.A. Bettinger. 2001. Relationships between salvage logging and forest avifauna in lodgepole pine forests of the central Oregon Pumice Zone. Unpublished Final Report, Weyerhaeuser Company, Springfield, Oregon.

Adamus, P.R., K. Larsen, G. Gillson, and C.R. Miller. 2001. Oregon breeding bird atlas. Oregon Field Ornithologists, P.O. Box 10373, Eugene, OR 97440. CD-ROM.

Altman, B. and A. Holmes. 2000. Conservation strategy for landbirds in the Columbia Plateau of eastern Oregon and Washington. Version 1.0. American Bird Conservancy and PRBO Conservation Science for Oregon-Washington Partners in Flight. www.orwapif.org.

American Ornithologists Union. 1957. Checklist of North American birds. 5th edition. American Ornithological Union, Washington, D.C.

American Ornithologists Union. 1998. Checklist of North American birds. 7th edition. American Ornithological Union, Washington, D.C.

Barton, D.C. and A.L. Holmes. 2004. Shrubsteppe and riparian bird monitoring in northeastern California and northwestern Nevada. Unpublished report, PRBO Conservation Science, Stinson Beach, California. PRBO Contribution #856.

Brewster, W. 1889. Descriptions of supposed new birds from western North America and Mexico. Auk 6:85-98.

Bystrak, Danny. Personal communication (email) with Bob Altman on November 17, 2009.

California Partners in Flight. 2005. The sagebrush bird conservation plan: a strategy for protecting and managing sagebrush habitats and associated birds in California. Version 1.0. PRBO Conservation Science, Stinson Beach, California. http://www.prbo.org/calpif/plans.

Campbell, W.R., N.K. Dawe, I. McTaggart-Cowan, J.M. Copper, G.W. Kaiser, M.C.E. McNall, and G.E.J. Smith. 1997. The Birds of British Columbia, Volume 3, Passerines: Flycatchers through Vireos. University of British Columbia Press, Vancouver. 693 pp.

Cannings, R.J. 1987. Gray flycatcher: a new breeding bird for Canada. American Birds 41: 376-378.

Cannings, R.J. 1995. Status of the Gray Flycatcher in British Columbia. Ministry of Environment, Land, and Parks, Wildlife Branch. Wildlife Bulletin No. B-76. 9 pp.

Cannings, Richard. Personal Communication. Telephone conversation February 2, 2009 with Kent Woodruff.

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. http://sagemap.wr.usgs.gov/Docs/shrubsteppe_landscapes.pdf

Dobler, F.C., J. Eby, C. Perry, S. Richardson, and M. VanderHaegen. 1996. Status of Washington's shrub-steppe ecosystem: extent, ownership, and wildlife/vegetation relationships. Washington Department of Fish and Wildlife, Olympia. 39 pp.

Downes, Scott. 2006. Gray flycatchers nesting in the shrub-steppe of eastern Kittitas County. Washington Birds 9:71-73.

East Cascades Bird Conservancy, 2007. Crooked River National Grassland 2007 point count surveys and Gray Flycatcher study fourth year summary. Unpublished report submitted to U.S.D.A. Forest Service, Crooked River National Grassland.

Eckhardt, R.C. 1979. The adaptive syndrome of two guilds of insectivorous birds in the Colorado Rocky Mountains. Ecological Monograph 49:129-149.

Fix, D. 1984. The spring migration: March 1- May 31, 1984. American Birds 38:950.

Frakes, R.A. 1978. Niche relationships of five species of flycatchers. M.S. Thesis. Washington State University, Pullman.

Friedmann, H.L., F. Kiff, and S. I. Rothstein. 1977. A further contribution to knowledge of the host relations of the parasitic cowbirds. Smithsonian Contributions to Zoology, Number 235. Smithsonian Institution Press, Washington D.C., pages 14-15. http://si-pddr.si.edu/dspace/bitstream/10088/5409/2/SCtZ-0235-Lo_res.pdf

Gabrielson, I.N. and S.G. Jewett. 1940. Birds of Oregon. James, Kerns, and Abbott Company, Portland, Oregon.

Gashwiler, J.S. 1977. Bird populations in four vegetation types in central Oregon. U.S. Fish and Wildlife Service Special Scientific Report – Wildlife No.205.

Gaines D. 1988. Birds of Yosemite and the east slope. Artemisia Press. Lee Vining, CA.

Garret, K. and J. Dunn. 1981. Birds of southern California. Los Angeles Audubon Society, Los Angeles, California.

Gilligan, J., M. Smith, D. Rogers, and A. Contreras. 1994. Birds of Oregon: status and distribution. Cinclus Publications, McMinnville, Oregon.

Gillihan, S.W. 2006. Sharing the land with pinyon-juniper birds. Partners in Flight Western Working Group. Salt Lake City, Utah. http://www.pwrc.usgs.gov/pif/pubs/PJ%20manual%20Nov%2008%20low-res.pdf

Great Basin Bird Observatory 2005. Landbirds of Nevada and the habitats they need: A resource managers guide to conservation priority species. Great Basin Bird Observatory Technical Report No. 05-01. Great Basin Bird Observatory, Reno, Nevada.

Harper, B., S. Cannings, D. Fraser, and W.T. Munro. 1994. Provincial lists of species at risk. pp 16-23 *in* L.E. Harding and E. McCullum (editors). Biodiversity in British Columbia. Canadian Wildlife Service, Delta, B.C.

Harris, S.W. 1996. Northwestern California birds. 2nd edition. Humboldt State University Press, Arcata, California.

Heath, S.K. 2004. Songbird use of greater sage grouse population management units in the Bodie hills and Long Valley, California. Unpublished report of PRBO Conservation Science. PRBO contribution #1245.

Hoffman, R. 1927. Birds of the Pacific states. Houghton Mifflin, Boston, Massachusetts.

Holmes, A.L. 2007. Short-term effects of a prescribed burn on songbirds and vegetation in mountain big sagebrush. Western North American Naturalist 67(2):292-298.

Holmes, A.L. and G.R. Geupel. 1998. Avian population studies at Naval Weapons Systems Training Facility, Boardman, Oregon. Unpublished report submitted to the Department of Navy and Oregon Department of Fish and Wildlife. Point Reyes Bird Observatory, Stinson Beach, California. PRBO Contribution #844.

Holmes, A.L. and G. R Geupel. 2000. Columbia Plateau bird conservation project: year 2000 progress report. Unpublished report prepared for the Bureau of Land Management. PRBO Conservation Science.

Holmes, A.L. and D.C. Barton. 2003. Determinants of songbird distribution and abundance in sagebrush habitats of eastern Oregon and Washington. Unpublished report submitted to the Bureau of Land Management. PRBO Conservation Science, Stinson Beach, California. PRBO Contribution #1094.

Holmes, A.L., A. Hannuksela, N. Nur, and C. Martz. 2007. Patterns of bird abundance in relation to western juniper density and management on Steens Mountain, Oregon. Unpublished report for the Bureau of Land Management. PRBO Conservation Science, Petaluma, California. PRBO contribution #1559.

Howell, S.N.G. S.Webb. 1995. A guide to the birds of Mexico and northern Central America. Oxford University Press, New York.

Huff, M. and M. Brown. 2006. Eight years of terrestrial bird monitoring on national forests of the Pacific Northwest. Unpublished report, U.S.D.A. Forest Service, Portland, Oregon. 130 pp.

Hutto, R.L. 1992. Habitat distributions of migratory landbird species in western Mexico. Pp. 221-239 *in* Ecology and conservation of neotropical migrants (J.M. Hagan III and D.W. Johnston, editors). Smithsonian Institute Press, Washington, D.C.

Jewett, S.G. 1913. Three new birds from eastern Oregon. Condor 15:229.

Johnson, N.K. 1963. Biosystematics of the sibling species of flycatchers in the *Empidonax hammondii-oberholseri-wrightii* complex. University of California Publications in Zoology 66:79-238.

Johnson, N.K. 1994. Pioneering and natural expansion of breeding distributions in western North American birds. Pp 27-44 *in* J.R. Jehl, Jr. and N.K. Johnson (editors), A century of avifaunal change in western North America. Studies in Avian Biology No. 15.

Johnson, N.K. and C. Cicero. 1985. The breeding avifauna of San Benito Mountain, California: evidence for change over one-half century. Western Birds 16:1-23.

Johnson, N.K. and K.L. Garrett. 1974. Interior bird species expand breeding ranges into southern California. Western Birds 5:45-46.

Kozma, Jeff. Wildlife Biologist, Yakima Nation. Personal communication. Emails to Bob Altman on 8/31/2009 and 11/13/2009.

Larrison, E.J. 1971. Sight record of the Gray Flycatcher in Washington. Murrelet 52:40.

LaRue, C. Personal communication. Cited in Latta et al. 1998.

LaRue, C. T. 1994. Birds of northern Black Mesa, Navajo County, Arizona. Great Basin Naturalist 54:1-63. https://ojs.lib.byu.edu/ojs/index.php/wnan/article/view/1377/1234

Latta, M.J., C.J. Beardmore, and T.E. Corman. 1998. Arizona Partners in Flight draft bird conservation plan. Arizona Game and Fish Department, Phoenix. 199 pp.

Lavers, Norman. 1975. The status of the gray flycatcher in Washington State. Western Birds 6: 25-27. http://elibrary.unm.edu/sora/wb/v06n01/p0025-p0027.pdf

Lehman, P.E. 1994. The birds of Santa Barbara County, California. Vertebrate Museum, University of California, Santa Barbara.

Lindsay, John. 2007. Using landscape level data to predict the presence of Hammond's flycatcher, dusky flycatcher, and gray flycatcher in dry pine forests of north-central Washington. M.S. Thesis, Texas State University-San Marcos.

Littlefield, C. D. 1990. Birds of Malheur National Wildlife Refuge, Oregon. Oregon State University Press, Corvallis.

McCallum, D.A., S.R. Buchsbaum, and J.J. Price. 1978. Pinyon-juniper-ponderosa pine ecotone. American Birds 32:89.

Marks, Jeff. Montana Birds (editor). Personal communication. Email (species account) to Bob Altman, November 10, 2009.

Marshall, D.B., M.G. Hunter, and A.L. Contreras (editors). 2003. Birds of Oregon: a general reference. Oregon State University Press, Corvallis. 768 pp.

Manuwal, D.A. 1997. Neotropical bird communities in oak woodlands of south-central Washington. Final Report to Washington Department of Fish and Wildlife, Olympia. College of Forest Resources, University of Washington, Seattle.

Mayfield, H. 1975. Suggestions for calculating nest success. Wilson Bulletin 73:225-238.

Medin, D.E., B.L. Welch, and W.P. Clary. 2000. Bird habitat relationships along a Great Basin elevational gradient. U.S.D.A. Forest Service, Rocky Mountain Research Station Research Paper RMRS-RP-23.

Miller, C.R. 2003. Gray Flycatcher. Pp. 383-384 *in* Birds of Oregon: A general reference (D.B. Marshall, M.G. Hunter, and A.L. Contreras, editors). Oregon State University Press, Corvallis.

Miller, E.S., R.S. Demaree, Jr., and S.R. Tinling. 1978. Hematoza of passeriform birds from Eagle Lake, California. Proceedings of the Helminothological Society of Washington 45:266-268.

Murphy, M.T. 1989. Life history variability in North American breeding tyrant flycatchers: phylogeny, size, or ecology? Oikos 54:3-14.

Neel, L. (editor). 1999. Nevada Partners in Flight Bird Conservation Plan. Nevada Partners in Flight.

Nehls, Harry. Personal communication. Oregon Bird Records Committee Secretary. Telephone conversation, 2 February, 2009 with Kent Woodruff.

Nott, Phil. Program Director, Institute for Bird Populations. Personal communication. Email to Bob Altman, November 20, 2009.

Oberholser, H.C. 1920. *Empidonax griseus* in Oregon. Condor 22:37.

O'Meara, T., J. Haufler, L. Stelter, and J. Nagy. 1981. Nongame wildlife responses to chaining of pinyon-juniper woodlands. Journal of Wildlife Management 45(2): 381-389.

Opperman, H., K.M. Cassidy, T. Aversa, E.S. Hunn, and B. Senturia. 2006. Sound to Sage: Breeding bird atlas of Island, King, Kitsap, and Kittitas counties, Washington. Seattle Audubon Society, Version 1.1, September 2006. www.soundtosage.org.

Oregon Department of Fish and Wildlife. 2005. The Oregon Conservation Strategy. Oregon Department of Fish and Wildlife, Salem, Oregon. http://www.dfw.state.or.us/conservation strategy/.

Oregon Biodiversity Information Center. 2010. Rare, threatened, and endangered species of Oregon. Oregon Biodiversity Information Center, Oregon State University, Portland, Oregon. 100 pp.

Page, J.L., N. Dodd, T.O. Osborne, and J.A. Carson. 1978. The influence of livestock grazing on non-game wildlife. California-Nevada Wildlife 1978:159-173.

Paige, C., and S. A. Ritter. 1999. Birds in a sagebrush sea: managing sagebrush habitats for bird communities. Partners in Flight Western Working Group, Boise, ID. http://www.partnersinflight.org/wwg/sagebrush.pdf

Phillips, A.R. 1939. The type of *Empidonax wrightii* Baird. Auk 56:311-312.

Phillips, A.R. 1944. Some differences between the Wright's and Gray Flycatchers. Auk 61:293-294.

Phillips, A.R. 1996. Review of biosystematics of sibling species of flycatchers in the *Empidonax hammondii-oberholseri-wrightii* complex by N.K. Johnson. Auk 83:321-326.

Rich, T.R., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Ingio-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.H. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, and T.C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Laboratory of Ornithology, Ithaca, NY.

Rich, T.D., M.J. Wisdom, and V.A. Saab. 2005. Conservation of priority birds in sagebrush ecosystems. Pp 589-606 *in* Bird conservation implementation and integration in the Americas: proceedings of the third international Partners in Flight conference (C.J. Ralph and T.D. Rich editors). U.S.D.A. Forest Service, General Technical Report PSW-GTR-191.

Reinkensmeyer, D.P. 2000. Habitat associations of bird communities in shrub-steppe and western juniper woodlands. M.S. Thesis, Oregon State University, Corvallis.

Reynolds, T.D. and C.H. Trost. 1981. Grazing, crested wheatgrass, and bird populations in southeastern Idaho. Northwest Science 55:225-234.

Rogers, T.H. 1972. The nesting season. Northern Rocky Mountain-Intermountain region. American Birds 26:881.

Rosenberg, K.V., R.D. Ohmart, W.C. Hunter, and B.W. Anderson. 1991. Birds of the lower Colorado River valley. University of Arizona Press, Tucson.

Russell, H.N. and A.M. Woodbury. 1941. Nesting of the Gray Flycatcher. Auk 58:28-37.

Russell, S.M. and G. Monson. 1998. The birds of Sonora. University of Arizona Press, Tucson.

Russell, R.E. J.A. Royle, V.A. Saab, J.F. Lehmkuhl, W.M. Block, and J.R. Sauer. 2009. Modeling the effects of environmental disturbance on wildlife communities: avian response to prescribed fire. Ecological Applications 19:1253-1263.

Sauer, J. R., J. E. Hines, and J. Fallon. 2008. The North American Breeding Bird Survey, Results and Analysis 1966 - 2007. Version 5.15.2008. USGS Patuxent Wildlife Research Center, Laurel, MD. http://www.mbr-pwrc.usgs.gov/bbs/

Shuford, W.D. and P.J. Metropulos. 1996. The Glass Mountain Breeding Bird Atlas Project Preliminary Results, 1991-1995. A report to the U.S. Forest Service, Inyo National Forest, Point Reyes Bird Observatory, Stinson Beach, California.

Small, A. 1994. California birds: their status and distribution. Ibis Publication Company, Los Angeles.

Smith, M.R., P.W. Mattocks, Jr., K.M. and Cassidy. 1997. Breeding birds of Washington state, Volume 4, *in* Cassidy, K.M., Grue, C.E., Smith, M.R., and Dvornich, K.M (editors), Washington State Gap Analysis – Final Report. Seattle Audubon Society Publications in Zoology No. 1, Seattle, 558 pp.

Stephens, Dan. Personal communication. Wenatchee Valley College professor of biology. Telephone conversation 21 January, 2009 with Kent Woodruff.

Sterling, J.C. 1999. Gray Flycatcher (*Empidonax wrightii*). *In* The Birds of North America, Number 458 (A. Poole and F. Gill, editors). The Birds of North America, Inc., Philadelphia, PA.

Tweit, B. and J. Gilligan. 1993. The spring season: Oregon/Washington region. American Birds 47:448.

Tweit, B. and J. Johnson. 1992. The summer season: Oregon/Washington region. American Birds 46:1172.

U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. http://www.fws.gov/migratorybirds/

U.S. Fish and Wildlife Service. 2002. Birds of Conservation Concern 2002. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 99 pp. www.migratorybirds.fws.gov/reports/BCC02/BCC2002.pdf.

Wahl, T.R., B. Tweit, and S.G. Mlodinow. 2005. Birds of Washington: status and distribution. Oregon State University Press, Corvallis. 436 pp.

Washington Department of Fish and Wildlife. 2005. Comprehensive Wildlife Conservation Strategy. http://wdfw.wa.gov/wlm/cwcs.

Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, WA 177 pp.

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

Whitney, B. and K. Kaufman. 1987. The *Empidonax* challenge. Part 5. Birding 19:7-15.

Woodman. P. 1978. Forty first Breeding Bird Census: northern pinyon pine woodland. American Birds 32:91-92

Yaich, J.A., and Larrison, E.J. 1973. Nesting record and behavioral observations on the Gray Flycatcher in Washington. Murrelet 54:14–16.

APPENDIX A.

Fixed-radius point count data sources for Gray Flycatcher density estimates in Oregon and Washington.

Source	Location(s)	Habitat	Year(s)	Effort	Density
Holmes and Geupel 1998	Boardman Bombing Range, OR	grazed big sagebrush	1995-97	1,269 point counts	0.01
Holmes and Geupel 1998	Boardman Bombing Range, OR	ungrazed big sagebrush	1995-97	1,269 point counts	0.00
Holmes and Barton 2003	Extensive Columbia Basin and Great Basin, OR and WA	sagebrush	2000-02	4,428 point counts	0.19
Holmes 2007	Oregon Canyon Mountain near Vale, OR	mountain big sagebrush	2004	74 point counts	0.00
Barton and Holmes 2004a	Skedaddle Mountain, CA and NV	Wyoming big sagebrush	2002-04	432 point counts	0.04
Barton and Holmes 2004b	Fort Sage, CA and NV	big sagebrush (<10%)	2002-04	420 point counts	0.05
M. Vanderhagen pers. comm.	Douglas, Grant, and Lincoln counties, WA	sagebrush	2003-05	192 point counts	0.00

Spot-mapping data sources for Gray Flycatcher density estimates in Oregon and Washington.

Source	Location(s)	Habitat	Year(s)	Effort	Density
Gashwiler 1977	Millican Basin near Bend, OR	sagebrush (13.8%)	1971-73	20 ha plot (3 years)	0.00
Gashwiler 1977	Millican Basin near Bend, OR	juniper (17%)	1971-73	20 ha plot (2 years)	1.05
American Birds 1971	Near French Glen, OR	sagebrush	1970-71	16 ha plot (2 years)	0.03
J. Stephens pers. comm.	Extensive Columbia and Great Basins, OR and NV	big sagebrush	2008	25 ha plots (15)	0.02

Variable-radius point count data sources for Gray Flycatcher density estimates in Oregon and Washington.

Source	Location(s)	Habitat	Year(s)	Effort	Density
Dobler et al. 1996	Columbia Basin, WA	sagebrush	1988-90	574 transects	0.00
Reinkensmeyer 2000	Near Bend, OR	mountain big sagebrush	1998-99	384 point counts	0.01
Reinkensmeyer 2000	Near Bend, OR	old-growth juniper	1998-99	384 point counts	1.41
Reinkensmeyer 2000	Near Bend, OR	mid-successional juniper	1998-99	384 point counts	1.34
Holmes et al. 2007	Steens Mountain, OR	big sagebrush (28%)	2003-05	336 point counts	0.11
Holmes et al. 2007	Steens Mountain, OR	untreated juniper (10%)	2003-05	528 point counts	0.62
Holmes et al. 2007	Steens Mountain, OR	burned juniper (<1%)	2003-05	336 point counts	0.52
Holmes et al. 2007	Steens Mountain, OR	cut juniper (1%)	2003-05	288 point counts	0.41